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9618/11

May/June 2022

**1 hour 30 minutes**

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- Answer **all** questions.
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- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **16** pages. Any blank pages are indicated.

1 Computers store data in binary form.

(a) State the difference between a tebibyte and a terabyte.

.....  
 ..... [1]

(b) Convert the signed denary value –100 into an 8-bit two's complement binary integer.

Working .....  
 .....

Answer ..... [1]

(c) Convert the denary number 251 into hexadecimal. Show your working.

Working .....  
 .....  
 .....  
 .....

Answer ..... [2]

(d) Add the following unsigned binary integers.

$$\begin{array}{r} 01010000 \\ + 00111110 \\ \hline \end{array}$$

[1]

2 A computer has hardware and software.

(a) The hardware includes different types of memory.

(i) Complete the description of computer memory.

Random Access Memory (RAM) and Read Only Memory (ROM) are both examples of ..... memory.

One item that is stored in RAM is .....

One item that is stored in ROM is .....

RAM can be either Static RAM (SRAM) or Dynamic RAM (DRAM).

SRAM uses transistors arranged as .....

DRAM uses transistors and .....

[5]

(ii) Explain the difference between Programmable ROM (PROM), Erasable Programmable ROM (EPROM) and Electrically Erasable Programmable ROM (EEPROM).

.....  
.....  
.....  
.....  
.....  
..... [3]

- (b)** A magnetic hard disk is used to store data on the computer.

Describe the principal operations of a magnetic hard disk.

[5]

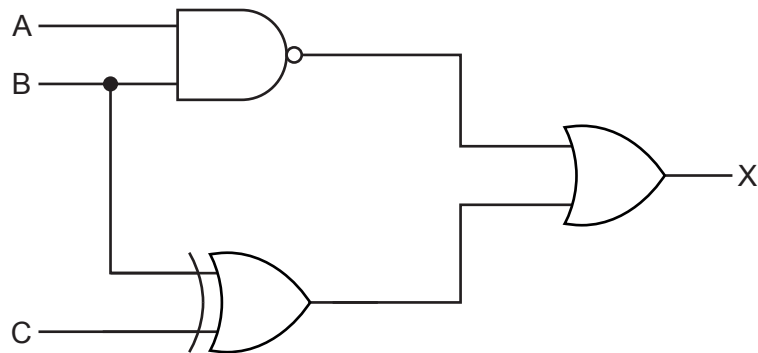
(c) Computers consist of logic gates.

- (i) Complete the table by writing **one** set of values (input 1 and input 2) for each gate that will give the output 1.

Gate	Input 1	Input 2	Output
AND			1
NAND			1
XOR			1
NOR			1

[4]

- (ii) Write the logic expression for the given logic circuit.



.....

.....

..... [3]

- 3 A teacher is writing examination papers on a laptop computer. The computer is connected to the internet. The teacher is concerned about the security and privacy of the papers.

(a) State the difference between the security of data and the privacy of data.

.....

.....

..... [1]

(b) Identify **and** describe **two** threats to the data. Identify **one** security measure to protect against each threat. Each security measure must be different.

Threat 1 .....

Description .....

.....

Security measure .....

Threat 2 .....

Description .....

.....

Security measure ..... [6]

- 4 A teacher uses a relational database, MARKS, to store data about students and their test marks.

The database has the following structure:

STUDENT(StudentID, FirstName, LastName)

TEST(TestID, Description, TotalMarks)

STUDENT\_TEST(StudentID, TestID, Mark)

- (a) Describe the advantages of using a relational database compared to a file-based approach.

.....

.....

.....

.....

.....

.....

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.....

.....

.....

.....

..... [4]

- (b) Give the highest level of Normal Form (NF) the database MARKS is in **and** justify your choice.

Normal Form .....

Justification .....

.....

.....

..... [3]

- (c) (i) Sample data to be stored in the table `STUDENT_TEST` is shown.

<b>StudentID</b>	<b>TestID</b>	<b>Mark</b>
12	A1	50
12	P10	100
13	A1	75
14	P10	60

Write a Structured Query Language (SQL) script to create the table `STUDENT_TEST`.

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

- (ii) Write a Structured Query Language (SQL) script to find the average mark of students in test A7.

.....

.....

.....

.....

.....

..... [3]



- (d) The mark a student is awarded in a test will be entered into the database. This mark needs to be a whole number between 0 and the maximum number of marks for that test (inclusive).

Explain how data validation **and** data verification can be used when a mark is entered.

.....

.....

.....

.....

.....

.....

.....

..... [4]

5 A programmer uses an Integrated Development Environment (IDE) to develop a program.

(a) Draw **one** line from each IDE feature to its correct description.

IDE feature	Description
Context-sensitive prompt	Executes one line of the program and then stops
Dynamic syntax check	Underlines or highlights statements that do not meet the rules of the language
Breakpoint	Outputs the contents of variables and data structures
Single stepping	Stops the code executing at a set line
Report window	Displays predictions of the code being entered

[4]

(b) The programmer wants to allow users to edit, improve and redistribute the program.

Identify **two** different types of software licence that the programmer could use.

1 .....

2 .....

[2]

(c) Explain the benefits to the programmer of using program libraries.

.....

.....

.....

.....

.....

.....

.....

..... [3]

- 6 (a)** A computer system is designed using the basic Von Neumann model.

- (i) Describe the role of the registers in the Fetch-Execute (F-E) cycle.

[5]

- (ii) Describe when interrupts are detected in the F-E cycle **and** how the interrupts are handled.

[illegible]

[5]

- (b) Identify **one** factor that can affect the performance of the computer system **and** state how it impacts the performance.

Factor .....

Impact .....

.....

.....

[2]

**Question 6 continues on the next page.**

- (c) The table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC).

Instruction		Explanation
Opcode	Operand	
AND	#n	Bitwise AND operation of the contents of ACC with the operand
XOR	#n	Bitwise XOR operation of the contents of ACC with the operand
OR	#n	Bitwise OR operation of the contents of ACC with the operand
LSL	#n	Bits in ACC are shifted logically n places to the left. Zeros are introduced on the right hand end
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left hand end
# denotes a denary number, e.g. #123		

- (i) Complete the register to show the result **after** the instruction AND #2 is executed.

Register before:

0	1	1	0	1	1	0	1
---	---	---	---	---	---	---	---

Register after:

--	--	--	--	--	--	--	--

[1]

- (ii) Complete the register to show the result **after** the instruction OR #8 is executed.

Register before:

0	1	1	0	1	1	0	1
---	---	---	---	---	---	---	---

Register after:

--	--	--	--	--	--	--	--

[1]

- (iii) Complete the register to show the result **after** the operation `LSL #4` is executed.

Register before:

0	1	1	0	1	1	0	1
---	---	---	---	---	---	---	---

Register after:

--	--	--	--	--	--	--	--

[1]

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## 9618/12

May/June 2022

**1 hour 30 minutes**

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- 1 (a) Draw **one** line from each image representation term to its correct definition.

Term	Definition
Pixel	The number of pixels wide by the number of pixels high
Bit depth	The smallest identifiable component of an image
Image resolution	Stores data about the image file, e.g. file format, number of bits per pixel, file size
File header	The number of bits used to represent each colour

[3]

- (b) The following section of a bitmap image is 10 pixels wide and 5 pixels high. In this example, each colour is represented by a letter, e.g. B is blue.

B	B	B	B	B	B	B	B	B	B
Y	Y	P	Y	Y	Y	P	Y	Y	Y
R	R	M	R	P	K	T	T	R	R
B	O	P	Y	Y	Y	P	G	P	P
R	O	R	P	P	P	R	R	R	R

The complete image can have up to 256 colours.

- (i) Identify the smallest number of bits that can be used to represent each colour in the complete bitmap image.

..... [1]

- (ii) Calculate an estimate for the file size of the section of the bitmap image shown, giving your answer in bytes. Use your answer from **part (b)(i)**.

Show your working.

Working .....

.....

.....

.....

Answer ..... bytes

[2]

- (c) Describe how changing the colour depth of an image affects its file size.

.....

.....

.....

..... [2]

- (d) The first row of pixels in the image from **part (b)** is shown:

B	B	B	B	B	B	B	B	B	B
---	---	---	---	---	---	---	---	---	---

Explain how this row of pixels can be compressed using lossless compression.

.....

.....

.....

..... [2]

2 A car has several features.

- (a) One feature is a lane detection system. This system monitors the lines on either side of the lane. If the car gets too close to one line, the system automatically moves the car away from the line.

Explain why the lane detection system is an example of an embedded system.

.....

.....

..... [2]

- (b) Two other features:

- record the number of miles travelled in the current journey, from when the engine is turned on to when it is turned off
- record the total number of miles the car has travelled since it was built.

Identify the data that will be stored in the primary **and** secondary storage of the car for these **two** features.

Primary .....

.....

Secondary .....

..... [2]

- (c) The car has a resistive touchscreen for the user to select options.

Tick (✓) **one** box in each row to show whether each statement about a resistive touchscreen is true or false.

Statement	True	False
The screen always has five different layers		
A processor determines the horizontal and vertical coordinates of the point of contact		
The touchscreen will work if any object touches the screen		

[1]

- 3 The table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC).

Instruction		Explanation
Opcode	Operand	
AND	#n	Bitwise AND operation of the contents of ACC with the operand
AND	<address>	Bitwise AND operation of the contents of ACC with the contents of <address>
XOR	#n	Bitwise XOR operation of the contents of ACC with the operand
XOR	<address>	Bitwise XOR operation of the contents of ACC with the contents of <address>
OR	#n	Bitwise OR operation of the contents of ACC with the operand
OR	<address>	Bitwise OR operation of the contents of ACC with the contents of <address>
<address> can be an absolute or a symbolic address # denotes a denary number, e.g. #123		

- (a) The ACC currently contains the following positive binary integer:

0	1	1	0	0	1	0	1
---	---	---	---	---	---	---	---

Write the bit manipulation instruction that would change the binary integer in ACC to:

1	1	1	1	1	1	1	1
---	---	---	---	---	---	---	---

Opcode ..... Operand .....

[2]

- (b) The ACC currently contains the following positive binary integer:

0	1	1	0	0	1	0	1
---	---	---	---	---	---	---	---

Write the bit manipulation instruction that would change the binary integer in ACC to:

1	0	0	1	1	0	1	0
---	---	---	---	---	---	---	---

Opcode ..... Operand .....

[2]

- (c) Convert the following positive binary integer into hexadecimal.

0 1 1 1 1 1 1 0

..... [1]

- (d) A **three-place logical shift** to the **left** is performed on the following positive binary integer.

Show the result of this logical shift.

0 1 1 1 1 1 1 0

..... [1]

- (e) Convert the denary numbers 127 and 12 to 8-bit binary and then perform the subtraction 12 – 127 in binary.

Show your working.

127 in binary .....

12 in binary .....

12 – 127 in binary .....

.....

.....

.....

.....

[3]

4 A school stores personal data about its staff and students on its computer system.

- (a) Explain why the school needs to keep both its data **and** its computer system secure from unauthorised access.

Data .....

.....

Computer system .....

.....

[2]

- (b) Complete the table by identifying **two** security threats to the data on a computer.

Describe each threat.

Give a different prevention method for each threat.

Threat	Description	Prevention method
..... .....	..... ..... ..... .....	..... .....
..... .....	..... ..... ..... .....	..... .....

[6]

- (c) Data is encrypted when it is transmitted within the school network, or externally such as over the internet.

Describe what is meant by encryption **and** explain why it is used.

.....

.....

.....

..... [2]

- 5 A database, FILMS, stores information about films and actors.

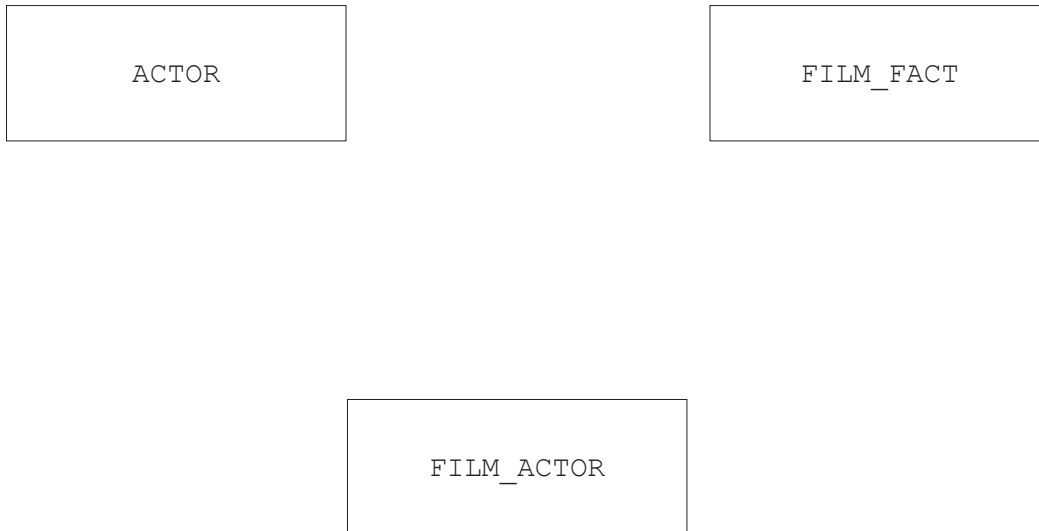
Part of the database is shown:

```

ACTOR(ActorID, FirstName, LastName, DateOfBirth)
FILM_FACT(FilmID, FilmTitle, ReleaseDate, Category)
FILM_ACTOR(ActorID, FilmID)

```

- (a) Complete the entity-relationship (E-R) diagram.



[2]

- (b) A composite primary key consists of two or more attributes that together form the primary key.

Explain why the table FILM\_ACTOR has a composite primary key.

.....

.....

.....

..... [2]



- (c) Complete the SQL script to return the IDs of all the actors in the film with the title Cinderella.

```

SELECT .....

FROM FILM_ACTOR

INNER JOIN .....

ON FILM_FACT.FilmID = .....

WHERE FILM_FACT.FilmTitle = ..... ;

```

[4]

- (d) Write an SQL script to count the number of films that were released in January 2022.

```

.....

.....

.....

.....

.....

.....

```

[3]

- (e) A Database Management System (DBMS) is used to create and manipulate the database.

Complete the descriptions of the features and tools found in a DBMS using the given terms. Not all terms will be used.

<b>Boolean</b>	<b>data dictionary</b>	<b>data redundancy</b>	<b>field names</b>
<b>input</b>	<b>interface</b>	<b>logical schema</b>	<b>normalisation</b>
<b>operating system</b>	<b>output</b>	<b>primary keys</b>	<b>query</b>
<b>structure</b>			

A DBMS provides data management. This includes the development of a

..... that stores information about the data stored, such as  
..... and .....

The ..... uses methods, such as an E-R diagram, to show the structure of the database and its relationships.

The ..... processor allows a user to perform searches to find specific data. The DBMS also provides a developer ..... that allows the user to create tables, forms and reports.

[6]

6 A programmer uses language translators when writing and testing a program.

(a) Describe the operation of a compiler.

.....

.....

.....

..... [2]

(b) Describe the operation of an interpreter.

.....

.....

.....

..... [2]

(c) Explain how a programmer can make use of a typical Integrated Development Environment (IDE) when writing **and** testing a program.

Writing .....

.....

.....

.....

.....

Testing .....

.....

.....

..... [4]

7 Complete the truth table for the following logic expression:

$$X = (A \text{ XOR } B) \text{ AND NOT } C$$

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[2]

8 Describe **one** application of Artificial Intelligence (AI).

.....

.....

.....

.....

.....

..... [3]

- 9 (a) The following incomplete table contains four network devices and their descriptions.

Complete the table by writing the missing devices and missing descriptions.

Device	Description
.....	Receives and sends data between two networks operating on the same protocol
Wireless Network Interface Card (WNIC)	..... ..... .....
.....	Restores the digital signal so it can be transmitted over greater distances
Wireless Access Point (WAP)	..... ..... .....

[4]

- (b) Describe **three** differences between fibre-optic cables and copper cables.

- 1 .....
- .....
- 2 .....
- .....
- 3 .....
- .....

[3]

- (c) Ethernet uses Carrier Sense Multiple Access/Collision Detection (CSMA/CD).

Describe CSMA/CD.

.....

.....

.....

.....

.....

.....

.....

..... [4]



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9618/13

May/June 2022

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1 Text and numbers are examples of data stored in a computer.

(a) A character set is used to represent characters in a computer.

(i) Describe what is meant by a **character set**.

.....

.....

.....

.....

.....

..... [2]

(ii) Identify **two** character sets and state **one** difference between them.

Character set 1 .....

Character set 2 .....

Difference .....

..... [3]

(iii) Describe how lossless compression can be used to reduce the file size of a text file.

.....

.....

.....

.....

.....

..... [2]

(iv) Explain why lossy compression should **not** be used on a text file.

.....

.....

.....

.....

.....

..... [2]

- (b)** A computer can represent numerical data in different forms.

Complete the table by writing the answer to each statement.

Statement	Answer
The hexadecimal value 11 represented in denary	
The smallest denary number that can be represented by an unsigned 8-bit binary integer	
The denary number 87 represented in Binary Coded Decimal (BCD)	
The denary number 240 represented in hexadecimal	
The denary number $-20$ represented in 8-bit two's complement binary	

[5]

## Working space

[illegible]

- 2 (a)** The Fetch-Execute (F-E) cycle is represented in register transfer notation.

Describe each of the given steps.

Step	Description
PC $\leftarrow$ [PC] + 1	<p>.....</p> <p>.....</p> <p>.....</p>
MDR $\leftarrow$ [[MAR]]	<p>.....</p> <p>.....</p> <p>.....</p>
MAR $\leftarrow$ [PC]	<p>.....</p> <p>.....</p> <p>.....</p>

[3]

- (b)** Explain how interrupts are handled during the F-E cycle.

..... [5]

[5]

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- 3 (a) The table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC).

Instruction		Explanation
Opcode	Operand	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
LDI	<address>	Indirect addressing. The address to be used is at the given address. Load the contents of this second address to ACC
<address> can be an absolute or symbolic address # denotes a denary number, e.g. #123		

The current contents of main memory are:

**Address**

100	101
101	67
102	104
103	100
104	68

Complete the table by writing the value stored in the accumulator after the execution of each instruction.

Instruction	Accumulator
LDM #103	
LDD 102	
LDI 103	

[3]

(b) The instructions in **part (a)** are examples of the data movement group.

Describe **two other** instruction groups.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

- (c) The table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC).

Instruction		Explanation
Opcode	Operand	
AND	Bn	Bitwise AND operation of the contents of ACC with the operand
XOR	Bn	Bitwise XOR operation of the contents of ACC with the operand
OR	Bn	Bitwise OR operation of the contents of ACC with the operand
B denotes a binary number, e.g. B01001010		

The binary value 00111101 is stored in the memory address 200.

Each instruction in the diagram is performed on the data in memory address 200.

Draw **one** line from each instruction to its correct result.

Instruction	Result
	01111101
XOR B11110000	00111101
OR B01010101	11111111
AND B11111111	11000010
	11001101

[3]



4 A computer has system software including an operating system.

(a) Describe the key management tasks of an operating system.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) Utility software is a type of system software.

(i) Describe the purpose of back-up software and defragmentation software.

Back-up software .....

.....

.....

.....

Defragmentation software .....

.....

.....

..... [4]

(ii) Give **one other** example of utility software.

..... [1]

- 5 A company wants to store data about its employees in a computer system. The owner of the company wants to ensure the security and integrity of the data.

(a) (i) State why data needs to be kept secure.

.....  
 ..... [1]

(ii) One way the data stored in a computer can be kept secure is by using back-up software.

Give **two other** ways the data stored in a computer can be kept secure.

1 .....  
 .....  
 2 .....  
 ..... [2]

(b) The data about the employees is currently stored on paper. The data needs to be transferred into the computer system.

Data validation and verification are used to help maintain the integrity of the data.

(i) Identify **and** describe **one** method of data verification that can be used when transferring the data from paper to the computer.

Method .....  
 Description .....  
 .....  
 ..... [2]

(ii) The company needs to transfer the date of birth of each employee into the computer system.

Give **one** example of how each of the following data validation rules can be used to validate the date of birth when it is entered into the system.

Range check .....  
 .....  
 Presence check .....  
 .....  
 Length check .....  
 ..... [3]

- (iii) Explain why the data in the system may **not** be correct even after validating and verifying the data.

.....

.....

.....

.....

.....

..... [2]

- 6 A relational database, `TECHNOLOGY`, stores data about the staff in a company and the computer devices used by the staff.

The database has the following tables:

```
STAFF(StaffID, FirstName, LastName, DateOfBirth, JobTitle)
```

```
DEVICE(DeviceID, Type, DatePurchased, StaffID)
```

- (a) Describe the relationship between the two tables. Refer to the primary and foreign keys in your answer.

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (b) The database uses a Data Definition Language (DDL) and Data Manipulation Language (DML).

- (i) Complete the SQL script to return the number of devices stored in the database for the staff member with the first name 'Ali' and last name 'Khan'.

```
SELECT ..... (STAFF.StaffID)

FROM .....

INNER JOIN DEVICE

..... STAFF.StaffID = DEVICE.StaffID

WHERE STAFF.FirstName = 'Ali'

..... STAFF.LastName = 'Khan';
```

[4]

- (ii) The table `DEVICE` needs a new attribute to store whether the device has been returned by the staff member, or not.

Write a Structured Query Language (SQL) script to insert the new attribute into the table `DEVICE`.

.....

.....

.....

..... [2]

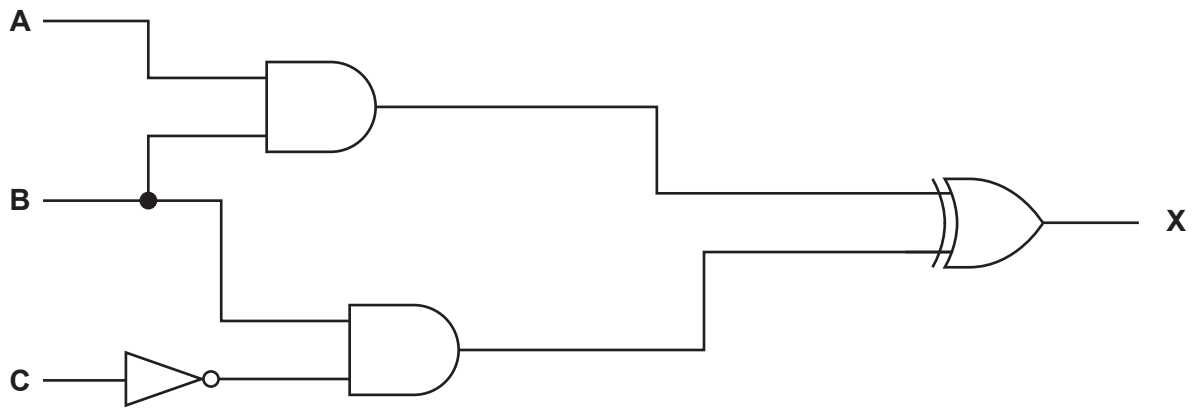
- (c) The database is in Third Normal Form (3NF).

Complete the table by describing the three normal forms.

Normal Form	Description
First Normal Form (1NF)	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
Second Normal Form (2NF)	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
Third Normal Form (3NF)	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>

[3]

- 7 (a) Write the logic expression for the following logic circuit.



.....  
 ..... [3]

- (b) Complete the truth table for the following logic expression:

$$X = (A \text{ NAND } B) \text{ OR } (A \text{ AND NOT } C)$$

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[2]

8 A company uses cloud computing.

(a) Define cloud computing.

.....  
..... [1]

(b) State what is meant by a public cloud and a private cloud.

Public cloud .....  
.....  
Private cloud .....  
..... [2]

(c) Give **two** benefits and **one** drawback of using cloud computing.

Benefit 1 .....  
.....  
Benefit 2 .....  
.....  
Drawback .....  
..... [3]

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## 9618/11

October/November 2022

**1 hour 30 minutes**

You must answer on the question paper.

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **20** pages. Any blank pages are indicated.

- 1 (a) (i) Convert the unsigned binary integer into denary.

00100111

Answer ..... [1]

- (ii) Convert the Binary Coded Decimal (BCD) into denary.

00100111

Answer ..... [1]

- (iii) Convert the 8-bit two's complement binary integer into denary.

11100111

Answer ..... [1]

- (b) Perform the following binary subtraction. Show your working.

$$\begin{array}{r}
 1\ 0\ 1\ 1\ 0\ 0\ 1\ 1 \\
 -\ 0\ 1\ 1\ 1\ 0\ 1\ 0\ 1 \\
 \hline
 \end{array}$$

[2]

- (c) Give **one** similarity and **two** differences between the ASCII and Unicode character sets.

Similarity .....

.....

Difference 1 .....

.....

Difference 2 .....

.....

[3]

- (d) Sound samples are recorded and saved in a file.

- (i) State what is meant by **sampling rate**.

.....

..... [1]

- (ii) Explain the effect of increasing the **sampling resolution** on the sound file.

.....

.....

.....

..... [2]

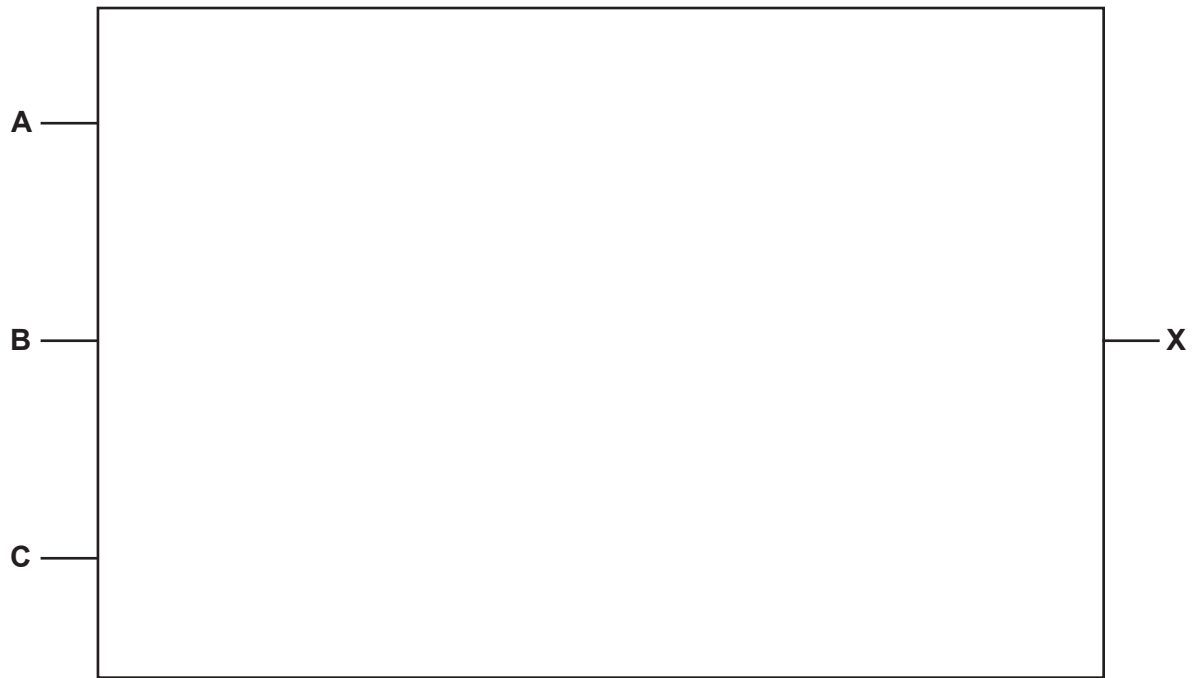
2 Draw **one** line from each security feature to its most appropriate description.

Security feature	Description
firewall	converts data to an alternative form
pharming	redirects a user to a fake website
anti-virus software	verifies the authenticity of data
encryption	scans files on the hard drive for malicious software
	accepts or rejects incoming and outgoing packets based on criteria

[4]

- 3 (a) Draw a logic circuit for the logic expression:

$$X = \text{NOT } ((\text{NOT } A \text{ AND NOT } B) \text{ OR } (\text{NOT } B \text{ AND NOT } C))$$



[2]

- (b) Complete the truth table for the logic expression:

$$X = \text{NOT } ((\text{NOT } A \text{ AND NOT } B) \text{ OR } (\text{NOT } B \text{ AND NOT } C))$$

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[2]

- 4 A photographer creates a relational database to store data about photographs taken at birthday parties.

The database, `PHOTOGRAPHS`, stores details of the customer, the party, the photographs taken and the cameras used.

The photographer has several cameras that are used for taking the photographs at the parties.

Each camera has a specific lens type (for example, `XY32Z`) and lighting type (for example, `F1672`).

Data about each photograph is stored in the database including the party at which it was taken, the time it was taken and the camera used.

The database has these four tables:

```
CUSTOMER(CustomerID, FirstName, LastName, Telephone)
```

```
PARTY(PartyID, CustomerID, PartyDate, StartTime)
```

```
PHOTO_DATA(PhotoID, PartyID, TimeTaken, CameraID)
```

```
CAMERA_DATA(CameraID, LensType, LightingType)
```

- (a) Complete the entity-relationship (E-R) diagram for the database `PHOTOGRAPHS`.



[3]

- (b) The database is normalised and is in Third Normal Form (3NF).

Describe the characteristics of a database that is in Third Normal Form (3NF).

.....

.....

.....

.....

.....

..... [3]

- (c) The table shows some sample data for the table PHOTO\_DATA.

PhotoID	PartyID	TimeTaken	CameraID
ST23-56	BD987	08:34	NIK-02
ST23-57	BD987	08:55	NIK-02
ST23-60	BC08	09:01	CAN-01
ST23-61	BC08	10:23	CAN-12
ST23-62	BC08	10:56	NIK-01

- (i) State what is meant by a **tuple**. Give an example of a tuple from PHOTO\_DATA.

Tuple .....

.....

Example .....

..... [2]

- (ii) Complete the Structured Query Language (SQL) script to display the total number of photographs that have been taken using a camera with a camera ID starting with CAN.

SELECT ..... (.....)

FROM .....

WHERE CameraID LIKE ..... ;

[4]

- (d) Write an SQL script to include two new fields in `CAMERA_DATA` to store the number of photographs currently on the camera **and** the date the camera was last used.

.....

.....

.....

.....

.....

..... [3]



**Question 5 begins on page 10.**

- 5 (a) State what is meant by the **stored program concept** in the Von Neumann model of a computer system.

.....  
 ..... [1]

- (b) A Central Processing Unit (CPU) contains several special purpose registers and other components.

- (i) State the role of the following registers.

Program Counter (PC) .....  
 .....

Index Register (IX) .....  
 .....

Status Register (SR) .....  
 .....

.....  
 ..... [3]

- (ii) Tick (✓) **one** box in each row to identify the system bus used by each CPU component.

CPU component	Data bus	Address bus	Control bus
System clock			
Memory Address Register (MAR)			

[1]

- (iii) Describe the purpose of the Control Unit (CU) in a CPU.

.....  
 .....  
 .....  
 ..... [2]

(c) Describe the purpose of an interrupt in a computer system.

.....

.....

.....

..... [2]

(d) Identify **two** causes of a software interrupt.

1 .....

.....

2 .....

..... [2]

- 6 The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Opcode	Operand	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the index register. Copy the contents of this calculated address to ACC
LDR	#n	Immediate addressing. Load the number n to IX
STO	<address>	Store contents of ACC at the given address
ADD	<address>	Add the contents of the given address to the ACC
ADD	#n	Add the denary number n to the ACC
INC	<register>	Add 1 to the contents of the register (ACC or IX)
CMP	#n	Compare the contents of ACC with number n
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False
OUT		Output to the screen the character whose ASCII value is stored in ACC
END		Return control to the operating system
<address> can be an absolute or a symbolic address # denotes a denary number, e.g. #123 B denotes a binary number, e.g. B01001101		

- (a) The current contents of main memory and selected values from the ASCII character set are given.
- (i) Trace the program currently in memory using the trace table.

Address	Instruction
77	LDR #0
78	LDX 110
79	CMP #35
80	JPE 92
81	ADD 100
82	STO 101
83	LDM #1
84	ADD 100
85	STO 100
86	INC IX
87	LDX 110
88	CMP #35
89	JPN 81
90	LDD 100
91	ADD #48
92	OUT
93	END
...	
100	0
101	0
...	
110	66
111	65
112	35

ASCII value	Character
49	1
50	2
51	3
52	4
65	A
66	B
67	C
68	D

(ii) The following instructions are repeated for your reference.

Instruction		Explanation
Opcode	Operand	
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
STO	<address>	Store contents of ACC at the given address

State the purpose of this part of an assembly language program.

```
LDD 100
STO 165
LDD 101
STO 100
LDD 165
STO 101
```

.....

.....

[1]

**Question 6(b) begins on page 16.**

(b) The following table shows another part of the instruction set for the processor.

Instruction		Explanation
Opcode	Operand	
AND	#n	Bitwise AND operation of the contents of ACC with the operand
AND	Bn	Bitwise AND operation of the contents of ACC with the binary number n
XOR	#n	Bitwise XOR operation of the contents of ACC with the operand
XOR	Bn	Bitwise XOR operation of the contents of ACC with the binary number n
OR	#n	Bitwise OR operation of the contents of ACC with the operand
OR	Bn	Bitwise OR operation of the contents of ACC with the binary number n
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left-hand end
<address> can be an absolute or a symbolic address # denotes a denary number, e.g. #123 B denotes a binary number, e.g. B01001101		

(i) The current contents of the ACC are:

1	0	0	1	0	0	1	1
---	---	---	---	---	---	---	---

Show the result after the execution of the following instruction.

XOR B00011111

.....

.....

--	--	--	--	--	--	--	--

[1]

(ii) The current contents of the ACC are:

1	0	0	1	0	0	1	1
---	---	---	---	---	---	---	---

Show the result after the execution of the following instruction.

AND B11110000

.....

.....

--	--	--	--	--	--	--	--

[1]



(iii) The current contents of the ACC are:

1	0	0	1	0	0	1	1
---	---	---	---	---	---	---	---

Show the result after the execution of the following instruction.

OR B11001100

.....  
 .....

--	--	--	--	--	--	--	--

[1]

(iv) The current contents of the ACC are:

1	0	0	1	0	0	1	1
---	---	---	---	---	---	---	---

Show the result after the execution of the following instruction.

LSR #2

.....  
 .....

--	--	--	--	--	--	--	--

[1]

(c) Tick (✓) **one or more** boxes in each row to indicate whether the task is performed in the first pass or the second pass of a two-pass assembler.

Task	First pass	Second pass
Remove comments.		
Read the assembly language program one line at a time.		
Generate the object code.		
Check the opcode is in the instruction set.		

[2]

- 7 (a) State **two** benefits to a programmer of using Dynamic Link Library (DLL) files.

1 .....

.....

2 .....

.....

[2]

- (b) Memory management is one of the tasks performed by an Operating System (OS).

Describe the ways in which memory management organises and allocates Random Access Memory (RAM).

.....

.....

.....

.....

[2]

- (c) An Operating System may include a utility program to compress text files.

Describe **one** appropriate method of compressing a text file.

.....

.....

.....

.....

.....

.....

[3]

- (d) Explain the reasons why increasing the amount of cache memory can improve the performance of a CPU.

.....

.....

.....

.....

[2]

- (e) State the name of a peripheral device port that provides a physical connection in the computer for each of these peripherals.

3D printer .....

Monitor .....

[2]

- 8 A Local Area Network (LAN) uses a bus topology.

Describe how Carrier Sense Multiple Access/Collision Detection (CSMA/CD) is used in a bus network.

.....

.....

.....

.....

.....

.....

.....

..... [4]

- 9 Many modern televisions are examples of embedded systems.

(a) Explain why these televisions are embedded systems.

.....

.....

.....

..... [2]

(b) Embedded systems use Electrically Erasable Programmable ROM (EEPROM).

Describe **one** benefit of using EEPROMs in an embedded system.

.....

.....

.....

..... [2]

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## 9618/12

October/November 2022

**1 hour 30 minutes**

You must answer on the question paper.

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **20** pages. Any blank pages are indicated.

- 1 (a) Draw **one** line from each utility software to its most appropriate purpose.

Utility software	Purpose
virus checker	to reorganise files so they are contiguous
disk formatter	to scan for malicious program code
backup	to decrease the file size
disk repair	to initialise a disk
defragmentation	to create copies of files in case the original is lost
	to check for and fix inconsistencies on a disk

[5]

- (b) Compilers and interpreters translate programs written in a high-level language into a low-level language.

- (i) State **two** drawbacks of using a compiler compared to an interpreter during program development.

1 .....

.....

.....

2 .....

.....

.....

[2]

- (ii) Explain why high-level language programs might be partially compiled and partially interpreted.

.....

.....

.....

.....

[2]

- 2 (a) (i) Convert the two's complement binary integer into denary.

10010110

Answer .....

[1]

- (ii) Convert the unsigned binary integer into hexadecimal.

10010110

Answer .....

[1]

- (iii) Convert the unsigned binary integer into Binary Coded Decimal (BCD). Show your working.

10010101

Working .....

.....

.....

Answer .....

[2]

- (b) Perform the following binary addition.

$$\begin{array}{r}
 1 \ 0 \ 0 \ 0 \ 1 \ 1 \ 0 \ 0 \\
 + \ 0 \ 1 \ 0 \ 0 \ 0 \ 1 \ 1 \ 0 \\
 \hline
 \end{array}$$

[1]

3 (a) A greenhouse has an automatic window.

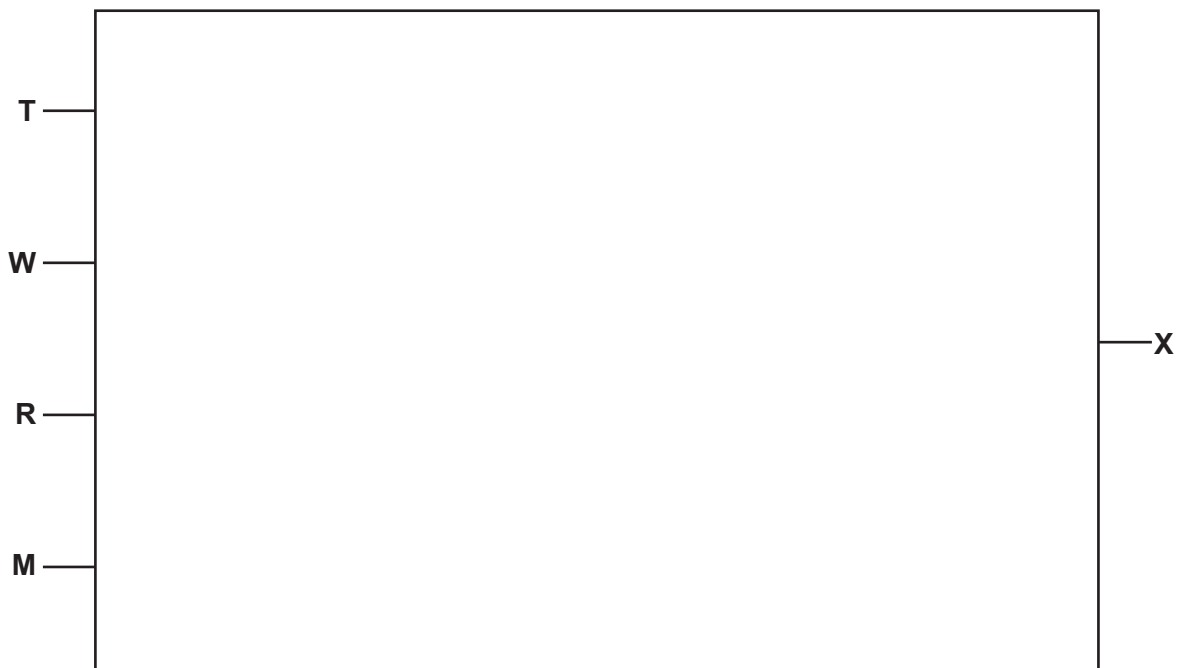
The window (**X**) operates according to the following criteria:

Parameter	Description of parameter	Binary value	Condition
<b>T</b>	Temperature	1	Too high
		0	Acceptable
<b>W</b>	Wind speed	1	Too high
		0	Acceptable
<b>R</b>	Rain	1	Detected
		0	Not detected
<b>M</b>	Manual override	1	On
		0	Off

The window opens (**X** = 1) if:

- the temperature is too high **and** the wind speed is acceptable
- and**
- rain is not detected, **or** the manual override is off.

Draw a logic circuit to represent the operation of the window.



[3]



(b) Complete the truth table for the logic expression:

$$X = \text{NOT } (A \text{ OR } B \text{ OR } C) \text{ AND } (B \text{ NOR } C)$$

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[2]

(c) Embedded systems contain Read Only Memory (ROM) and Random Access Memory (RAM).

Explain the reasons why ROM is used in an embedded system.

.....

.....

.....

.....

.....

..... [2]

- 4 (a) State the difference between **data verification** and **data validation**.

.....

.....

..... [1]

- (b) A checksum can be used to detect errors during data transmission.

Describe how a checksum is used.

.....

.....

.....

.....

.....

..... [3]

- (c) One validation method is a presence check.

Describe **two other** validation methods that can be used to validate non-numeric data.

1 .....

.....

2 .....

.....

[2]

- 5 A relational database, GARDEN, has the following tables:

OWNER(OwnerID, FirstName, TelephoneNo, TreeID, TreePosition)

TREE(TreeID, ScientificName, MaxHeight, FastGrowing)

- (a) The database is **not** in Third Normal Form (3NF).

Explain how the database can be normalised to 3NF.

.....

.....

.....

.....

.....

..... [3]

- (b) Write the Structured Query Language (SQL) script to add a new record in the table TREE to store the following data:

Attribute	Value
TreeID	LOW_1276
ScientificName	Salix_Alba
MaxHeight	30.00
FastGrowing	TRUE

.....

.....

.....

..... [3]

- (c) State what is meant by a **candidate key** in a relational database.

.....

..... [1]

- (d) (i) Describe, using an example, what is meant by a **data dictionary**.

.....

.....

.....

..... [2]

- (ii) Describe what is meant by a **logical schema**.

.....

.....

.....

..... [2]

**6 (a)** A student uses a networked laptop computer to send an email to a colleague.

**(i)** Explain how a digital signature ensures the email is authentic.

.....

.....

.....

..... [2]

**(ii)** Describe how a firewall protects the data on the computer.

.....

.....

.....

.....

.....

..... [3]

**(b)** The student records a sound file.

**(i)** Explain the effect of increasing the sampling rate on the accuracy of the sound recording.

.....

.....

.....

..... [2]

**(ii)** Explain the effect of decreasing the sampling resolution on the file size of the sound recording.

.....

.....

.....

..... [2]

- 7 The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Opcode	Operand	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the index register. Copy the contents of this calculated address to ACC
LDR	#n	Immediate addressing. Load the number n to IX
STO	<address>	Store the contents of ACC at the given address
ADD	<address>	Add the contents of the given address to the ACC
ADD	#n	Add the denary number n to the ACC
INC	<register>	Add 1 to the contents of the register (ACC or IX)
JMP	<address>	Jump to the given address
CMP	<address>	Compare the contents of ACC with the contents of <address>
CMI	<address>	Indirect addressing. The address to be used is at the given address. Compare the contents of ACC with the contents of this second address
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False
END		Return control to the operating system
<address> can be an absolute or symbolic address # denotes a denary number, e.g. #123 B denotes a binary number, e.g. B01001101		

- (a) Trace the program currently in memory using the trace table, stopping when line 90 is executed for a second time.

Address	Instruction	Instruction address	ACC	IX	Memory address						
					100	101	102	103	110	111	112
75	LDR #0				0	0	112	4	1	4	0
76	LDX 110										
77	CMI 102										
78	JPE 91										
79	CMP 103										
80	JPN 84										
81	ADD 101										
82	STO 101										
83	JMP 86										
84	INC ACC										
85	STO 101										
86	LDD 100										
87	INC ACC										
88	STO 100										
89	INC IX										
90	JMP 76										
91	END										
...	↗										
100	0										
101	0										
102	112										
103	4										
...	↗										
110	1										
111	4										
112	0										

[5]

(b) The following table shows another part of the instruction set for the processor.

Instruction		Explanation
Opcode	Operand	
AND	#n	Bitwise AND operation of the contents of ACC with the operand
AND	<address>	Bitwise AND operation of the contents of ACC with the contents of <address>
XOR	#n	Bitwise XOR operation of the contents of ACC with the operand
XOR	Bn	Bitwise XOR operation of the contents of ACC with the binary number n
XOR	<address>	Bitwise XOR operation of the contents of ACC with the contents of <address>
OR	#n	Bitwise OR operation of the contents of ACC with the operand
OR	<address>	Bitwise OR operation of the contents of ACC with the contents of <address>
LSL	#n	Bits in ACC are shifted logically n places to the left. Zeros are introduced on the right-hand end
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left-hand end
<address> can be an absolute or symbolic address # denotes a denary number, e.g. #123 B denotes a binary number, e.g. B01001101		

The contents of memory addresses 50 and 51 are shown:

Memory address	Data value
50	01001101
51	10001111

(i) The current contents of the ACC are:

0	1	0	1	0	0	1	1
---	---	---	---	---	---	---	---

Show the contents of the ACC after the execution of the following instruction.

XOR B00011111

.....

.....

--	--	--	--	--	--	--	--

[1]



(ii) The current contents of the ACC are:

0	1	0	1	0	0	1	1
---	---	---	---	---	---	---	---

Show the contents of the ACC after the execution of the following instruction.

AND 50

.....  
 .....

--	--	--	--	--	--	--	--

[1]

(iii) The current contents of the ACC are:

0	1	0	1	0	0	1	1
---	---	---	---	---	---	---	---

Show the contents of the ACC after the execution of the following instruction.

LSL #3

.....  
 .....

--	--	--	--	--	--	--	--

[1]

(iv) The current contents of the ACC are:

0	1	0	1	0	0	1	1
---	---	---	---	---	---	---	---

Show the contents of the ACC after the execution of the following instruction.

OR 51

.....  
 .....

--	--	--	--	--	--	--	--

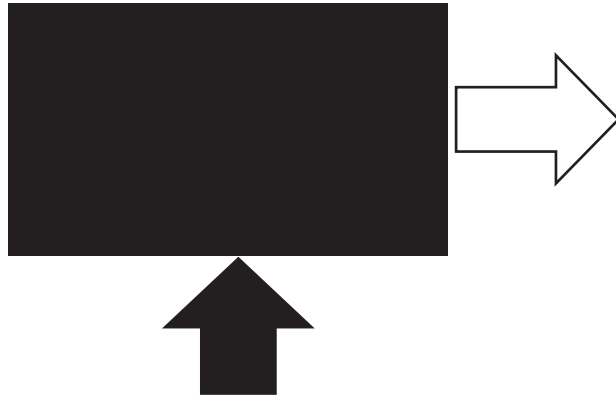
[1]

- (c) Write the register transfer notation for each of the stages in the fetch-execute cycle described in the table.

Description	Register transfer notation
Copy the address of the next instruction into the Memory Address Register.	
Increment the Program Counter.	
Copy the contents of the Memory Data Register into the Current Instruction Register.	

[3]

- 8 The following bitmap image has a resolution of  $4096 \times 4096$  pixels and a colour depth of 24 bits per pixel.



The image is displayed on a monitor that has a screen resolution of  $1920 \times 1080$  pixels.

- (a) Tick (✓) **one** box in each row to identify the effect of each action on the image file size.

Action	Increases the file size	Decreases the file size	No change to the file size
Change the colour depth of the image file to 16 bits per pixel.			
Change the screen resolution to $1366 \times 768$ pixels.			
Change the colour of the rectangle from black to red.			

[2]

- (b) State **two** benefits of creating a vector graphic instead of a bitmap image.

1 .....

.....

2 .....

.....

[2]

- (c) A second bitmap image is stored using a colour depth of 8 bits per pixel.

The file is compressed using run-length encoding (RLE).

- (i) The table shows the compressed and uncompressed values for parts of the image file.

Each colour of the pixel in the image is represented by a hexadecimal value.

Complete the table. The first row has been completed for you.

Uncompressed image	RLE compressed image
EA F1 F1 F2 F2 F2 EA	1EA 2F1 3F2 1EA
	2AB 2FF 11D 167
32 32 80 81 81	

[2]

- (ii) RLE is an example of lossless compression.

Explain why lossless compression is more appropriate than lossy compression for a text file.

.....

.....

.....

.....

..... [2]

- 9 One use of Artificial Intelligence (AI) is for facial recognition software.

Describe the social impact of using facial recognition software to identify individuals in an airport.

.....

.....

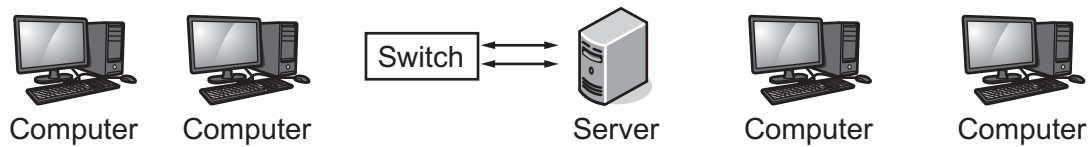
.....

..... [2]

- 10** A Local Area Network (LAN) consists of four computers, one server and a switch.

The LAN uses a star topology.

- (a)** Complete the following diagram to show how the hardware is connected.



[1]

- (b)** A router is attached to one of the devices on the LAN shown in **part (a)** to connect the LAN to the internet.

- (i)** Identify the device. Give a reason for your choice.

Device .....

Reason .....

.....

.....

[2]

- (ii)** Describe the role **and** function of the router in the network.

.....

.....

.....

.....

.....

..... [3]



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9618/13

October/November 2022

**1 hour 30 minutes**

You must answer on the question paper.

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **20** pages. Any blank pages are indicated.

**BLANK PAGE**

1 A digital audio message needs to be recorded.

- (a) Tick (✓) **one** box in each row to identify the effect of each action on the accuracy of the recording.

Action	Accuracy increases	Accuracy decreases	Accuracy does not change
Change the sampling rate from 40 kHz to 60 kHz.			
Change the duration of the recording from 20 minutes to 40 minutes.			
Change the sampling resolution from 24 bits to 16 bits.			

[2]

- (b) The audio message is recorded with a sampling rate of 50 kHz and a sampling resolution of 16 bits.

The recording is 20 minutes in length.

Calculate the file size of the recording.

Give your answer in megabytes **and** show your working.

Working .....

.....

.....

.....

Answer ..... megabytes

[2]

- (c) A computer uses a buffer when playing the audio message.

Explain the purpose of a buffer in a computer system using **one other** example.

.....

.....

.....

.....

.....

..... [3]

- 2 The relational database `ASTRONOMY` is used to store data about telescopes, the companies that own the telescopes and the photographs taken by the telescopes.

The database has these three tables:

`COMPANY (TelephoneNumber, CompanyID, CompanyName)`

`PHOTOGRAPH (PhotoID, TelescopeID, DateTaken, TimeTaken, Elevation)`

`TELESCOPE (TelescopeID, CompanyID, SerialNumber)`

- (a) Complete the following table by writing the correct answer for each item.

Item	Answer
a suitable field for the primary key in <code>COMPANY</code>	
a candidate key in <code>TELESCOPE</code>	
the degree of relationship between <code>TELESCOPE</code> and <code>PHOTOGRAPH</code>	

[3]

- (b) A Database Management System (DBMS) has several features.

Identify the feature that describes the relationship between data and its structure.

..... [1]

- (c) Complete the SQL script to return the total number of telescopes owned by the company whose ID begins with `HW`.

```
SELECT ..... (.....)
FROM TELESCOPE
WHERE ..... LIKE .....
```

[4]

- (d) Write the SQL script to add **one** field to the table `PHOTOGRAPH` to store the resolution of the photograph, e.g. 1920 × 1068.

.....

.....

.....

..... [2]

- (e) The photographs are stored as bitmap images.

Complete the statements about bitmap images by writing the missing words.

The ..... of a bitmap image is the number of bits that are used to store each pixel.

Metadata about the image is stored in the ..... of the file.

[2]

- (f) Describe the purpose of a query processor in a DBMS.

.....

.....

.....

..... [2]

- 3 Draw **one** line from each Operating System (OS) management task to its most appropriate description.

OS Management task	Description
hardware management	dynamically allocates memory to processes
security management	marks unallocated file storage for availability
memory management	installs programs for devices connected to external ports
process management	validates user and process authenticity
	allows processes to transfer data to and from each other

[4]

- 4 (a) A Central Processing Unit (CPU) contains several special purpose registers and other components.

(i) State the roles of the following registers.

Memory Address Register (MAR) .....

.....

.....

Memory Data Register (MDR) .....

.....

.....

[2]

(ii) State when interrupts are detected during the Fetch-Execute (F-E) cycle.

.....

..... [1]

(b) A computer system contains a system clock.

Describe the purpose of the system clock.

.....

.....

.....

..... [2]

(c) Upgrading secondary storage to solid state typically improves the performance of computer systems.

Identify **one other** upgrade to the hardware **and** explain why it improves the performance of a computer system.

Upgrade .....

Explanation .....

.....

.....

[2]

- 5 (a) Draw a logic circuit for the logic expression:

$$X = \text{NOT} ((\text{NOT} (A \text{ AND } B)) \text{ OR } (\text{NOT} (B \text{ AND } C)))$$



[3]

- (b) Complete the truth table for the logic expression:

$$Y = (\text{NOT } P \text{ AND } Q) \text{ OR } (Q \text{ AND NOT } R)$$

P	Q	R	Working space	Y
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[2]



**Question 6 begins on page 10.**

- 6 The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Opcode	Operand	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the index register. Copy the contents of this calculated address to ACC
LDR	#n	Immediate addressing. Load the number n to IX
MOV	<register>	Moves the contents of the accumulator to the given register (IX)
STO	<address>	Store contents of ACC at the given address
ADD	<address>	Add the contents of the given address to the ACC
ADD	#n	Add the denary number n to the ACC
SUB	#n	Subtract the denary number n from the ACC
INC	<register>	Add 1 to the contents of the register (ACC or IX)
JMP	<address>	Jump to the given address
CMP	#n	Compare the contents of ACC with number n
CMI	<address>	Indirect addressing. The address to be used is at the given address. Compare the contents of ACC with the contents of this second address
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False
OUT		Output to the screen the character whose ASCII value is stored in ACC
END		Return control to the operating system
<address> can be an absolute or a symbolic address # denotes a denary number, e.g. #123 B denotes a binary number, e.g. B01001101		

- (a) The current contents of main memory and selected values from the ASCII character set are given.
- (i) Trace the program currently in memory using the trace table.

Address	Instruction
75	LDR #0
76	LDD 100
77	CMP #2
78	JPE 91
79	LDX 110
80	SUB #32
81	CMP #65
82	JPN 86
83	LDM #1
84	ADD 101
85	STO 101
86	LDM #1
87	ADD 100
88	STO 100
89	INC IX
90	JMP 76
91	LDD 101
92	ADD #48
93	OUT
94	END
...	
100	1
101	0
...	
110	97
111	98
112	97

ASCII value	Character
49	1
50	2
51	3
52	4
65	A
66	B
67	C
68	D

[4]

- (ii) Explain the purpose of **relative addressing** in an assembly language program.

.....

.....

.....

..... [2]

- (b) The following table shows another part of the instruction set for the processor.

Instruction		Explanation
Opcode	Operand	
AND	#n	Bitwise AND operation of the contents of ACC with the operand
AND	Bn	Bitwise AND operation of the contents of ACC with the binary number n
AND	<address>	Bitwise AND operation of the contents of ACC with the contents of <address>
XOR	#n	Bitwise XOR operation of the contents of ACC with the operand
XOR	<address>	Bitwise XOR operation of the contents of ACC with the contents of <address>
OR	#n	Bitwise OR operation of the contents of ACC with the operand
OR	Bn	Bitwise OR operation of the contents of ACC with the binary number n
OR	<address>	Bitwise OR operation of the contents of ACC with the contents of <address>
LSL	#n	Bits in ACC are shifted logically n places to the left. Zeros are introduced on the right-hand end
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left-hand end
<address> can be an absolute or a symbolic address # denotes a denary number, e.g. #123 B denotes a binary number, e.g. B01001101		

- (i) The current contents of the ACC are:

0	0	1	1	0	1	1	0
---	---	---	---	---	---	---	---

Show the contents of the ACC after the execution of the following instruction.

AND B01001100

.....

.....

--	--	--	--	--	--	--	--

[1]

(ii) The current contents of the ACC are:

1	0	0	1	0	1	0	1
---	---	---	---	---	---	---	---

Show the contents of the ACC after the execution of the following instruction.

OR B01001111

.....  
 .....

--	--	--	--	--	--	--	--

[1]

(iii) The current contents of the ACC are:

1	0	0	1	1	1	0	1
---	---	---	---	---	---	---	---

Show the contents of the ACC after the execution of the following instruction.

LSR #2

.....  
 .....

--	--	--	--	--	--	--	--

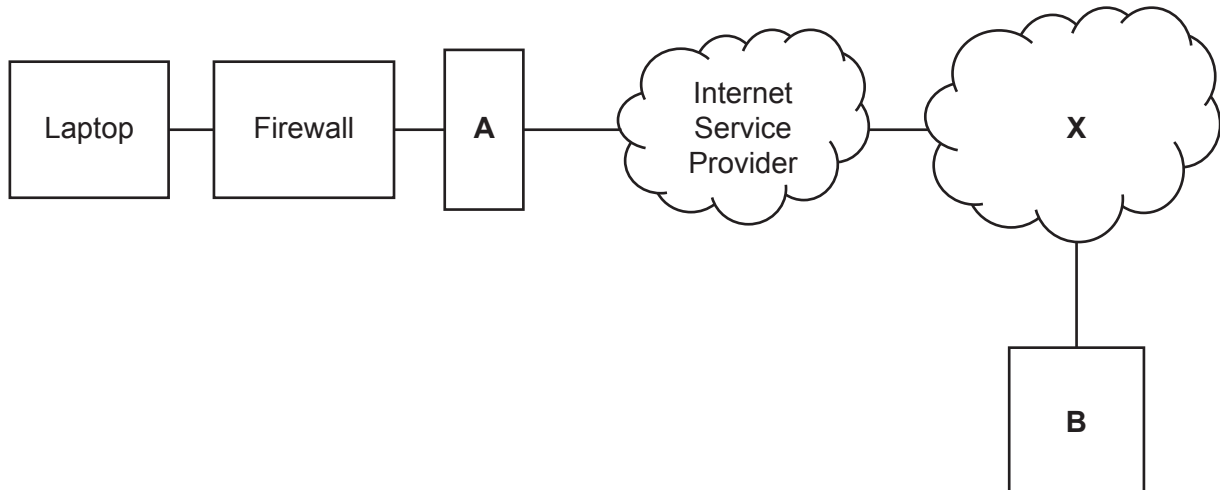
[1]

(c) One instruction group is data movement.

Give the name of **one other** instruction group.

.....  
 ..... [1]

- 7 (a) The diagram shows the hardware and software used to retrieve files stored on the cloud.



Complete the following table by writing the answer for each row.

Answer	
The name of device <b>A</b> that allows the laptop to connect to the internet	
A type of cloud, <b>X</b>	
An example of an application, <b>B</b> , that can run on the cloud	

[3]

- (b) Give **one** advantage and **two** disadvantages of transmitting data using satellites instead of copper cables.

Advantage 1 .....

.....

Disadvantage 1 .....

.....

Disadvantage 2 .....

.....

[3]

(c) Local Area Networks (LANs) can be made up of several subnetworks.

(i) Give **two** benefits of dividing a network into subnetworks by subnetting the LAN.

- 1 .....
- .....
- 2 .....
- .....

[2]

(ii) A subnet mask is used when subnetting a LAN.

Two devices on the LAN are located in different subnetworks.

The IP addresses and corresponding subnet masks are shown:

Device IP address	Subnet mask
10.10.12.1	255.0.0.0
192.168.12.4	255.255.255.0

Identify the following network ID and host ID.

The network ID for the device with the IP address 10.10.12.1

.....

The host ID for the device with the IP address 192.168.12.4

.....

[2]

- 8 (a) (i) Explain why some programs are distributed under an open source licence.

.....

.....

.....

..... [2]

- (ii) Explain how a programmer benefits from distributing a program under a commercial licence.

.....

.....

.....

..... [2]

- (b) A commercial program for a vehicle repair garage includes an Artificial Intelligence (AI) module that can diagnose faults and suggest repairs.

Describe **one** economic impact the AI module may have on the garage.

.....

.....

.....

..... [2]



- 9 (a) (i) Convert the unsigned binary value into hexadecimal.

10010011

Answer ..... [1]

- (ii) Convert the unsigned binary value into denary.

10010011

Answer ..... [1]

- (b) State **two** benefits of using Binary Coded Decimal (BCD) to represent values.

Benefit 1 .....

.....

Benefit 2 .....

.....

[2]

10 (a) Explain the importance of feedback in a control system.

.....

.....

.....

.....

.....

..... [3]

(b) (i) Identify **one** sensor that could be used in a car alarm system.

Justify your choice.

Sensor .....

Justification .....

.....

.....

..... [2]

(ii) The car alarm is an example of an embedded system.

Describe the characteristics of an embedded system.

.....

.....

.....

.....

.....

..... [3]

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**9608/01**

**For Examination from 2015**

**1 hour 30 minutes**

No Additional Materials are required.

Do not use staples, paper clips, glue or correction fluid.

No calculators allowed.

The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **16** printed pages.

- 1 A database is designed to store data about students at a college and the subjects which they study.

- All students are based in a tutor group.
- A tutor supervises all the students in their tutor group.
- Each subject has one subject teacher only.
- Students study a number of subjects.

This table `StudentSubjects` was a first attempt at the database design.

Table: `StudentSubjects`

StudentName	TutorGroup	Tutor	Subject	Level	SubjectTeacher
Tom	6	SAN	Physics	A	SAN
			Chemistry	A	MEB
			General Studies	AS	DIL
Joe	7	MEB	Geography	AS	ROG
			French	AS	HEN
Samir	6	SAN	Computer Science	A	VAR
			Chemistry	A	MEB
			Maths	A	COR
			General Studies	A	DIL

- (a) (i) Explain why the table is **not** in First Normal Form (1NF).

.....  
 ..... [1]

- (ii) Explain your answer by referring to the data.

.....  
 ..... [1]

(b) The design is changed to:

Student (StudentName, TutorGroup, Tutor)  
 StudentSubjectChoices (StudentName, Subject, Level, SubjectTeacher)

Using the data given in the first attempt table, show how this data is now stored in the revised table designs.

Table: Student

StudentName	TutorGroup	Tutor

Table: StudentSubjectChoices

StudentName	Subject	Level	SubjectTeacher

[3]

(c) (i) Explain what is meant by a primary key.

.....

.....

.....

..... [2]

- (ii) A student is **not** allowed to choose the same subject at A Level and AS.

What is the primary key of table `StudentSubjectChoices`?

..... [1]

- (iii) There is a relationship between tables `Student` and `StudentSubjectChoices`.

Explain how the relationship is established using a primary key and foreign key.

1 什么关系  
2 通过什么主键联系  
the primary key in student is student name  
which is the foreign key in ~  
links them together

..... [2]

- (d) The design of table `StudentSubjectChoices` is:

`StudentSubjectChoices (StudentName, Subject, Level, SubjectTeacher)`

Explain why this table **is not** in Second Normal Form (2NF).

.....  
.....  
.....  
..... [2]

- (e) The design of table `Student` is:

`Student (StudentName, TutorGroup, Tutor)`

Explain why this table is **not** in Third Normal Form (3NF).

.....  
.....  
.....  
..... [2]



2 When data is transmitted, it may become corrupted.

(a) Explain how a parity check can be used to detect a possible error in a transmitted byte.

.....

.....

.....

.....

.....

..... [3]

(b) Describe how parity can be used to identify and correct the single error in this transmitted data block.

```

0 1 1 0 1 1 0 1
1 0 0 1 0 1 1 1
0 1 0 1 0 1 0 0
1 0 0 0 1 0 0 1
0 1 1 0 0 0 1 1
1 0 0 0 0 1 1 0
0 1 1 0 1 1 0 1

```

0	1	0	0	0	0	0	0
---	---	---	---	---	---	---	---

 Parity byte

.....

.....

.....

.....

.....

..... [3]

- 3 The table shows the assembly language instructions for a processor which has one general purpose register – the Accumulator.

Instruction		Explanation
Op Code	Operand	
LDD	<address>	load using direct addressing
STO	<address>	store the contents of the Accumulator at the given address
LDI	<address>	load using indirect addressing
LDX	<address>	load using indexed addressing
INC		add 1 to the contents of the Accumulator
END		end the program and return to the operating system

- (a) Write on the diagram to explain the instruction shown.  
Show the contents of the Accumulator after the execution of the instruction.

LDD 105

Accumulator

Main memory	
100	0100 0000
101	0110 1000
102	1111 1110
103	1111 1010
104	0101 1101
105	0001 0001
106	1010 1000
107	1100 0001
...	
200	1001 1111

[2]

- (b) Write on the diagram to explain the instruction shown.  
Show the contents of the registers after the execution of the instruction.

LDX 101

Accumulator

Index Register

Main memory	
100	0100 0000
101	0110 1000
102	1111 1110
103	1111 1010
104	0101 1101
105	0001 0001
106	1010 1000
107	1100 0001
...	
200	1001 1111

[4]

(c) Trace this assembly language program using the trace table.

500	LDD	507
501	INC	
502	STO	509
503	LDD	508
504	INC	
505	STO	510
506	END	
507	22	
508	170	
509	0	
510	0	

Accumulator	Memory Address			
	507	508	509	510
	22	170	0	0

[5]

- 4 The website [www.checkyourwellbeing.com](http://www.checkyourwellbeing.com) offers help and advice about personal well-being.

The website has a link – ‘Calculate my BMI’ – that users can click to work out their ‘Body Mass Index’.

When the ‘Calculate my BMI’ link is clicked on the client computer, this webpage is requested.

```
1  <html>
2  <head>
3  <title>Body Mass Index</title>
4
5  </head>
6
7  <body>
8  Calculate my body mass index
9
10 <Script Language = "JavaScript">
11
12 var myWeight = prompt("Enter your weight (in kg.)", "");
13
14 var myHeight = prompt("Enter your height (in m.)", "");
15
16 var myBMI = myWeight / (myHeight * myHeight);
17 myBMI = myBMI.toFixed(2)
18
19 alert("My calculated BMI is ..." + myBMI) ;
20
21 if (myBMI < 18.5)
22 {
23     alert("UNDERWEIGHT") ;
24 }
25
26 if (myBMI > 25)
27 {
28     alert("OVERWEIGHT") ;
29 }
30 if (myBMI >=18.5 && myBMI<=25)
31 {
32     alert("WITHIN RANGE")
33 }
34
35 </Script>
36
37 </body>
38 </html>
```

Loading the webpage produced this sequence of dialogue boxes:



(a) Which lines in the webpage script are JavaScript code?

..... [1]

(b) (i) Give the identifiers of **two** variables which have been used by the programmer.

1 .....

2 ..... [2]

(ii) What group of program statements are performing selection?

line number ..... up to line number ..... [1]

(c) By studying the web page script and its use, what is the use in JavaScript of:

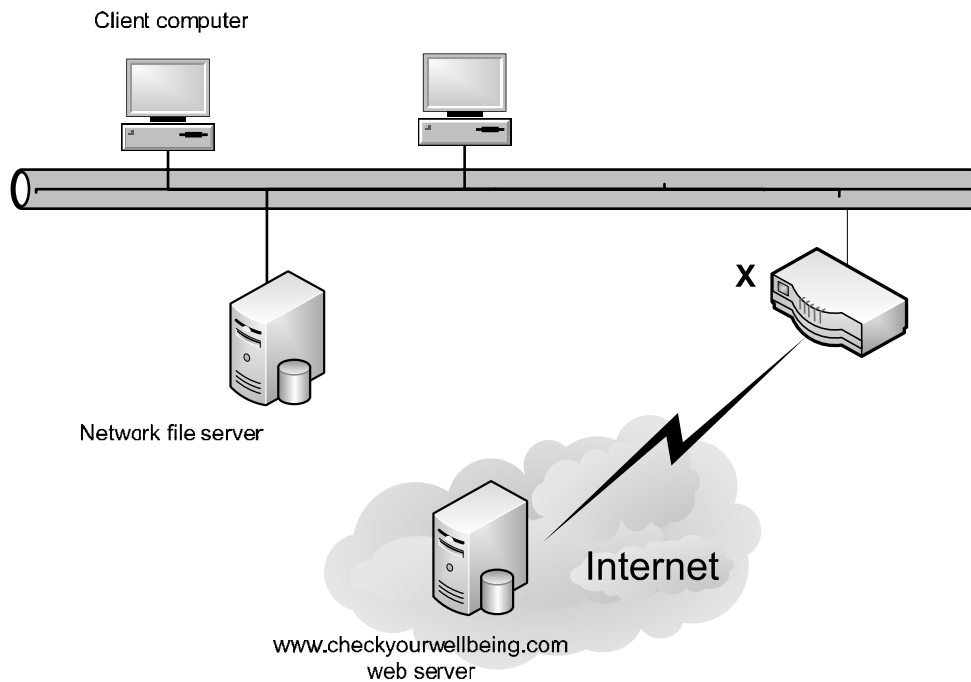
(i) the `prompt` function?

.....  
 ..... [2]

(ii) the `alert` function?

.....  
 ..... [2]

(d) The diagram shows the client computer network with the connection to the Internet.



What is the hardware device labelled X?

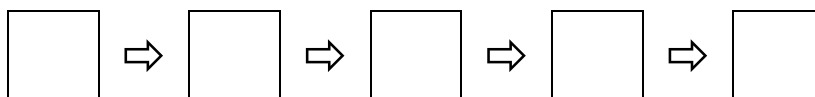
..... [1]

(e) Put **five** of these statements in the correct sequence to describe how the content of the page shown is displayed by the client computer's browser software.

Two of the statements will **not** be used.

- A The client computer processes the JavaScript code.
- B The page content is transmitted to the client computer.
- C The page is displayed on the client computer.
- D The user clicks on the hyperlink and the web page is requested from the network file server.
- E The web server processes the JavaScript code.
- F The user clicks on the hyperlink and the web page is requested from the www.checkyourwellbeing.com web server.
- G The server finds the web page.

The sequence is: (fill in the letters)



[5]

(f) How is this JavaScript code run?

..... [1]

(g) The web developer tested the JavaScript code without involving the web server.

Explain how this is possible.

.....  
.....  
..... [1]

- 5 Here are the contents of three memory locations with addresses shown in denary.

Address	Memory contents
<b>150</b>	0100 0111
<b>151</b>	1100 1101
<b>152</b>	1001 1100

- (a) (i) What is the binary value for address 150?

..... [1]

- (ii) What is the hexadecimal value for the contents of address 152?

..... [1]

- (b) The numbers in location 151 and 152 are the height and width (in pixels) of a bitmap graphic currently in main memory. What are the dimensions of the bitmap in denary?

Height: .....pixels

Width: .....pixels [2]

- (c) A bitmap graphic can be saved in a number of different image resolutions.

- (i) How many bits are required to store each pixel for a black and white bitmap?

..... [1]

- (ii) For a 256-colour bitmap, each pixel requires a byte of memory.  
Explain this statement.

..... [2]

- (iii) In addition to the pixel data values and its dimensions, what other information is stored in the bitmap file?

..... [2]



- (iv) Bitmaps may use compression techniques to reduce the file size.

Explain the difference between 'lossless' and 'lossy' techniques for achieving this compression.

.....

.....

.....

.....

.....

.....

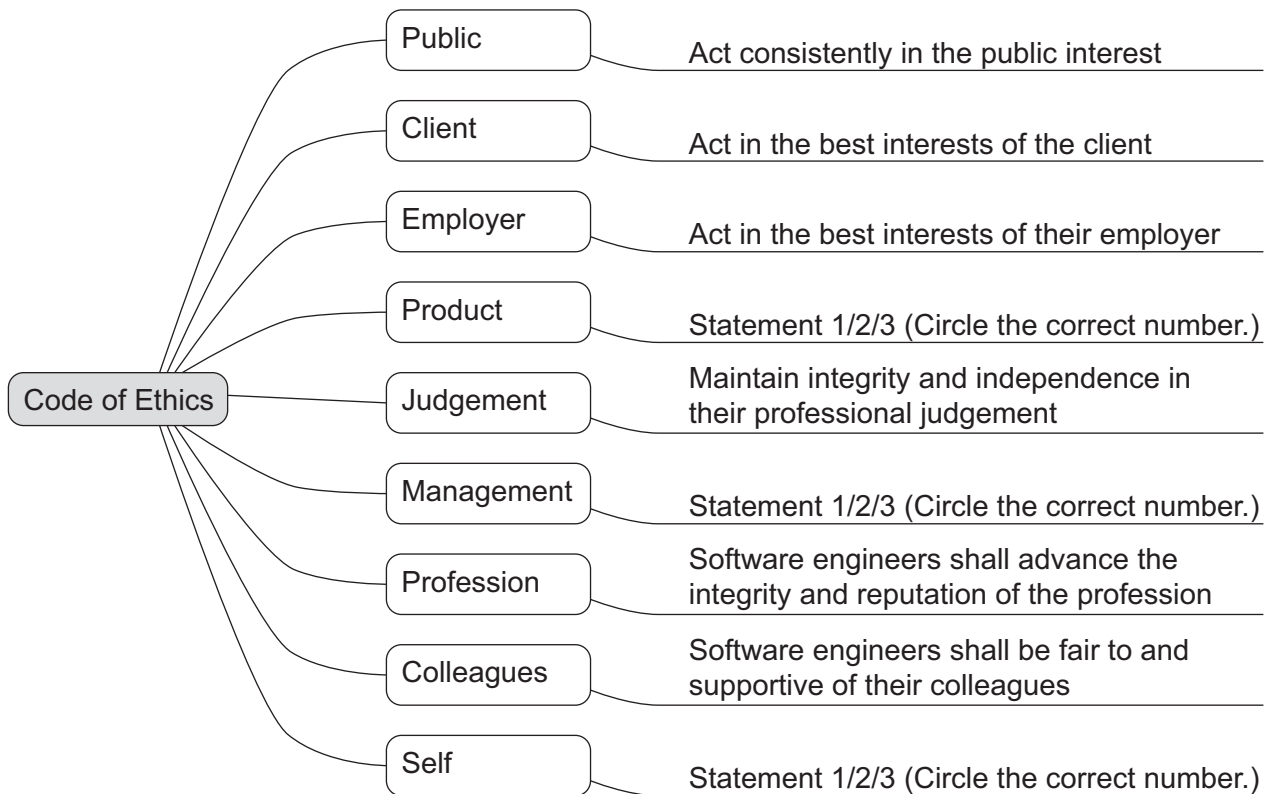
.....

.....

..... [4]

## 6 The ACM and IEEE set out eight principles for ethics and professional practice.

The categories, with a short explanation, are shown in this diagram.



### Statement 1

Team leaders should subscribe to and promote an ethical approach to the management of software development and maintenance.

### Statement 2

Software engineers shall participate in lifelong learning regarding the practice of the profession.

### Statement 3

Software and related modifications meet the highest possible standards.

- (a) These **three** statements need to be added to the diagram.

Circle the correct numbers on the diagram to indicate the positions for Statement 1, Statement 2 and Statement 3. [2]

- (b) For each of these three workplace scenarios, unethical behaviour is demonstrated.

Explain the principle(s) which are **not** being met.

- (i) Workplace scenario 1

A large project is devolved to project teams, each led by a project leader. One project leader fails to inform his manager that he has major concerns that:

- their team's software contribution is taking much longer to write and test than anticipated
- they are consequently at risk of spending over their allocated budget.

.....  
 .....  
 .....  
 ..... [3]

- (ii) Workplace scenario 2

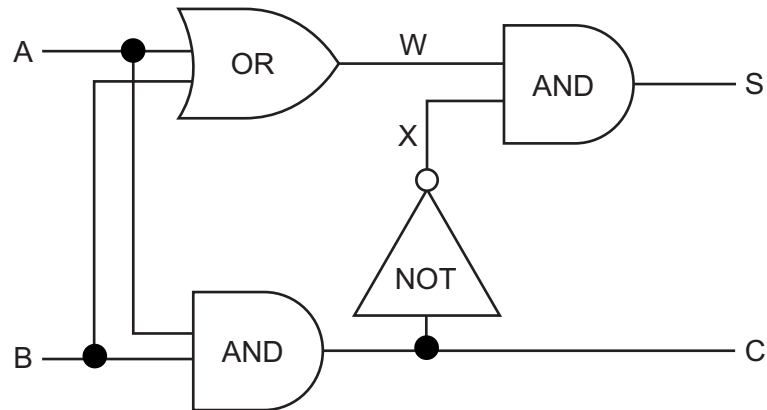
The software house is about to train a number of programmers in a new programming language. Two employees are refusing to attend the training.

.....  
 .....  
 .....  
 ..... [2]

- (iii) The company is developing some monitoring software which requires sensors placed in a nature reserve. One employee considers the sensors will be a danger to some of the wildlife, but is told by his manager that the matter is none of his concern.

.....  
 .....  
 .....  
 ..... [2]

- 7 (a) Complete the table to show the outputs for the possible inputs to this circuit.



A	B	W	X	C	S
0	0				
0	1				
1	0				
1	1				

[5]

- (b) State a possible use for this circuit in a processor.

.....

..... [1]



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**COMPUTER SCIENCE**

**9608/11**

## Paper 1 Theory Fundamentals

May/June 2015

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

## READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams, graphs or rough working.

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The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

This document consists of **16** printed pages.

- 1 (i) Convert the following binary number into hexadecimal.

1 0 1 1 1 0 0 0

.....[1]

- (ii) Convert the following denary number into BCD format.

9 7

.....[1]

- (iii) Using two's complement, show how the following denary numbers could be stored in an 8-bit register:

114

--	--	--	--	--	--	--	--

- 93

--	--	--	--	--	--	--	--

[2]

2 (a) Sound can be represented in a computer in a digital format.

(i) Give the definition of the term sampling.

.....  
 .....  
 .....[1]

(ii) Give **one** reason why 16-bit sampling is used in an audio compact disc (CD).

.....  
 .....[1]

(iii) Explain what is meant by the term sampling resolution.

.....  
 .....  
 .....  
 .....[2]

(iv) Give **one** benefit and **one** drawback of using a higher sampling resolution.

Benefit .....  
 .....  
 Drawback .....  
 .....[2]

(b) Describe **two** typical features found in software for editing sound files.

1 .....  
 .....  
 2 .....  
 .....[2]

(c) Explain the difference between *lossless* and *lossy* data compression techniques.

.....

.....

.....

.....

.....

.....[3]



3 Five modes of addressing and five descriptions are shown below.

Draw a line to connect **each** mode of addressing to its correct description.

### Mode of addressing

direct

immediate

indexed

indirect

relative

### Description

the operand is the address of the address of the value to be used

the operand is the address of the value to be used

the operand is the offset from the current address where the value to be used is stored

the operand plus the contents of the index register is the address of the value to be used

the operand is the value to be used

[4]

4 (a) Sensors are one type of input device.

For each of the following situations, name a **different** sensor that could be used.

(i) air conditioning in an office building

.....[1]

(ii) maintaining correct growing conditions in a greenhouse

.....[1]

(iii) detecting an intruder in a building

.....[1]

(b) Sensors are used to monitor seismic activity. At the end of each day, all the data are transmitted to a central computer. This is hundreds of kilometres away.

Describe **one** way of ensuring that the integrity of the data is retained during the transmission stage.

.....

.....

.....

.....

.....

.....

.....[4]

**5 (a)** Telephone calls can be made by using:

- conventional telephones (using the Public Service Telephone Network (PSTN) system) over a wired network
- a computer, equipped with speakers and microphone, connected to the Internet

Put a tick (✓) in the correct column to match each description to the appropriate communication method.

<b>Description</b>	<b>Conventional telephone using PSTN</b>	<b>Internet-based system</b>
connection only in use whilst sound is being transmitted		
dedicated channel used between two points for the duration of the call		
connection maintained throughout the telephone call		
encoding schemes and compression technology used		
lines remain active even during a power outage		

[5]

**(b)** Distinguish between the Internet and the World Wide Web (WWW).

.....

.....

.....

.....

.....

.....[3]

**(c)** Name the hardware device that is being described:

- (i)** A device that transfers data from one network to another in an intelligent way. It has the task of forwarding data packets to their destination by the most efficient route.

.....[1]

- (ii)** A device used between two dissimilar LANs. The device is required to convert data packets from one protocol to another.

.....[1]

- (iii)** A device or software that provides a specific function for computers using a network. The most common examples handle printing, file storage and the delivery of web pages.

.....[1]

- 6 (a) Name the **most** suitable input or output device for each of the following uses.

Give a different device in **each** case.

Description of use	Input or output device
input of credit card number into an online form	
selection of an option at an airport information kiosk	
output of a single high-quality photograph	
output of several hundred high-quality leaflets	
input of a hard copy image into a computer	

[5]

- (b) All of the uses in **part (a)** involve the input or output of data.

- (i) Describe **two** methods of preventing accidental loss of data.

- 1 .....
- .....
- 2 .....
- .....[2]

- (ii) Describe **one** way of ensuring the security of the data against malicious damage.

- .....
- .....[1]

- 7 A system is monitored using sensors. The sensors output binary values corresponding to physical conditions, as shown in the table:

Parameter	Description of parameter	Binary value	Description of condition
<b>P</b>	oil pressure	1	pressure $\geq$ 3 bar
		0	pressure $<$ 3 bar
<b>T</b>	temperature	1	temperature $\geq$ 200°C
		0	temperature $<$ 200°C
<b>R</b>	rotation	1	rotation $\leq$ 1000 revs per minute (rpm)
		0	rotation $>$ 1000 revs per minute (rpm)

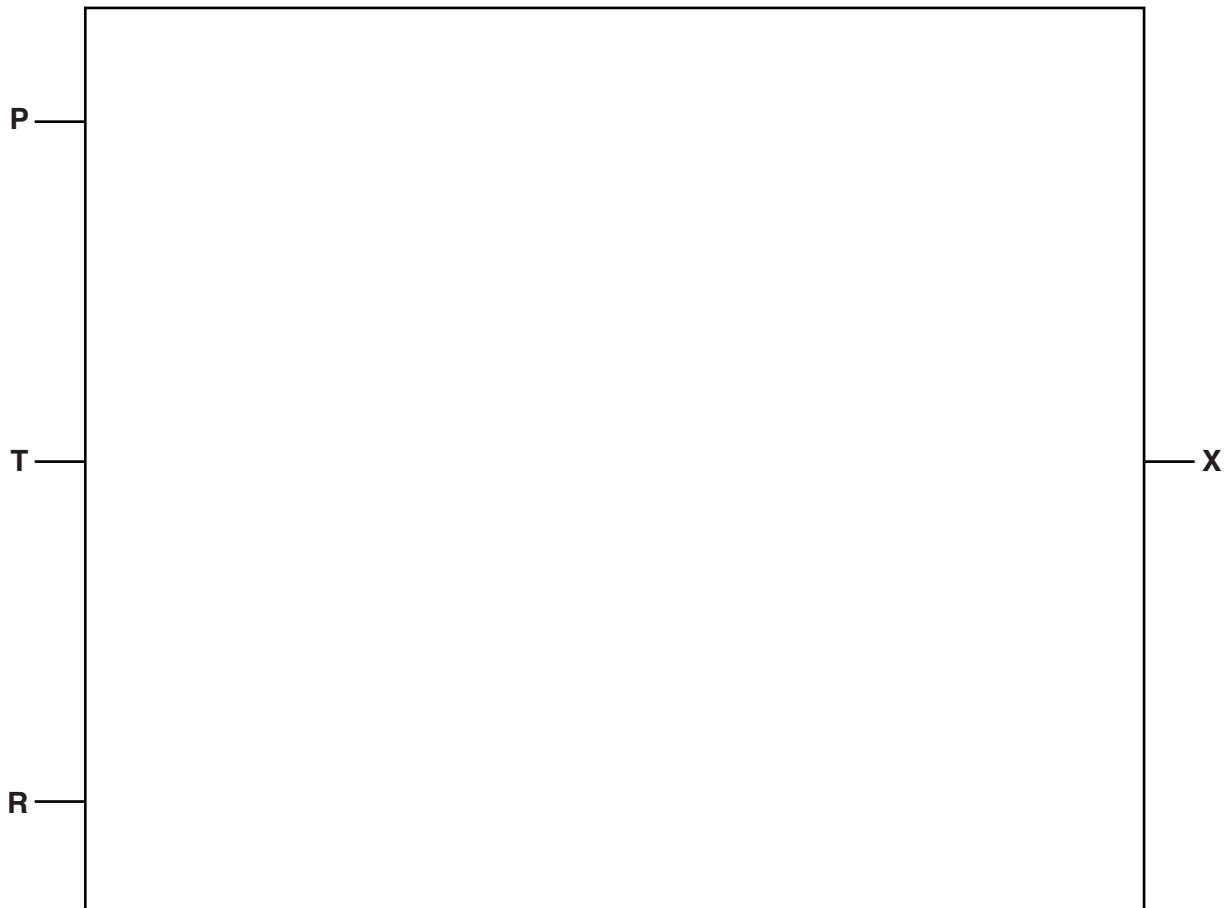
The outputs of the sensors form the inputs to a logic circuit. The output from the circuit, X, is 1 if any of the following three conditions occur:

**either** oil pressure  $\geq$  3 bar **and** temperature  $\geq$  200°C

**or** oil pressure  $<$  3 bar **and** rotation  $>$  1000 rpm

**or** temperature  $\geq$  200°C **and** rotation  $>$  1000 rpm

- (a) Draw a logic circuit to represent the above system.



(b) Complete the truth table for this system.

P	T	R	Workspace	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

- 8 (a) Explain how the width of the data bus and system clock speed affect the performance of a computer system.

Width of the data bus .....

.....

.....

.....

Clock speed .....

.....

.....

.....[3]

- (b) Most computers use Universal Serial Bus (USB) ports to allow the attachment of devices.

Describe **two** benefits of using USB ports.

1 .....

.....

2 .....

.....[2]

- (c) The table shows six stages in the von Neumann fetch-execute cycle.

Put the stages into the correct sequence by writing the numbers 1 to 6 in the right hand column.

Description of stage	Sequence number
the instruction is copied from the Memory Data Register (MDR) and placed in the Current Instruction Register (CIR)	
the instruction is executed	
the instruction is decoded	
the address contained in the Program Counter (PC) is copied to the Memory Address Register (MAR)	
the value in the Program Counter (PC) is incremented so that it points to the next instruction to be fetched	
the instruction is copied from the memory location contained in the Memory Address Register (MAR) and is placed in the Memory Data Register (MDR)	

[6]



**Question 9 begins on page 14.**

- 9 A database has been designed to store data about salespersons and the products they have sold.

The following facts help to define the structure of the database:

- each salesperson works in a particular shop
- each salesperson has a unique first name
- each shop has one or more salespersons
- each product which is sold is manufactured by one company only
- each salesperson can sell any of the products
- the number of products that each salesperson has sold is recorded

The table `ShopSales` was the first attempt at designing the database.

FirstName	Shop	ProductName	NoOfProducts	Manufacturer
Nick	TX	television set	3	SKC
		refrigerator	2	WP
		digital camera	6	HKC
Sean	BH	hair dryer	1	WG
		electric shaver	8	BG
John	TX	television set	2	SKC
		mobile phone	8	ARC
		digital camera	4	HKC
		toaster	3	GK

- (a) State why the table is **not** in First Normal Form (1NF).

.....  
 .....[1]

(b) The database design is changed to:

SalesPerson (FirstName, Shop)

SalesProducts (FirstName, ProductName, NoOfProducts, Manufacturer)

Using the data given in the first attempt table (ShopSales), show how these data are now stored in the revised table designs.

Table: SalesPerson

FirstName	Shop

Table: SalesProducts

FirstName	ProductName	NoOfProducts	Manufacturer

[3]

- (c) (i) A relationship between the two tables has been implemented.

Explain how this has been done.

.....

.....

.....

.....

.....[2]

- (ii) Explain why the `SalesProducts` table is **not** in Third Normal Form (3NF).

.....

.....

.....

.....[2]

- (iii) Write the table definitions to give the database in 3NF.

.....

.....

.....

.....[2]

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**COMPUTER SCIENCE**

9608/12

## Paper 1 Theory Fundamentals

May/June 2015

**1 hour 30 minutes**

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.....  
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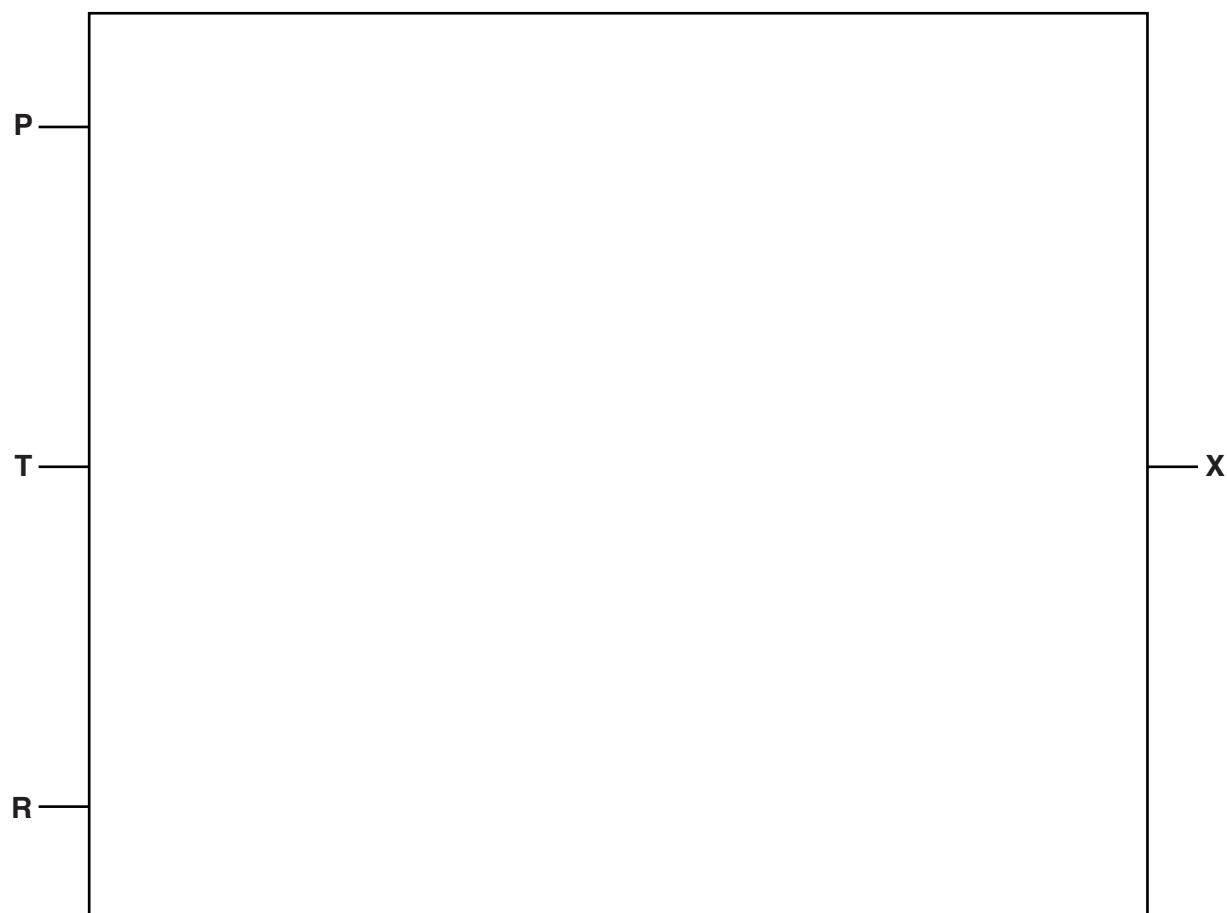
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(a) Draw a logic circuit to represent the above system.



**(b)** Complete the truth table for this system.

<b>P</b>	<b>T</b>	<b>R</b>	<b>Workspace</b>	<b>X</b>
<b>0</b>	<b>0</b>	<b>0</b>		
<b>0</b>	<b>0</b>	<b>1</b>		
<b>0</b>	<b>1</b>	<b>0</b>		
<b>0</b>	<b>1</b>	<b>1</b>		
<b>1</b>	<b>0</b>	<b>0</b>		
<b>1</b>	<b>0</b>	<b>1</b>		
<b>1</b>	<b>1</b>	<b>0</b>		
<b>1</b>	<b>1</b>	<b>1</b>		

[4]

- 8 (a) Explain how the width of the data bus and system clock speed affect the performance of a computer system.

Width of the data bus .....

.....

.....

.....

Clock speed .....

.....

.....

.....[3]

- (b) Most computers use Universal Serial Bus (USB) ports to allow the attachment of devices.

Describe **two** benefits of using USB ports.

1 .....

.....

2 .....

.....[2]

- (c) The table shows six stages in the von Neumann fetch-execute cycle.

Put the stages into the correct sequence by writing the numbers 1 to 6 in the right hand column.

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the instruction is executed	
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[6]



**Question 9 begins on page 14.**

- 9 A database has been designed to store data about salespersons and the products they have sold.

The following facts help to define the structure of the database:

- each salesperson works in a particular shop
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		electric shaver	8	BG
John	TX	television set	2	SKC
		mobile phone	8	ARC
		digital camera	4	HKC
		toaster	3	GK

- (a) State why the table is **not** in First Normal Form (1NF).

.....  
.....[1]

**(b)** The database design is changed to:

SalesPerson (FirstName, Shop)

SalesProducts (FirstName, ProductName, NoOfProducts, Manufacturer)

Using the data given in the first attempt table (ShopSales), show how these data are now stored in the revised table designs.

Table: SalesPerson

FirstName	Shop

Table: SalesProducts

FirstName	ProductName	NoOfProducts	Manufacturer

[3]

- (c) (i) A relationship between the two tables has been implemented.

Explain how this has been done.

.....

.....

.....

.....

.....[2]

- (ii) Explain why the `SalesProducts` table is **not** in Third Normal Form (3NF).

.....

.....

.....

.....[2]

- (iii) Write the table definitions to give the database in 3NF.

.....

.....

.....

.....[2]

---

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NUMBER

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**COMPUTER SCIENCE**

**9608/13**

## Paper 1 Theory Fundamentals

May/June 2015

**1 hour 30 minutes**

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The maximum number of marks is 75.

This document consists of **16** printed pages.

- 1 (a) (i) Using two's complement, show how the following denary numbers could be stored in an 8-bit register:

124

--	--	--	--	--	--	--	--

−77

--	--	--	--	--	--	--	--

[2]

- (ii) Convert the two numbers in **part (a) (i)** into hexadecimal.

124 .....

−77 .....

[2]

- (b) Binary Coded Decimal (BCD) is another way of representing numbers.

- (i) Write the number 359 in BCD form.

..... [1]

- (ii) Describe a use of BCD number representation.

.....

..... [2]

- 2 Assemblers translate from assembly language to machine code. Some assemblers scan the assembly language program twice; these are referred to as two-pass assemblers.

The following table shows five activities performed by two-pass assemblers.

Write 1 or 2 to indicate whether the activity is carried out during the first pass or during the second pass.

Activity	First pass or second pass
any symbolic address is replaced by an absolute address	
any directives are acted upon	
any symbolic address is added to the symbolic address table	
data items are converted into their binary equivalent	
forward references are resolved	

[5]

- 3 (a) Give the definition of the terms firewall and authentication. Explain how they can help with the security of data.

Firewall .....

.....

.....

.....

.....

.....

.....

Authentication .....

.....

.....

.....

[3]

- (b) Describe **two** differences between data integrity and data security.

.....

.....

.....

.....

.....

.....

.....

[2]

- (c) Data integrity is required at the input stage and also during transfer of the data.

- (i) State **two** ways of maintaining data integrity at the input stage. Use examples to help explain your answer.

.....

.....

.....

.....

.....

.....

[3]



- (ii) State **two** ways of maintaining data integrity during data transmission. Use examples to help explain your answer.

.....

.....

.....

.....

.....

..... [3]

**4 (a)** There are two types of RAM: dynamic RAM (DRAM) and static RAM (SRAM).

Five statements about DRAM and SRAM are shown below.

Draw a line to link each statement to the appropriate type of RAM.

Statement	Type of RAM
requires data to be refreshed periodically in order to retain the data	
has more complex circuitry	DRAM
does not need to be refreshed as the circuit holds the data as long as the power supply is on	
requires higher power consumption which is significant when used in battery-powered devices	SRAM
used predominantly in cache memory of processors where speed is important	

[5]

**(b)** Describe **three** differences between RAM and ROM.

.....

.....

.....

.....

.....

..... [3]

**(c)** DVD-RAM and flash memory are two examples of storage devices.

Describe **two** differences in how they operate.

.....

.....

.....

.....

..... [2]

5 (a) Name and describe **three** buses used in the von Neumann model.

Bus 1 .....

Description .....

.....

.....

Bus 2 .....

Description .....

.....

.....

Bus 3 .....

Description .....

.....

.....

[6]

(b) The sequence of operations shows, in register transfer notation, the fetch stage of the fetch-execute cycle.

```
1  MAR ← [PC]
2  PC  ← [PC] + 1
3  MDR ← [ [MAR] ]
4  CIR ← [MDR]
```

- [register] denotes contents of the specified register or memory location
- step 1 above is read as “the contents of the Program Counter are copied to the Memory Address Register”

(i) Describe what is happening at step 2.

.....

..... [1]

(ii) Describe what is happening at step 3.

.....

.....

..... [1]

**(iii)** Describe what is happening at step 4.

.....  
..... [1]

**(c)** Describe what happens to the registers when the following instruction is executed:

LDD 35

.....  
.....  
.....  
..... [2]

**(d) (i)** Explain what is meant by an interrupt.

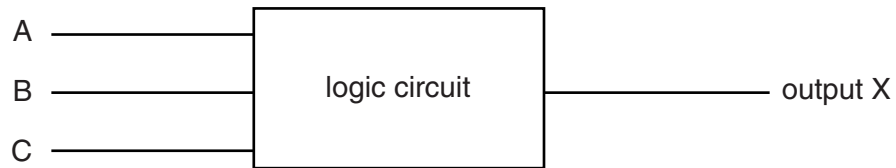
.....  
.....  
.....  
..... [2]

**(ii)** Explain the actions of the processor when an interrupt is detected.

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
..... [4]

- 6 (a) Three digital sensors A, B and C are used to monitor a process. The outputs from the sensors are used as the inputs to a logic circuit.

A signal, X, is output from the logic circuit:



Output, X, has a value of 1 if either of the following two conditions occur:

- sensor A outputs the value 1 OR sensor B outputs the value 0
- sensor B outputs the value 1 AND sensor C outputs the value 0

Draw a logic circuit to represent these conditions.



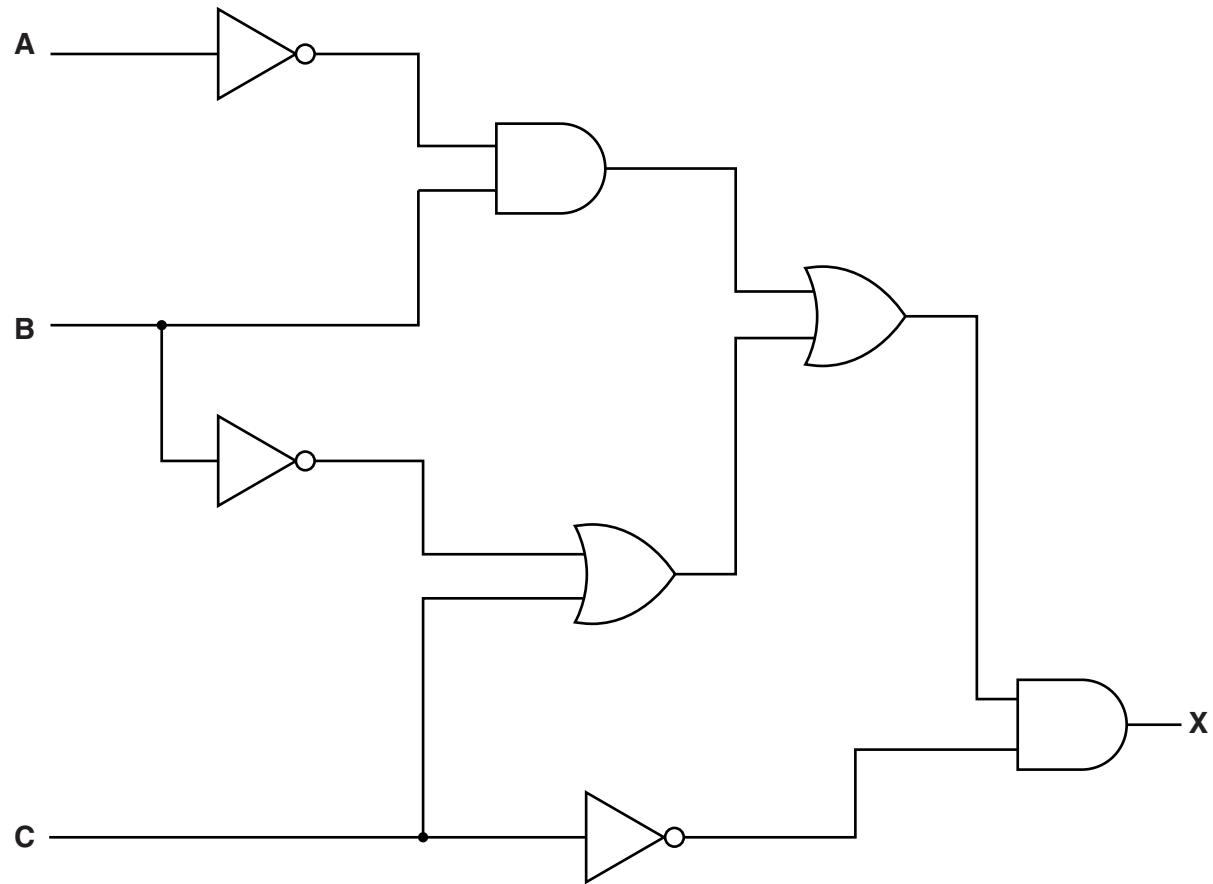
[5]

**(b)** Complete the truth table for the logic circuit described in **part (a)**.

<b>A</b>	<b>B</b>	<b>C</b>	<b>Working Space</b>	<b>X</b>
<b>0</b>	<b>0</b>	<b>0</b>		
<b>0</b>	<b>0</b>	<b>1</b>		
<b>0</b>	<b>1</b>	<b>0</b>		
<b>0</b>	<b>1</b>	<b>1</b>		
<b>1</b>	<b>0</b>	<b>0</b>		
<b>1</b>	<b>0</b>	<b>1</b>		
<b>1</b>	<b>1</b>	<b>0</b>		
<b>1</b>	<b>1</b>	<b>1</b>		

[4]

(c) Write a logic statement that describes the following logic circuit.



.....  
.....  
.....  
..... [3]



**Question 7 begins on page 14.**

- 7 The table shows assembly language instructions for a processor which has one general purpose register, the Accumulator (ACC).

Instruction		Explanation
Op code	Operand	
LDD	<address>	Direct addressing. Load contents of given address to ACC
STO	<address>	Store the contents of ACC at the given address
LDI	<address>	Indirect addressing. The address to be used is at the given address. Load the contents of this second address to ACC
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the index register. Copy the contents of this calculated address to ACC
INC	<register>	Add 1 to contents of the register (ACC)
JMP	<address>	Jump to the given address
END		Return control to operating system

The diagram shows the contents of the memory.

Main memory

120	0 0 0 0 1 0 0 1
121	0 1 1 1 0 1 0 1
122	1 0 1 1 0 1 1 0
123	1 1 1 0 0 1 0 0
124	0 1 1 1 1 1 1 1
125	0 0 0 0 0 0 0 1
126	0 1 0 0 0 0 0 1
127	0 1 1 0 1 0 0 1
200	1 0 0 0 1 0 0 0

- (a) (i) Show the contents of the Accumulator after execution of the instruction:

**LDD 121**

Accumulator:

--	--	--	--	--	--	--	--

[1]

- (ii) Show the contents of the Accumulator after execution of the instruction:

**LDI 124**

Accumulator:

--	--	--	--	--	--	--	--

Explain how you arrived at your answer.

.....

.....

.....

..... [3]

- (iii) Show the contents of the Accumulator after execution of the instruction:

**LDX 120**

Index Register:

0	0	0	0	0	1	1	0
---	---	---	---	---	---	---	---

Accumulator:

--	--	--	--	--	--	--	--

Explain how you arrived at your answer.

.....

.....

.....

..... [3]

(b) Trace the assembly language program using the trace table.

```

300    LDD    321
301    INC
302    STO    323
303    LDI    307
304    INC
305    STO    322
306    END
307    320
      ↘    ↘
320    49
321    36
322    0
323    0

```

Trace table:

Accumulator	Memory address			
	320	321	322	323
	49	36	0	0

[6]

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**COMPUTER SCIENCE**

**9608/11**

## Paper 1 Theory Fundamentals

## October/November 2015

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

## READ THESE INSTRUCTIONS FIRST

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Write in dark blue or black pen.

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At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

This document consists of **12** printed pages.

1 (a) Explain the term bit streaming.

.....

.....

.....

.....[2]

(b) A person watches a film streamed from a website on a tablet computer.

(i) Give **two** benefits of using bit streaming for this purpose.

1 .....

.....

2 .....

.....

[2]

(ii) State **two** potential problems of using bit streaming for this purpose.

1 .....

.....

2 .....

.....

[2]

(c) Explain the terms on-demand bit streaming and real-time bit streaming.

.....

.....

.....

.....

.....

.....

.....

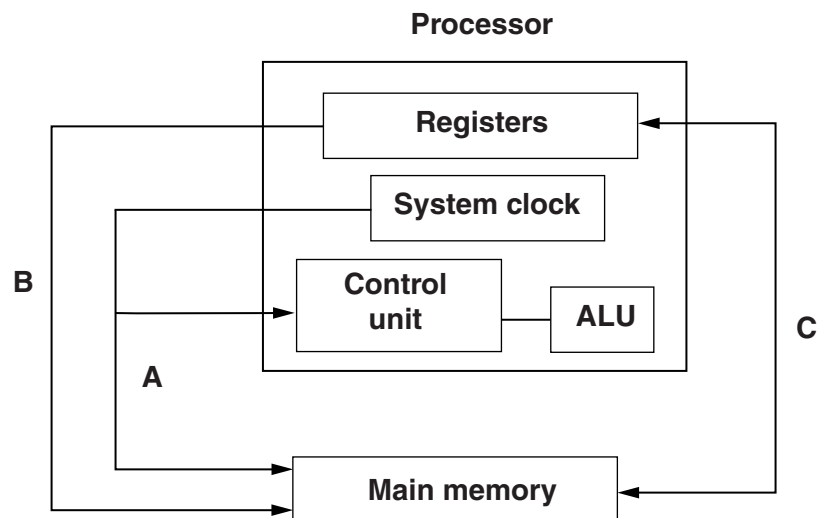
.....

.....

.....

.....[4]

2 (a)



The diagram above shows a simplified form of processor architecture.

Name the three buses labelled A, B and C.

- A .....
- B .....
- C ..... [3]

(b) State the role of each of the following special purpose registers used in a typical processor.

- Program Counter .....
- .....
- Memory Data Register .....
- .....
- Current Instruction Register .....
- .....
- Memory Address Register .....
- ..... [4]

- 3 (a) The table shows four statements about IP addresses.

Tick (✓) to show which of the statements are true.

Statement	True (✓)
The IP address consists of any number of digits separated by single dots (.)	
Each number in an IP address can range from 0 to 255	
IP addresses are used to ensure that messages and data reach their correct destinations	
Public IP addresses are considered to be more secure than private IP addresses	

[2]

- (b) Consider the URL:

<http://cie.org.uk/computerscience.html>

- (i) Give the meaning of the following parts of the URL.

http .....

.....

.....

cie.org.uk .....

.....

.....

computerscience.html .....

.....

.....

[3]

- (ii) Sometimes the URL contains the characters %20 and ?.

Describe the function of these characters.

%20 .....

.....

? .....

.....

[2]



- 4 Paul works part-time for a large software company. The company sells security software to a number of banks. He also runs his own software company that produces and sells computer games.

Six statements about computer ethics are shown below.

Draw lines to indicate whether each statement describes ethical or unethical behaviour.

**Statement**

To save time, Paul fakes the test results when testing the bank security software.

Paul uses the software developed in his day job to help write some of the games software routines.

To allow him to concentrate on his games software, Paul has frequently turned down job opportunities in his day job.

To make the games software more realistic, Paul uses password protection code used in the bank security software.

Because his work load is increasing, Paul is now using overseas companies to write some of the routines used in his games software.

Paul carries out training on how to write games software in his spare time.

Ethical

Unethical

[6]

- 5** A computer system in a control room is used to monitor earthquake activity.

An earthquake zone has a number of sensors to detect seismic activity.

The system detects when seismic activity is greater than 3 on the Richter Scale. Whenever this happens, a printer in the control room prints a report.

- (i)** Identify the steps that are required in this monitoring system.

.....

.....

.....

.....

.....

.....

.....[4]

- (ii)** When the system detects high activity, operators may need to respond rapidly. A printer is useful for hard copies, but may not be the best way to inform operators.

Give a reason why.

.....

.....[1]

- (iii)** Name an alternative output device for this monitoring system and give a reason for your choice.

Output device .....

Reason for choice .....

.....

.....[2]

- 6 A company operates a chemical plant, which has a number of processes. Local computers monitor these processes and collect data.

The computers transfer these data to a central computer 50km away. A telecommunications company (telco) provides cables.

Engineers at the telco had to decide which type of cable to use. They considered the use of either copper cable or fibre optic cable.

State **two** benefits of each type of cable. Each benefit must be clearly different.

Benefits of copper cable

1 .....

.....

2 .....

.....

Benefits of fibre optic cable

1 .....

.....

2 .....

.....

[4]

7 (a) (i) Describe what is meant by a client-server model of networked computers.

.....

.....

.....

.....[2]

(ii) Give **two** benefits of using the client-server model.

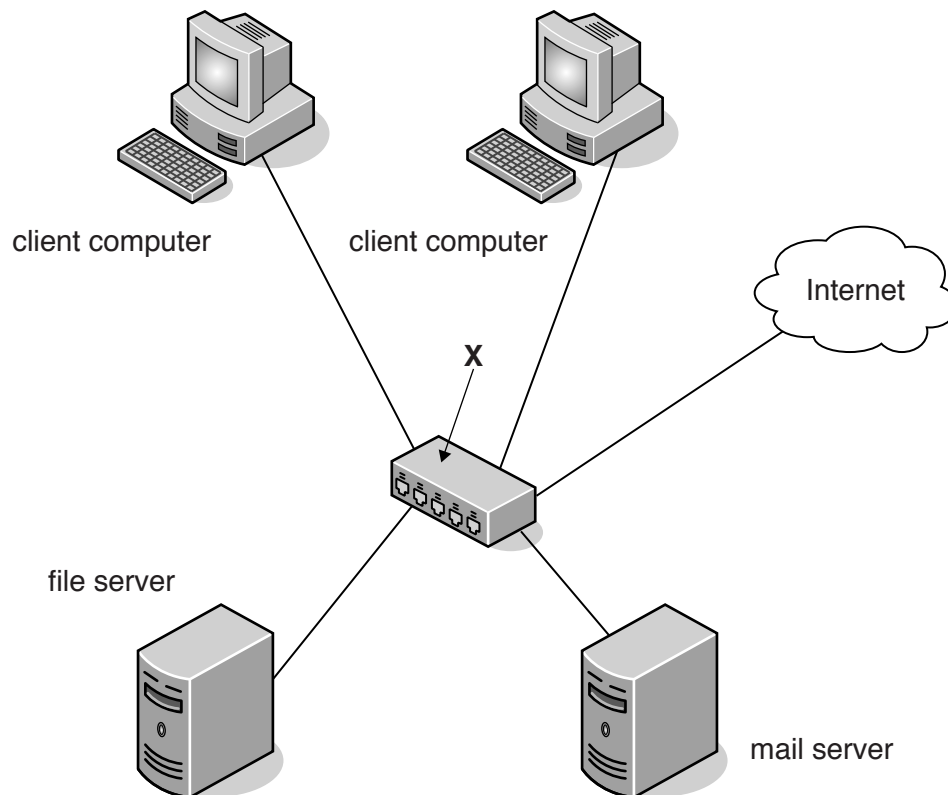
1 .....

.....

2 .....

.....[2]

(b) The diagram shows a computer network with connection to the Internet.



Name the hardware device labelled **X**.

.....[1]

- (c) A web page offers a link for users to request another web page. The requested web page contains HTML code and JavaScript code.

Put each statement in the correct sequence by writing the numbers 1 to 5 in the right-hand column.

Statement	Sequence number
The requested web page is displayed on the client computer	
The user clicks on the hyperlink and the web page is requested from the web server	
The requested web page content is transmitted to the client computer	
The client computer processes the JavaScript code using the web browser software	
The web server locates the requested web page	

[5]

**8 (a)** Six computer graphics terms and seven descriptions are shown below.

Draw a line to link each term to its correct description.

Term	Description
Bitmap graphic	Measured in dots per inch (dpi); this value determines the amount of detail an image has
Image file header	Picture element
Image resolution	Image made up of rows and columns of picture elements
Pixel	Image made up of drawing objects. The properties of each object determine its shape and appearance.
Screen resolution	Specifies the image size, number of colours, and other data needed to display the image data
Vector graphic	Number of samples taken per second to represent some event in a digital format
	Value quoted for a monitor specification, such as 1024 × 768. The larger the numbers, the more picture elements will be displayed.

[6]

- (b) (i)** A black and white image is 512 pixels by 256 pixels.

Calculate the file size of this image in kilobytes (KB) (1 KB = 1024 bytes).  
Show your working.

.....

.....

.....

.....

.....[2]

- (ii)** Give a reason why it is important to estimate the file size of an image.

.....

.....

.....[1]

- 9 (a)** Give a brief description of each of the following terms:

Validation .....

.....

.....

Verification .....

.....

.....[2]

- (b)** Data are to be transferred between two devices. Parity checks are carried out on the data.

Explain what is meant by a parity check. Give an example to illustrate your answer.

.....

.....

.....

.....

.....

.....

.....

.....[4]

10 (a) Explain the term computer virus.

.....

.....

.....

.....[2]

(b) A virus checker has been installed on a PC.

Give **two** examples of when a virus checker should perform a check.

1 .....

.....

2 .....

.....

[2]

11 A game program is written which can be either interpreted or compiled. The table below shows five statements about the use of interpreters and compilers.

Tick (✓) to show whether the statement refers to an interpreter or to a compiler.

Statement	Interpreter	Compiler
This translator creates an executable file		
When this translator encounters a syntax error, game execution halts		
The translator analyses and checks each line just before executing it		
This translator will produce faster execution of the game program		
Use of this translator makes it more difficult for the user to modify the code of the game		

[5]

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**COMPUTER SCIENCE**

9608/12

## Paper 1 Theory Fundamentals

## October/November 2015

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

This document consists of **14** printed pages and **2** blank pages.

1 (a) Give **three** differences between Dynamic RAM (DRAM) and Static RAM (SRAM).

.....

.....

.....

.....

.....

.....[3]

(b) (i) Examples of primary and secondary storage devices include:

- hard disk
- DVD-RW
- flash memory

For each device, describe the type of media used.

Hard disk .....

.....

DVD-RW .....

.....

Flash memory .....

.....[3]

(ii) Describe the internal operation of the following devices:

DVD-RW .....

.....

DVD-RAM .....

.....[2]

2 (a) Describe how a laser mouse operates.

.....

.....

.....

.....

.....

.....[3]

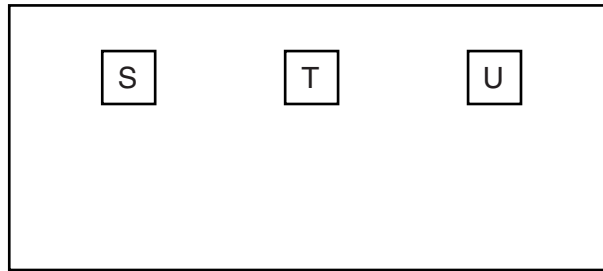
(b) The following table shows a list of five statements which describe the stages when a page is printed using an inkjet printer.

Put each statement in the correct sequence by writing the numbers 1 to 5 in the right-hand column.

Statement	Sequence number
Paper feed stepper motor activated; sheet of paper fed from paper tray	
Printer driver translates data into a suitable format for the printer	
The print head moves across the page; ink is sprayed each time the print head pauses for a fraction of a second	
Paper feed stepper motor advances paper a fraction of a cm after each complete head pass	
Printer receives data from the computer and stores the data in the printer's buffer	

[5]

- 3 A touch screen has three squares where a selection can be made:



- (a) The x-coordinate of the centre of the three squares is held in three memory locations:

	Address	Memory contents
S	40	0000 1011 0100
T	41	0010 0101 0100
U	42	0100 0110 1100

- (i) Give the hexadecimal value of the memory contents for U.

.....  
.....[1]

- (ii) Convert the denary number 40 into binary.

.....  
.....[1]

- (b)** Bitmap graphics are used to represent squares S, T and U.

These can be saved in a number of different image resolutions.

- (i)** Give the number of bits required to store each pixel for a black and white bitmap.

.....[1]

- (ii)** Identify how many bits are required to store each pixel for a 256-colour bitmap.

Explain your answer.

.....  
.....  
.....[2]

- (c)** Images can be compressed to reduce file size.

- (i)** Describe how lossless compression techniques work.

.....  
.....  
.....  
.....[2]

- (ii)** Describe how lossy compression techniques work.

.....  
.....  
.....  
.....[2]

**4 (a)** Sound can be represented digitally in a computer.

Explain the terms sampling resolution and sampling rate.

Sampling resolution .....  
.....  
.....  
.....

Sampling rate .....  
.....  
.....  
.....[4]

**(b)** The following information refers to a music track being recorded on a CD:

- music is sampled 44 100 times per second
- each sample is 16 bits
- each track requires sampling for left and right speakers

**(i)** Calculate the number of bytes required to store one second of sampled music.  
Show your working.

.....  
.....  
.....  
.....[2]

**(ii)** A particular track is four minutes long.

Describe how you would calculate the number of megabytes required to store this track.

.....  
.....  
.....  
.....[2]

- (c) When storing music tracks in a computer, the MP3 format is often used. This reduces file size by about 90%.

Explain how the music quality is apparently retained.

.....

.....

.....

.....

.....

.....[3]

- 5 Bobby is a senior programmer at a software house which produces intruder detection software. He also runs his own software company which develops and sells various computer applications.

The following table shows seven activities which Bobby carries out.

Put a tick (✓) in the appropriate column to identify if the activity is ethical or unethical.

Activity	Ethical	Unethical
gives away passwords used in the intruder detection software		
uses source code developed at the software house for the software he develops for his own company		
insists that staff work to deadlines		
turns down training opportunities offered by his employer		
writes and sells software that reads confidential data from client computers		
fakes test results of safety-critical software		
has the software applications developed overseas for sale in his own country		

[7]



6 (a) A student wrote the following logic statement:

X is 1 if (B is NOT 1 AND S is NOT 1) OR (P is NOT 1 AND S is 1)

Draw a logic circuit to represent the above logic statement.



[6]

(b) Complete the truth table for this system.

B	S	P	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

- 7 (a) The string of characters, “BINARY CODE”, was transmitted using 11 bytes of data. An additional byte, called the parity byte, was also transmitted.

Parity bytes can be used to identify exactly which bit has been transmitted incorrectly.

The table shows bit patterns for all 12 bytes after transmission. Even parity was used and the first bit is the parity bit.

	character	bit 1	bit 2	bit 3	bit 4	bit 5	bit 6	bit 7	bit 8
byte 1	B	0	1	0	0	0	0	1	0
byte 2	I	1	1	0	0	1	0	0	1
byte 3	N	0	1	0	0	1	1	1	0
byte 4	A	0	1	0	0	0	0	0	1
byte 5	R	1	1	0	1	0	0	1	0
byte 6	Y	0	1	1	1	1	0	0	1
byte 7		1	0	1	0	0	0	0	0
byte 8	C	1	1	0	0	0	0	1	1
byte 9	O	1	1	0	0	1	1	1	1
byte 10	D	0	1	0	0	0	1	0	0
byte 11	E	1	1	0	0	0	1	0	1
parity byte		0	0	1	0	0	0	1	0

- (i) There is one error in the transmission.

Indicate the byte number and bit number of the bit which has been incorrectly transmitted.

Byte number .....

Bit number .....[2]

- (ii) Explain your answer to **part (i)**.

.....  
 .....  
 .....  
 .....[2]

**(b)** Verification and validation can be applied during data entry.

Describe what is meant by these terms. For each method, explain why it is needed.

Verification .....

.....

.....

.....

Validation .....

.....

.....

.....[4]

- 8 The table shows assembly language instructions for a processor which has one general purpose register – the Accumulator (ACC).

Instruction		Explanation
Op code	Operand	
LDD	<address>	Direct addressing. Load the contents of the given address to ACC
LDX	<address>	Index addressing. Form the address from <address> + the contents of the index register. Copy the contents of this calculated address to ACC
LDI	<address>	Indirect addressing. The address to be used is at the given address. Load the contents of this second address to ACC
STO	<address>	Store the contents of ACC at the given address
INC	<register>	Add 1 to contents of the register (ACC or IX)
ADD	<address>	Add the contents of the given address to the ACC
END		Return control to the operating system

The diagram shows the contents of the memory:

main memory	
100	0000 0010
101	1001 0011
102	0111 0011
103	0110 1011
104	0111 1110
105	1011 0001
106	0110 1000
107	0100 1011
↓	↓
200	1001 1110

- (a) (i) Show the contents of the Accumulator after execution of the instruction:

**LDD 102**

Accumulator:

--	--	--	--	--	--	--	--

[1]

(ii) Show the contents of the Accumulator after execution of the instruction:

**LDX 101**

Index register:	0	0	0	0	0	1	0	0
-----------------	---	---	---	---	---	---	---	---

Accumulator:								
--------------	--	--	--	--	--	--	--	--

Explain how you arrived at your answer.

.....  
.....  
.....  
.....[3]

(iii) Show the contents of the Accumulator after execution of the instruction:

**LDI 103**

Accumulator:								
--------------	--	--	--	--	--	--	--	--

Explain how you arrived at your answer.

.....  
.....  
.....  
.....  
.....  
.....[4]

(b) Trace the assembly language program using the trace table.

```

800    LDD    810
801    INC
802    STO    812
803    LDD    811
804    ADD    812
805    STO    813
806    END
810    28
811    41
812    0
813    0

```

Trace table:

Accumulator	Memory address			
	810	811	812	813
	28	41	0	0

[6]



---

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**COMPUTER SCIENCE**

**9608/13**

## Paper 1 Theory Fundamentals

## October/November 2015

**1 hour 30 minutes**

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[2]

(i) Give **two** benefits of using bit streaming for this purpose.

1 .....

2 .....

[2]

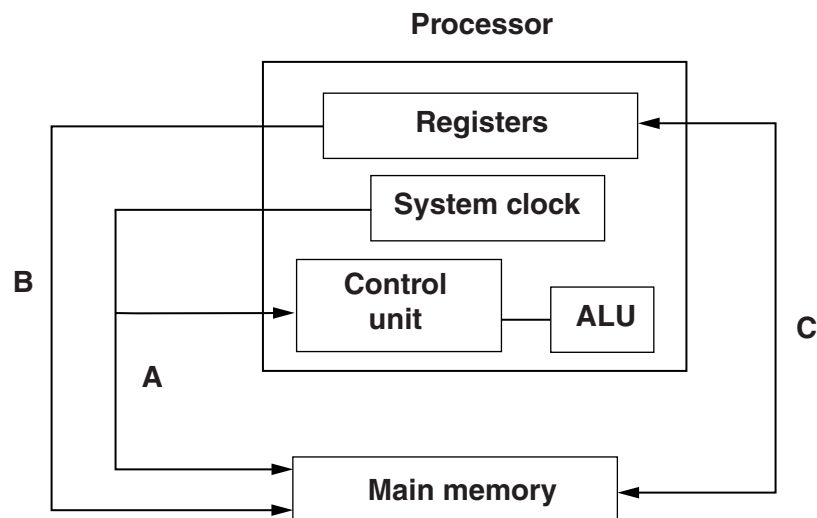
1 .....

2 .....

[2]

.....[4]

2 (a)



The diagram above shows a simplified form of processor architecture.

Name the three buses labelled A, B and C.

- A .....
- B .....
- C ..... [3]

(b) State the role of each of the following special purpose registers used in a typical processor.

- Program Counter .....
- .....
- Memory Data Register .....
- .....
- Current Instruction Register .....
- .....
- Memory Address Register .....
- ..... [4]

- 3 (a) The table shows four statements about IP addresses.

Tick (✓) to show which of the statements are true.

Statement	True (✓)
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Each number in an IP address can range from 0 to 255	
IP addresses are used to ensure that messages and data reach their correct destinations	
Public IP addresses are considered to be more secure than private IP addresses	

[2]

- (b) Consider the URL:

<http://cie.org.uk/computerscience.html>

- (i) Give the meaning of the following parts of the URL.

http .....  
.....  
.....  
cie.org.uk .....  
.....  
.....  
computerscience.html .....  
.....  
.....

[3]

- (ii) Sometimes the URL contains the characters %20 and ?.

Describe the function of these characters.

%20 .....  
.....  
? .....  
.....

[2]

- 4 Paul works part-time for a large software company. The company sells security software to a number of banks. He also runs his own software company that produces and sells computer games.

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Paul carries out training on how to write games software in his spare time.

Ethical

Unethical

[6]

- 5** A computer system in a control room is used to monitor earthquake activity.

An earthquake zone has a number of sensors to detect seismic activity.

The system detects when seismic activity is greater than 3 on the Richter Scale. Whenever this happens, a printer in the control room prints a report.

- (i)** Identify the steps that are required in this monitoring system.

.....

.....

.....

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.....

.....

.....[4]

- (ii)** When the system detects high activity, operators may need to respond rapidly. A printer is useful for hard copies, but may not be the best way to inform operators.

Give a reason why.

.....

.....[1]

- (iii)** Name an alternative output device for this monitoring system and give a reason for your choice.

Output device .....

Reason for choice .....

.....

.....[2]

- 6 A company operates a chemical plant, which has a number of processes. Local computers monitor these processes and collect data.

The computers transfer these data to a central computer 50km away. A telecommunications company (telco) provides cables.

Engineers at the telco had to decide which type of cable to use. They considered the use of either copper cable or fibre optic cable.

State **two** benefits of each type of cable. Each benefit must be clearly different.

Benefits of copper cable

1 .....

.....

2 .....

.....

Benefits of fibre optic cable

1 .....

.....

2 .....

.....

[4]

7 (a) (i) Describe what is meant by a client-server model of networked computers.

.....

.....

.....

.....[2]

(ii) Give **two** benefits of using the client-server model.

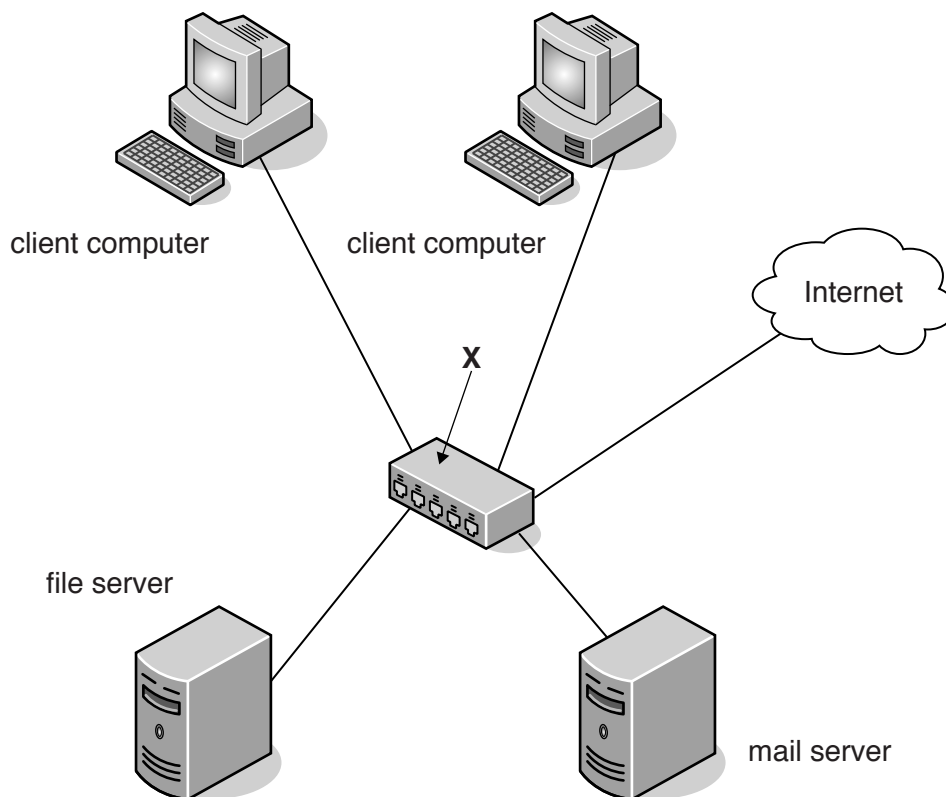
1 .....

.....

2 .....

.....[2]

(b) The diagram shows a computer network with connection to the Internet.



Name the hardware device labelled **X**.

.....[1]



- (c) A web page offers a link for users to request another web page. The requested web page contains HTML code and JavaScript code.

Put each statement in the correct sequence by writing the numbers 1 to 5 in the right-hand column.

Statement	Sequence number
The requested web page is displayed on the client computer	
The user clicks on the hyperlink and the web page is requested from the web server	
The requested web page content is transmitted to the client computer	
The client computer processes the JavaScript code using the web browser software	
The web server locates the requested web page	

[5]

**8 (a)** Six computer graphics terms and seven descriptions are shown below.

Draw a line to link each term to its correct description.

Term	Description
Bitmap graphic	Measured in dots per inch (dpi); this value determines the amount of detail an image has
Image file header	Picture element
Image resolution	Image made up of rows and columns of picture elements
Pixel	Image made up of drawing objects. The properties of each object determine its shape and appearance.
Screen resolution	Specifies the image size, number of colours, and other data needed to display the image data
Vector graphic	Number of samples taken per second to represent some event in a digital format
	Value quoted for a monitor specification, such as 1024 × 768. The larger the numbers, the more picture elements will be displayed.

[6]

- (b) (i)** A black and white image is 512 pixels by 256 pixels.

Calculate the file size of this image in kilobytes (KB) (1 KB = 1024 bytes).  
Show your working.

.....

.....

.....

.....

.....[2]

- (ii)** Give a reason why it is important to estimate the file size of an image.

.....

.....

.....[1]

- 9 (a)** Give a brief description of each of the following terms:

Validation .....

.....

.....

Verification .....

.....

.....[2]

- (b)** Data are to be transferred between two devices. Parity checks are carried out on the data.

Explain what is meant by a parity check. Give an example to illustrate your answer.

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.....[4]

10 (a) Explain the term computer virus.

.....

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.....[2]

(b) A virus checker has been installed on a PC.

Give **two** examples of when a virus checker should perform a check.

1 .....

.....

2 .....

.....

[2]

11 A game program is written which can be either interpreted or compiled. The table below shows five statements about the use of interpreters and compilers.

Tick (✓) to show whether the statement refers to an interpreter or to a compiler.

Statement	Interpreter	Compiler
This translator creates an executable file		
When this translator encounters a syntax error, game execution halts		
The translator analyses and checks each line just before executing it		
This translator will produce faster execution of the game program		
Use of this translator makes it more difficult for the user to modify the code of the game		

[5]

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CANDIDATE  
NAME

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CENTRE  
NUMBER

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NUMBER

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**COMPUTER SCIENCE**

**9608/11**

## Paper 1 Theory Fundamentals

May/June 2016

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

## READ THESE INSTRUCTIONS FIRST

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At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

This document consists of **15** printed pages and **1** blank page.

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Draw lines to link each language translator to the correct one or more definitions.

**Language translator**

**Definition**

Compiler

The software reads the source code and reports all errors. The software produces an executable file.

Assembler

The software reads each statement and checks it before running it. The software halts when it encounters a syntax error.

Interpreter

The software translates a high-level language program into machine code for the processor to execute.

The software translates low-level statements into machine code for the processor to execute.

[3]

- 2 (a) Convert the following denary integer into 8-bit binary.

55

--	--	--	--	--	--	--	--

[1]

- (b) Convert the following Binary Coded Decimal (BCD) number into denary.

10000011

.....[1]

- (c) Convert the following denary integer into 8-bit two's complement.

-102

--	--	--	--	--	--	--	--

[2]

- (d) Convert the following hexadecimal number into denary.

4E

.....[1]

- 3 (a) Describe how special purpose registers are used in the fetch stage of the fetch-execute cycle.

.....

.....

.....

.....

.....

.....

.....

.....[4]

- (b) Use the statements A, B, C and D to complete the description of how the fetch-execute cycle handles an interrupt.

A	the address of the Interrupt Service Routine (ISR) is loaded to the Program Counter (PC).
B	the processor checks if there is an interrupt.
C	when the ISR completes, the processor restores the register contents.
D	the register contents are saved.

At the end of the cycle for the current instruction .....

If the interrupt flag is set, ....., ..... and .....

The interrupted program continues its execution.

[4]



- 4** A group of students broadcast a school radio station on a website. They record their sound clips (programmes) in advance and email them to the producer.

**(a)** Describe how sampling is used to record the sound clips.

.....

.....

.....

.....

.....

.....[3]

**(b)** The students use software to compress the sound clips before emailing them.

**(i)** Circle your chosen method of compression and justify your choice.

Lossy / Lossless

Justification: .....

.....

.....

.....[3]

Students also email images to the radio station for use on its website.

These are compressed before sending using run-length encoding (RLE).

**(ii)** Explain what is meant by run-length encoding.

.....

.....

.....

.....

.....

.....[3]

(iii) The following diagrams show:

- the denary colour code that represents each colour
- the first three rows of a bitmap image

Colour symbol	Colour code (denary)
B	153
W	255

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	B	B	B	B	B	B	B	B	B	B	W	W	W	B	B	B
1	B	B	B	B	B	B	B	B	B	W	W	W	W	W	W	B
2	B	B	B	B	B	B	B	W	W	W	W	W	W	W	W	W
...																
95																

Show how RLE will compress the first three rows of this image.

Row 1: .....

Row 2: .....

Row 3: .....[2]

- 5 Three types of software licensing and four descriptions are shown in the table below.

Put a tick (✓) in each row to match each description to the appropriate type of software licensing.

Description	Type of software		
	Open source	Shareware	Commercial
Software is purchased before it can be used			
Source code comes with the software			
Software is provided free on a trial basis			
The software can be modified by the user			

[4]

- 6 A team of software engineers is developing a new e-commerce program for a client.

State **three** of the principles of the ACM/IEEE Software Engineering Code of Ethics. Illustrate each one, with an example, describing how it will influence their working practices.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

3 .....

.....

.....

.....[6]

7 Access to World Wide Web content uses IP addressing.

(a) State what IP stands for.

.....[1]

(b) The following table shows four possible IP addresses.

Indicate for each IP address whether it is valid or invalid and give a reason.

Address	Denary / Hexadecimal	Valid or Invalid	Reason
3.2A.6AA.BBBB	Hexadecimal		
2.0.255.1	Denary		
6.0.257.6	Denary		
A.78.F4.J8	Hexadecimal		

[4]

(c) Describe **two** differences between public and private IP addresses.

1 .....

.....

2 .....

.....[2]

- 8 A school stores a large amount of data. This includes student attendance, qualification, and contact details. The school's software uses a file-based approach to store this data.

(a) The school is considering changing to a DBMS.

(i) State what DBMS stands for.

.....[1]

(ii) Describe **two** ways in which the Database Administrator (DBA) could use the DBMS software to ensure the security of the student data.

1 .....

.....

.....

.....

2 .....

.....

.....

.....[4]

(iii) A feature of the DBMS software is a query processor.

Describe how the school secretary could use this software.

.....

.....

.....

.....[2]

(iv) The DBMS has replaced software that used a file-based approach with a relational database.

Describe how using a relational database has overcome the previous problems associated with a file-based approach.

.....

.....

.....

.....[3]

- (b) The database design has three tables to store the classes that students attend.

**STUDENT**(StudentID, FirstName, LastName, Year, TutorGroup)

**CLASS**(ClassID, Subject)

**CLASS-GROUP**(StudentID, ClassID)

Primary keys are not shown.

There is a one-to-many relationship between **CLASS** and **CLASS-GROUP**.

- (i) Describe how this relationship is implemented.

.....  
.....  
.....[2]

- (ii) Describe the relationship between **CLASS-GROUP** and **STUDENT**.

.....[1]

- (iii) Write an SQL script to display the `StudentID` and `FirstName` of all students who are in the tutor group 10B. Display the list in alphabetical order of `LastName`.

.....  
.....  
.....  
.....[4]

- (iv) Write an SQL script to display the `LastName` of all students who attend the class whose `ClassID` is CS1.

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....[4]

**Question 9 begins on page 12.**

- 9 The table shows assembly language instructions for a processor which has one general purpose register, the Accumulator (ACC) and an index register (IX).

Instruction		Explanation
Op code	Operand	
LDD	<address>	Direct addressing. Load the contents of the given address to ACC.
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the index register. Copy the contents of this calculated address to ACC.
STO	<address>	Store contents of ACC at the given address.
ADD	<address>	Add the contents of the given address to ACC.
INC	<register>	Add 1 to the contents of the register (ACC or IX).
DEC	<register>	Subtract 1 from the contents of the register (ACC or IX).
CMP	<address>	Compare contents of ACC with contents of <address>.
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True.
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False.
JMP	<address>	Jump to the given address.
OUT		Output to screen the character whose ASCII value is stored in ACC.
END		Return control to the operating system.

- (a) The diagram shows the current contents of a section of main memory and the index register:

60	0011 0010
61	0101 1101
62	0000 0100
63	1111 1001
64	0101 0101
65	1101 1111
66	0000 1101
67	0100 1101
68	0100 0101
69	0100 0011
...	
1000	0110 1001

Index register: 

0	0	0	0	1	0	0	0
---	---	---	---	---	---	---	---



(i) Show the contents of the Accumulator after the execution of the instruction:

LDX 60

Accumulator:

--	--	--	--	--	--	--	--

Show how you obtained your answer.

.....

.....

.....

.....[2]

(ii) Show the contents of the index register after the execution of the instruction:


DEC IX

Index register:

--	--	--	--	--	--	--	--

[1]

(b) Complete the trace table on the opposite page for the following assembly language program.

50	LDD 100
51	ADD 102
52	STO 103
53	LDX 100
54	ADD 100
55	CMP 101
56	JPE 58
57	JPN 59
58	OUT
59	INC IX
60	LDX 98
61	ADD 101
62	OUT
63	END
...	
100	20
101	100
102	1
103	0

IX (Index Register)

1

Selected values from the ASCII character set:

ASCII Code	118	119	120	121	122	123	124	125
Character	v	w	x	y	z	{		}

Trace table:

Instruction address	Working space	ACC	Memory address				IX	OUTPUT
			100	101	102	103		
			20	100	1	0	1	
50								
51								
52								
53								
54								
55								

[7]

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**COMPUTER SCIENCE**

9608/12

## Paper 1 Theory Fundamentals

May/June 2016

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

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[3]

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55

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[1]

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.....[1]

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[2]

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4E

.....[1]

- 3 (a) Describe how special purpose registers are used in the fetch stage of the fetch-execute cycle.

.....

.....

.....

.....

.....

.....

.....

.....[4]

- (b) Use the statements A, B, C and D to complete the description of how the fetch-execute cycle handles an interrupt.

A	the address of the Interrupt Service Routine (ISR) is loaded to the Program Counter (PC).
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[4]



- 4 A group of students broadcast a school radio station on a website. They record their sound clips (programmes) in advance and email them to the producer.

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.....

.....

.....

.....

.....

.....[3]

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Lossy / Lossless

Justification: .....

.....

.....

.....[3]

Students also email images to the radio station for use on its website.

These are compressed before sending using run-length encoding (RLE).

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.....

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.....[3]

(iii) The following diagrams show:

- the denary colour code that represents each colour
- the first three rows of a bitmap image

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W	255

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0	B	B	B	B	B	B	B	B	B	B	W	W	W	B	B	B
1	B	B	B	B	B	B	B	B	B	W	W	W	W	W	W	B
2	B	B	B	B	B	B	B	W	W	W	W	W	W	W	W	W
...																
95																

Show how RLE will compress the first three rows of this image.

Row 1: .....

Row 2: .....

Row 3: .....[2]

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1 .....

.....

2 .....

.....[2]

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.....

.....

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.....

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(iii) A feature of the DBMS software is a query processor.

Describe how the school secretary could use this software.

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.....[2]

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.....  
.....  
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.....[1]

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.....  
.....  
.....  
.....[4]

(iv) Write an SQL script to display the `LastName` of all students who attend the class whose `ClassID` is CS1.

.....  
.....  
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**Question 9 begins on page 12.**

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62	0000 0100
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64	0101 0101
65	1101 1111
66	0000 1101
67	0100 1101
68	0100 0101
69	0100 0011
...	
1000	0110 1001

Index register: 

0	0	0	0	1	0	0	0
---	---	---	---	---	---	---	---



- (i) Show the contents of the Accumulator after the execution of the instruction:

LDX 60

Accumulator:

--	--	--	--	--	--	--	--

Show how you obtained your answer.

.....

.....

.....

.....[2]

- (ii) Show the contents of the index register after the execution of the instruction:


DEC IX

Index register:

--	--	--	--	--	--	--	--

[1]

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52	STO 103
53	LDX 100
54	ADD 100
55	CMP 101
56	JPE 58
57	JPN 59
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60	LDX 98
61	ADD 101
62	OUT
63	END
...	
100	20
101	100
102	1
103	0

IX (Index Register)

1

Selected values from the ASCII character set:

ASCII Code	118	119	120	121	122	123	124	125
Character	v	w	x	y	z	{		}

Trace table:

Instruction address	Working space	ACC	Memory address				IX	OUTPUT
			100	101	102	103		
			20	100	1	0	1	
50								
51								
52								
53								
54								
55								

[7]

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**COMPUTER SCIENCE**

**9608/13**

## Paper 1 Theory Fundamentals

May/June 2016

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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The maximum number of marks is 75.

This document consists of **13** printed pages and **3** blank pages.

**1** Describe **two** differences between a compiler and interpreter.

1 .....

.....

.....

.....

2 .....

.....

.....

.....[4]

**2 (a)** Convert the following 8-bit binary integer into denary.

01001101

.....[1]

**(b)** Convert the following denary number into Binary Coded Decimal (BCD).

82

.....[1]

**(c)** Convert the following two's complement integer number into denary.

11001011

.....

.....

.....[2]

**(d)** Convert the following denary number into hexadecimal. Show your working.

198

.....[2]

- 3 A company needs new software to manage its accounts. It is evaluating two different options. One option is open source software and the other is commercial software.

(a) Explain what is meant by open source software.

.....

.....

.....

.....[2]

(b) Explain what is meant by commercial software.

.....

.....

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.....[2]

(c) The company has decided to purchase commercial software.

Identify **four** benefits to the company in choosing the commercial software option.

1 .....

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2 .....

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3 .....

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4 .....

.....[4]

**Question 4 begins on page 5.**



- 4 The table shows assembly language instructions for a processor which has one general purpose register, the Accumulator (ACC) and an index register (IX).

Instruction		Explanation
Op code	Operand	
LDD	<address>	Direct addressing. Load the contents of the given address to ACC.
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the index register. Copy the contents of this calculated address to ACC.
STO	<address>	Store contents of ACC at the given address.
ADD	<address>	Add the contents of the given address to ACC.
INC	<register>	Add 1 to the contents of the register (ACC or IX).
DEC	<register>	Subtract 1 from the contents of the register (ACC or IX).
CMP	<address>	Compare contents of ACC with contents of <address>.
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True.
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False.
JMP	<address>	Jump to the given address.
OUT		Output to screen the character whose ASCII value is stored in ACC.
END		Return control to the operating system.

The diagram shows the contents of the index register:

Index register:	1	1	0	0	1	1	0	1
-----------------	---	---	---	---	---	---	---	---

- (a) Show the contents of the index register after the execution of the instruction:

INC IX

Index register:								
-----------------	--	--	--	--	--	--	--	--

[1]

(b) Complete the trace table on the opposite page for the following assembly language program.

20	LDX 90
21	DEC ACC
22	STO 90
23	INC IX
24	LDX 90
25	DEC ACC
26	CMP 90
27	JPE 29
28	JPN 31
29	ADD 90
30	OUT
31	ADD 93
32	STO 93
33	OUT
34	END
:	
:	
:	
90	2
91	90
92	55
93	34

IX 

2
---

Selected values from the ASCII character set:

ASCII Code	65	66	67	68	69	70	71	72
Character	A	B	C	D	E	F	G	H

Trace table:

Instruction	Working space	ACC	Memory address				IX	OUTPUT
			90	91	92	93		
			2	90	55	34	2	
20								
21								
22								
23								
24								
25								
26								

[7]

5 (a) A Database Management System (DBMS) provides the following features.

Draw a line to match each feature with its description.

Feature	Description
Data dictionary	A file or table containing all the details of the database design
Data security	Data design features to ensure the validity of data in the database
	A model of what the database will look like, although it may not be stored in this way
Data integrity	Methods of protecting the data including the uses of passwords and different access rights for different users of the database

[3]

A school stores a large amount of data that includes student attendance, qualification and contact details. The school is setting up a relational database to store these data.

(b) The school needs to safeguard against any data loss.

Describe **three** factors to consider when planning a backup procedure for the data.

Justify your decisions.

1 .....

.....

.....

2 .....

.....

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3 .....

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[6]

- (c) The database design has three tables to store the qualifications and grades each student has attained. The following is a sample of the data from each table.

**STUDENT**

StudentID	FirstName	LastName	Tutor
001AT	Ahmad	Tan	11A
003JL	Jane	Li	11B
011HJ	Heather	Jones	10A

**QUALIFICATION**

QualCode	Level	Subject
CS1	IGCSE	Computer Science
MT9	IGCSE	Maths
SC12	IGCSE	Science

**STUDENT-QUALIFICATION**

QualCode	StudentID	Grade	DateOfAward
SC12	011HJ	A	31/8/2014
SC12	003JL	C	31/8/2014
CS1	003JL	B	31/8/2014

- (i) Draw an Entity-Relationship (E-R) diagram to show the relationships between these three tables.

[2]

- (ii) State the type of relationship that exists between **STUDENT** and **STUDENT-QUALIFICATION**.

.....[1]

(iii) Describe how the relationship between `QUALIFICATION` and `STUDENT-QUALIFICATION` is implemented.

.....

.....

.....

.....[2]

(d) (i) The database will store each student's date of birth.

Write an SQL script to add a date of birth attribute to the appropriate table.

.....

.....

.....

.....[2]

(ii) Write an SQL script to display the `StudentID`, `Grade` and `DateOfAward` for the `QualCode` value of `SC12`.

.....

.....

.....

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.....

.....[3]

(iii) Write an SQL script to display the `FirstName` and `LastName` and `QualCode` for all `STUDENT-QUALIFICATIONS` for which the `Grade` value is `A`.

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.....[4]

- 6 (a) Explain the difference between the World Wide Web (WWW) and the Internet.

.....

.....

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.....[2]

- (b) Three methods of connecting devices include fibre-optic cables, copper cables and radio waves. The table below gives descriptions relating to these connection methods.

Tick (✓) one box on each row to show the method that best fits each description.

Description	Fibre-optic cable	Copper cable	Radio waves
Wireless medium			
Twisted-pair is an example			
Uses light waves			
WiFi			
Fastest transmission medium			

[5]

- (c) Bit streaming is used for both real-time and on-demand services.

Describe **one** difference between real-time and on-demand bit streaming.

.....

.....

.....

.....[2]

- (d) A device needs an IP address to connect to the Internet. IPv4 is the more common type of IP address.

Describe, using an example, the format of an IPv4 address.

.....

.....

.....

.....

.....

.....[3]

- (e) A computer user keys in the Uniform Resource Locator (URL) of a web page into a web browser.

Describe how the browser uses the Domain Name Service (DNS) to display the web page.

.....

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.....

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.....[4]



7 A bank holds personal data about its customers and their financial data.

(a) Describe the difference between security and integrity of data.

.....

.....

.....

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.....

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.....[4]

(b) Describe **three** security measures that the bank could implement to protect its electronic data.

Security measure 1 .....

Description .....

.....

.....

Security measure 2 .....

Description .....

.....

.....

Security measure 3 .....

Description .....

.....

.....

.....[6]





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**COMPUTER SCIENCE**

**9608/11**

## Paper 1 Theory Fundamentals

October/November 2016

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

## READ THESE INSTRUCTIONS FIRST

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Write in dark blue or black pen.

You may use an HB pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

This document consists of **13** printed pages and **3** blank pages.

1 (a) Five descriptions and seven relational database terms are shown below.

Draw a line to link each description to its correct database term.

Description	Database term
Any object, person or thing about which it is possible to store data	Secondary key
Dataset organised in rows and columns; the columns form the structure and the rows form the content	Candidate key
Any attribute or combination of attributes that can act as a unique key	Entity
Attribute(s) in a table that link to the primary key in another table to form a relationship	Foreign key
Attribute or combination of attributes that is used to uniquely identify a record	Primary key
	Table
	Tuple

[5]

(b) Explain what is meant by referential integrity.

.....

.....

.....

.....

.....

.....[3]

2 (a) State **two** differences between Static RAM (SRAM) and Dynamic RAM (DRAM).

- 1 .....
- .....
- 2 .....
- .....[2]

(b) (i) Explain why a computer needs an operating system.

- .....
- .....
- .....
- .....[2]

(ii) Give **two** key management tasks carried out by an operating system.

- 1 .....
- .....
- 2 .....
- .....[2]

(c) New program code is to be written in a high-level language. The use of Dynamic Link Library (DLL) files is considered in the design.

Describe what is meant by a DLL file.

- .....
- .....
- .....
- .....[2]

**3 (a) (i)** Convert the denary number 46 to an 8-bit binary integer.

.....  
.....[1]

**(ii)** Convert the denary integer –46 to an 8-bit two’s complement form.

.....  
.....[1]

**(iii)** Convert the denary number 46 into hexadecimal.

.....  
.....[1]

**(b)** Binary Coded Decimal (BCD) is another way of representing numbers.

**(i)** Describe how denary integers larger than 9 can be converted into BCD.  
Give an example in your answer.

.....  
.....  
.....  
.....[2]

**(ii)** Describe how an 8-bit BCD representation can be converted into a denary integer.  
Give an example in your answer.

.....  
.....  
.....  
.....[2]



**4** Describe the basic internal operation of the following devices:

**(i)** Keyboard

.....

.....

.....

.....[2]

**(ii)** Optical disc

.....

.....

.....

.....[2]

**(iii)** Optical mouse

.....

.....

.....

.....[2]

**(iv)** Scanner

.....

.....

.....

.....[2]

- 5 A motor is controlled by a logic circuit. The circuit has inputs (0 or 1) from three sensors R, T and W. The motor is switched off when the output from the logic circuit is 1.

The following table shows the three sensors and the conditions being monitored.

Sensor	Description	Binary value	Condition
R	rotation	0	rotation < 4000 rpm
		1	rotation $\geq$ 4000 rpm
T	temperature	0	temperature $\geq$ 90 °C
		1	temperature < 90 °C
W	water flow rate	0	water flow rate $\geq$ 50 litre/min
		1	water flow rate < 50 litre/min

The output, X, is 1 if:

temperature  $\geq$  90 °C and rotation  $\geq$  4000 rpm

or

temperature < 90 °C and water flow rate  $\geq$  50 litre/min

- (i) Draw a corresponding logic circuit.



[5]

(ii) Give a logic statement corresponding to the logic circuit in part (i).

.....

.....[2]

(iii) Complete the truth table for this system.

INPUT			Workspace	OUTPUT X
R	T	W		
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

6 A user watches a video available on a website. The website uses on-demand bit streaming.

Describe how it is possible to watch the video without it continually pausing.

.....

.....

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.....

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.....

.....

.....[4]

- 7 A small company produces scientific magazines. The owner buys some new desktop computers. The computers are used to store thousands of colour images (diagrams and photographs). All the computers have Internet access.

(a) Name **three** utility programs the company would use on all their computers. Describe what each program does.

1 .....

Description .....

.....

2 .....

Description .....

.....

3 .....

Description .....

.....[6]

(b) The images contained in the magazines are produced using either bitmap or vector graphics software.

Give **four** differences between bitmap and vector graphics.

1 .....

.....

2 .....

.....

3 .....

.....

4 .....

.....[4]

- (c) Employees using the new computers receive training. At the end of the training, each employee completes a series of questions.

Three answers given by an employee are shown below.

Explain why each answer is incorrect.

- (i) *“Encryption prevents hackers breaking into the company’s computers.”*

.....

.....

.....

.....[2]

- (ii) *“Data validation is used to make sure that data keyed in are the same as the original data supplied.”*

.....

.....

.....

.....[2]

- (iii) *“The use of passwords will always prevent unauthorised access to the data stored on the computers.”*

.....

.....

.....

.....[2]

- 8 The table shows assembly language instructions for a processor which has one general purpose register, the Accumulator (ACC) and an Index Register (IX).

Instruction		Explanation
Op code	Operand	
LDD	<address>	Direct addressing. Load the contents of the given address to ACC.
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the index register. Copy the contents of this calculated address to ACC.
STO	<address>	Store contents of ACC at the given address.
ADD	<address>	Add the contents of the given address to ACC.
CMP	<address>	Compare contents of ACC with contents of <address>
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True.
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False.
JMP	<address>	Jump to the given address.
OUT		Output to the screen the character whose ASCII value is stored in ACC.
END		Return control to the operating system.

The diagram shows the contents of the main memory:

Main memory	
800	0110 0100
801	0111 1100
802	1001 0111
803	0111 0011
804	1001 0000
805	0011 1111
806	0000 1110
807	1110 1000
808	1000 1110
809	1100 0010
:	
:	
2000	1011 0101

- (a) (i) Show the contents of the Accumulator after execution of the instruction:

LDD 802

Accumulator:

--	--	--	--	--	--	--	--

[1]

(ii) Show the contents of the Accumulator after execution of the instruction:

LDX 800

Index Register: 

0	0	0	0	1	0	0	1
---	---	---	---	---	---	---	---

Accumulator: 

--	--	--	--	--	--	--	--

Explain how you arrived at your answer.

.....

.....

.....

.....[3]

- (b) (i) Complete the trace table below for the following assembly language program. This program contains denary values.

100	LDD 800
101	ADD 801
102	STO 802
103	LDD 803
104	CMP 802
105	JPE 107
106	JPN 110
107	STO 802
108	OUT
109	JMP 112
110	LDD 801
111	OUT
112	END
:	
:	
800	40
801	50
802	0
803	90

Selected values from the ASCII character set:

ASCII code	40	50	80	90	100
Character	(	2	P	Z	d

Trace table:

ACC	Memory address				OUTPUT
	800	801	802	803	
	40	50	0	90	

[4]



(ii) There is a redundant instruction in the code in **part (b)(i)**.

State the address of this instruction.

.....[1]

(c) The program used the ASCII coding system for character codes. An alternative coding system is Unicode.

(i) Give **two** disadvantages of using ASCII code.

1 .....  
.....

2 .....  
.....[2]

(ii) Describe how Unicode is designed to overcome the disadvantages of ASCII.

.....  
.....  
.....  
.....[2]





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**COMPUTER SCIENCE**

9608/12

## Paper 1 Theory Fundamentals

## October/November 2016

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

This document consists of **12** printed pages.

- 1 (a) A student writes the following logic expression:

X is 1 IF (B is NOT 1 AND S is NOT 1) OR (P is NOT 1 AND S is 1)

Draw a logic circuit to represent this logic expression.

Do not attempt to simplify the logic expression.



[6]

- (b) Complete the truth table for the logic expression given in **part (a)**.

B	S	P	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

2 (a) When recording a video, state what is meant by frame rate.

.....  
.....[1]

(b) Video streaming can use either interlaced encoding or progressive encoding.

Describe what is meant by the following terms.

Interlaced encoding

.....  
.....  
.....  
.....

Progressive encoding

.....  
.....  
.....  
.....[4]

(c) (i) Name the video terms described below:

Description	Term
Pixels in two video frames have the same value in the same location. There is duplication of data between frames.	.....
A sequence of pixels in a single video frame have the same value.	.....

[2]

(ii) Give **one** file technique that could be applied when either of the two features, described in **part (c)(i)**, are present.

.....  
.....[1]

- 3 When an application program requests a file stored on a hard disk, the computer system reads the file. Use the statement labels A to H to complete the sequence of steps that describe how this happens.

Label	Statement
A	When the hard disk drive has read the file, it generates an interrupt.
B	While the file continues, the head reads successive clusters of sectors from the disk and writes data into the disk buffer.
C	The head reads the first cluster of sectors from disk and writes data into the disk buffer.
D	The head moves to the correct track.
E	The operating system transfers the contents of the disk buffer to the application program's data memory.
F	In the relevant directory file, the operating system looks up the track and sector where the file begins.
G	Application program passes file read request to the operating system.
H	The hard disk drive waits for the correct sector to arrive under the head.

1. The application program executes a statement to read a file.
2. ....
3. The operating system begins to spin the hard disk, if it is not currently spinning.
4. ....
5. ....
6. ....
7. ....
8. ....
9. ....
10. ....

[8]



- 4 Hexadecimal, Binary Coded Decimal (BCD) and binary values are shown below.

Draw a line to link each value to its correct denary value.

**Hexadecimal, BCD, binary**

**Denary**

Hexadecimal:

3A

BCD representation:

0100 1001

Binary integer:

01011101

Two's complement  
binary integer:

11000001

93

-65

58

-63

73

49

-93

[4]

- 5 The table shows assembly language instructions for a processor that has one general purpose register, the Accumulator (ACC) and an index register (IX).

Instruction		Explanation
Op Code	Operand	
LDD	<address>	Direct addressing. Load the contents of the given address to ACC.
LDX	<address>	Index addressing. Form the address from <address> + the contents of the index register. Copy the contents of this calculated address to ACC.
LDI	<address>	Indirect addressing. The address to be used is at the given address. Load the contents of this second address to ACC.
STO	<address>	Store the contents of ACC at the given address.
INC	<register>	Add 1 to contents of the register (ACC or IX).
ADD	<address>	Add the contents of the given address to the ACC.
END		Return control to the operating system.

The diagram shows the contents of a section of main memory:

Main memory	
100	0000 0010
101	1001 0011
102	0111 0011
103	0110 1011
104	0111 1110
105	1011 0001
106	0110 1000
107	0100 1011
...	
200	1001 1110

(a) (i) Show the contents of the Accumulator after the execution of the instruction:

LDD 102

ACC: 

--	--	--	--	--	--	--	--

[1]

(ii) Show the contents of the Accumulator after the execution of the instruction:

LDX 101

IX: 

0	0	0	0	0	1	0	0
---	---	---	---	---	---	---	---

ACC: 

--	--	--	--	--	--	--	--

Explain how you arrived at your answer.

.....  
.....  
.....  
.....[2]

(iii) Show the contents of the Accumulator after the execution of the instruction:

LDI 103


ACC: 

--	--	--	--	--	--	--	--

Explain how you arrived at your answer.

.....  
.....  
.....  
.....  
.....  
.....[3]

(b) Complete the trace table below for the following assembly language program.

800	LDD 810
801	INC ACC
802	STO 812
803	LDD 811
804	ADD 812
805	STO 813
806	END
...	
810	28
811	41
812	0
813	0

Trace table:

ACC	Memory address			
	810	811	812	813
	28	41	0	0

[6]

6 (a) Describe **two** differences between RAM and ROM.

- 1 .....
- .....
- 2 .....
- .....[2]

(b) State **three** differences between Dynamic RAM (DRAM) and Static RAM (SRAM).

- 1 .....
- .....
- 2 .....
- .....
- 3 .....
- .....[3]

7 One management task carried out by an operating system is to provide a user interface.

Describe **two** more of these management tasks.

- 1 .....
- .....
- .....
- .....
- 2 .....
- .....
- .....
- .....[4]

8 A programmer is writing a program that includes code from a program library.

(a) Describe **two** benefits to the programmer of using one or more library routines.

1 .....

.....

.....

.....

2 .....

.....

.....

.....[4]

(b) The programmer decides to use a Dynamic Link Library (DLL) file.

(i) Describe **two** benefits of using DLL files.

1 .....

.....

.....

.....

2 .....

.....

.....

.....[4]

(ii) State **one** drawback of using DLL files.

.....

.....

.....[2]

9 A health club offers classes to its members. A member needs to book into each class in advance.

- (a) The health club employs a programmer to update the class booking system. The programmer has to decide how to store the records. The choice is between using a relational database or a file-based approach.

Give **three** reasons why the programmer should use a relational database.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

3 .....

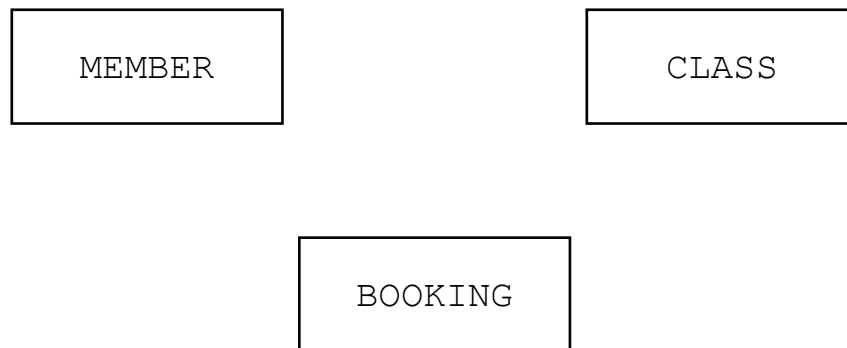
.....

.....

.....[6]

- (b) The programmer decides to use three tables: MEMBER, BOOKING and CLASS.

Complete the Entity-Relationship (E-R) diagram to show the relationships between these tables.



[2]

(c) The `CLASS` table has primary key `ClassID` and stores the following data:

<code>ClassID</code>	<code>Description</code>	<code>StartDate</code>	<code>ClassTime</code>	<code>NoOfSessions</code>	<code>AdultsOnly</code>
DAY01	Yoga beginners	12/01/2016	11:00	5	TRUE
EVE02	Yoga beginners	12/01/2016	19:00	5	FALSE
DAY16	Circuits	30/06/2016	10:30	4	FALSE

Write an SQL script to create the `CLASS` table.

.....

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.....

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.....[6]

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**COMPUTER SCIENCE**

**9608/13**

## Paper 1 Theory Fundamentals

## October/November 2016

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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Answer **all** questions.

No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

This document consists of **13** printed pages and **3** blank pages.

1 (a) Five descriptions and seven relational database terms are shown below.

Draw a line to link each description to its correct database term.

Description	Database term
Any object, person or thing about which it is possible to store data	Secondary key
Dataset organised in rows and columns; the columns form the structure and the rows form the content	Candidate key
Any attribute or combination of attributes that can act as a unique key	Entity
Attribute(s) in a table that link to the primary key in another table to form a relationship	Foreign key
Attribute or combination of attributes that is used to uniquely identify a record	Primary key
	Table
	Tuple

[5]

(b) Explain what is meant by referential integrity.

.....

.....

.....

.....

.....

.....[3]

2 (a) State **two** differences between Static RAM (SRAM) and Dynamic RAM (DRAM).

- 1 .....
- .....
- 2 .....
- .....[2]

(b) (i) Explain why a computer needs an operating system.

- .....
- .....
- .....
- .....[2]

(ii) Give **two** key management tasks carried out by an operating system.

- 1 .....
- .....
- 2 .....
- .....[2]

(c) New program code is to be written in a high-level language. The use of Dynamic Link Library (DLL) files is considered in the design.

Describe what is meant by a DLL file.

- .....
- .....
- .....
- .....[2]

**3 (a) (i)** Convert the denary number 46 to an 8-bit binary integer.

.....  
.....[1]

**(ii)** Convert the denary integer –46 to an 8-bit two’s complement form.

.....  
.....[1]

**(iii)** Convert the denary number 46 into hexadecimal.

.....  
.....[1]

**(b)** Binary Coded Decimal (BCD) is another way of representing numbers.

**(i)** Describe how denary integers larger than 9 can be converted into BCD.  
Give an example in your answer.

.....  
.....  
.....  
.....[2]

**(ii)** Describe how an 8-bit BCD representation can be converted into a denary integer.  
Give an example in your answer.

.....  
.....  
.....  
.....[2]

**4** Describe the basic internal operation of the following devices:

**(i)** Keyboard

.....

.....

.....

.....[2]

**(ii)** Optical disc

.....

.....

.....

.....[2]

**(iii)** Optical mouse

.....

.....

.....

.....[2]

**(iv)** Scanner

.....

.....

.....

.....[2]

- 5 A motor is controlled by a logic circuit. The circuit has inputs (0 or 1) from three sensors R, T and W. The motor is switched off when the output from the logic circuit is 1.

The following table shows the three sensors and the conditions being monitored.

Sensor	Description	Binary value	Condition
R	rotation	0	rotation < 4000 rpm
		1	rotation $\geq$ 4000 rpm
T	temperature	0	temperature $\geq$ 90 °C
		1	temperature < 90 °C
W	water flow rate	0	water flow rate $\geq$ 50 litre/min
		1	water flow rate < 50 litre/min

The output, X, is 1 if:

temperature  $\geq$  90 °C and rotation  $\geq$  4000 rpm

or

temperature < 90 °C and water flow rate  $\geq$  50 litre/min

- (i) Draw a corresponding logic circuit.



[5]

(ii) Give a logic statement corresponding to the logic circuit in part (i).

.....

.....[2]

(iii) Complete the truth table for this system.

INPUT			Workspace	OUTPUT X
R	T	W		
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

6 A user watches a video available on a website. The website uses on-demand bit streaming.

Describe how it is possible to watch the video without it continually pausing.

.....

.....

.....

.....

.....

.....

.....

.....[4]

- 7 A small company produces scientific magazines. The owner buys some new desktop computers. The computers are used to store thousands of colour images (diagrams and photographs). All the computers have Internet access.

(a) Name **three** utility programs the company would use on all their computers. Describe what each program does.

1 .....

Description .....

.....

2 .....

Description .....

.....

3 .....

Description .....

.....[6]

(b) The images contained in the magazines are produced using either bitmap or vector graphics software.

Give **four** differences between bitmap and vector graphics.

1 .....

.....

2 .....

.....

3 .....

.....

4 .....

.....[4]



- (c) Employees using the new computers receive training. At the end of the training, each employee completes a series of questions.

Three answers given by an employee are shown below.

Explain why each answer is incorrect.

- (i) *“Encryption prevents hackers breaking into the company’s computers.”*

.....

.....

.....

.....[2]

- (ii) *“Data validation is used to make sure that data keyed in are the same as the original data supplied.”*

.....

.....

.....

.....[2]

- (iii) *“The use of passwords will always prevent unauthorised access to the data stored on the computers.”*

.....

.....

.....

.....[2]

- 8 The table shows assembly language instructions for a processor which has one general purpose register, the Accumulator (ACC) and an Index Register (IX).

Instruction		Explanation
Op code	Operand	
LDD	<address>	Direct addressing. Load the contents of the given address to ACC.
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the index register. Copy the contents of this calculated address to ACC.
STO	<address>	Store contents of ACC at the given address.
ADD	<address>	Add the contents of the given address to ACC.
CMP	<address>	Compare contents of ACC with contents of <address>
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True.
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False.
JMP	<address>	Jump to the given address.
OUT		Output to the screen the character whose ASCII value is stored in ACC.
END		Return control to the operating system.

The diagram shows the contents of the main memory:

Main memory	
800	0110 0100
801	0111 1100
802	1001 0111
803	0111 0011
804	1001 0000
805	0011 1111
806	0000 1110
807	1110 1000
808	1000 1110
809	1100 0010
:	
:	
2000	1011 0101

- (a) (i) Show the contents of the Accumulator after execution of the instruction:

LDD 802

Accumulator:

--	--	--	--	--	--	--	--

[1]

(ii) Show the contents of the Accumulator after execution of the instruction:

LDX 800

Index Register: 

0	0	0	0	1	0	0	1
---	---	---	---	---	---	---	---

Accumulator: 

--	--	--	--	--	--	--	--

Explain how you arrived at your answer.

.....

.....

.....

.....[3]

- (b) (i) Complete the trace table below for the following assembly language program. This program contains denary values.

100	LDD 800
101	ADD 801
102	STO 802
103	LDD 803
104	CMP 802
105	JPE 107
106	JPN 110
107	STO 802
108	OUT
109	JMP 112
110	LDD 801
111	OUT
112	END
:	
:	
800	40
801	50
802	0
803	90

Selected values from the ASCII character set:

ASCII code	40	50	80	90	100
Character	(	2	P	Z	d

Trace table:

ACC	Memory address				OUTPUT
	800	801	802	803	
	40	50	0	90	

[4]

(ii) There is a redundant instruction in the code in **part (b)(i)**.

State the address of this instruction.

.....[1]

(c) The program used the ASCII coding system for character codes. An alternative coding system is Unicode.

(i) Give **two** disadvantages of using ASCII code.

1 .....  
.....

2 .....  
.....[2]

(ii) Describe how Unicode is designed to overcome the disadvantages of ASCII.

.....  
.....  
.....  
.....[2]





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**COMPUTER SCIENCE**

## Paper 1 Theory Fundamentals

9608/11

May/June 2017

**1 hour 30 minutes**

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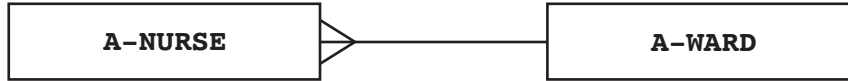
The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

This document consists of **15** printed pages and **1** blank page.

- 1 A hospital is divided into two areas, Area A and Area B. Each area has several wards. All the ward names are different.

A number of nurses are based in Area A. These nurses always work on the same ward. Each nurse has a unique Nurse ID of `STRING` data type.



- (a) Describe the relationship shown above.

.....  
 .....[1]

- (b) A relational database is created to store the ward and nurse data. The two table designs for Area A are:

A-WARD (WardName, NumberOfBeds)

A-NURSE (NurseID, FirstName, FamilyName, .....)

- (i) Complete the design for the A-NURSE table. [1]

- (ii) Explain how the relationship in **part (a)** is implemented.

.....  
 .....  
 .....  
 .....[2]

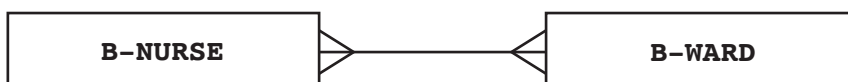
- (c) In Area B of the hospital, there are a number of wards and a number of nurses.

Each Area B ward has a specialism.

Each Area B nurse has a specialism.

A nurse can be asked to work in any of the Area B wards where their specialism matches with the ward specialism.

The relationship for Area B of the hospital is:



- (i) Explain what the degree of relationship is between the entities B-NURSE and B-WARD.

.....  
 .....[1]

- (ii) The design for the Area B data is as follows:

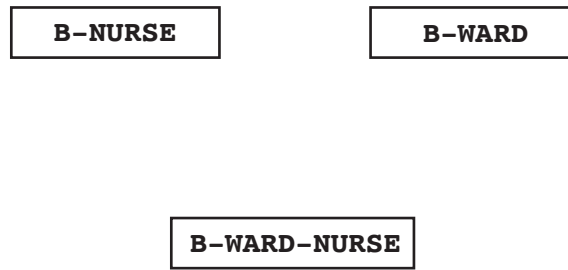
B-NURSE (NurseID, FirstName, FamilyName, Specialism)

B-WARD (WardName, NumberOfBeds, Specialism)

B-WARD-NURSE ( ..... )

Complete the attributes for the third table. Underline its primary key. [2]

- (iii) Draw the relationships on the entity-relationship (E-R) diagram.



[2]

- (d) Use the table designs in **part (c)(ii)**.

- (i) Write an SQL query to display the Nurse ID and family name for all Area B nurses with a specialism of 'THEATRE'.

.....  
 .....  
 ..... [3]

- (ii) Fatima Woo is an Area B nurse with the nurse ID of 076. She has recently married, and her new family name is Chi.

Write an SQL command to update her record.

UPDATE .....  
 SET .....  
 WHERE ..... [3]

- 2 (a) (i) The following sequence of steps (1 to 7) describe how a single page is printed on a laser printer.

The statements A, B, C and D are used to complete the sequence.

<b>A</b>	The paper passes through a fuser, which heats up the paper. The toner melts and forms a permanent image on the paper.
<b>B</b>	The electrical charge is removed from the drum and the excess toner is collected.
<b>C</b>	The image is converted on the drum into an electrostatic charge.
<b>D</b>	The oppositely-charged paper picks up the toner particles from the drum. After picking up the toner, the paper is discharged to stop it clinging to the drum.

Complete the sequence by writing one of the letters **A**, **B**, **C** or **D** on the appropriate row.

1. A laser beam and a rotating mirror are used to draw an image of the page on the photosensitive drum.
2. ....
3. Electrostatic charge attracts toner.
4. The charged paper is rolled against the drum.
5. ....
6. ....
7. .... [3]

- (ii) A computer user has a laser printer to print letters and documents. The user also prints digital photographs taken using a digital camera.

State the most suitable type of printer for printing the photographs.

.....[1]

- (b) The user is considering the purchase of a new laptop computer. She has read many product reviews and knows that there are different types of internal secondary storage available.

List **two** options for internal secondary storage.

Option 1 .....

Option 2 .....

Describe **one** advantage of one of the options.

Advantage of choosing option **1 / 2** (*circle*)

.....

.....[3]

**Question 3 begins on page 6.**

- 3 (a) A computer has a microphone and captures a voice recording using sound recording software.

Before making a recording, the user can select the sampling rate.

Define the term **sampling rate**. Explain how the sampling rate will influence the accuracy of the digitised sound.

Sampling rate .....

.....

.....

Explanation .....

.....

[2]

- (b) The computer also has bitmap software.

- (i) Define the terms **pixel** and **screen resolution**.

Pixel .....

.....

Screen resolution .....

.....

[2]

- (ii) A picture has been drawn and is saved as a monochrome bitmap image.

State how many pixels are stored in one byte.

.....[1]

- (iii) A second picture has width 2048 pixels and height 512 pixels. It is saved as a 256-colour image.

Calculate the file size in kilobytes.

Show your working.

.....

.....

.....

.....

.....

.....[3]

- (iv) The actual bitmap file size will be larger than your calculated value.

State another data item that the bitmap file stores in addition to the pixel data.

.....  
.....[1]

- 4 The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC) and an Index Register (IX).

Instruction		Op code (binary)	Explanation
Op code (mnemonic)	Operand		
LDM #n		0000 0001	Immediate addressing. Load the denary number n to ACC.
LDD <address>		0000 0010	Direct addressing. Load the contents of the location at the given address to ACC.
LDI <address>		0000 0101	Indirect addressing. At the given address is the address to be used. Load the contents of this second address to ACC.
LDX <address>		0000 0110	Indexed addressing. Form the address from <address> + the contents of the Index Register (IX). Copy the contents of this calculated address to ACC.
LDR #n		0000 0111	Immediate addressing. Load number n to IX.
STO <address>		0000 1111	Store the contents of ACC at the given address.

The following diagram shows the contents of a section of main memory and the Index Register (IX).

- (a) Show the contents of the Accumulator (ACC) after each instruction is executed.

IX	0	0	0	0	0	0	1	1
----	---	---	---	---	---	---	---	---

		Address	Main Memory contents
(i) LDM #500			
ACC .....	[1]	495	13
(ii) LDD 500		496	86
ACC .....	[1]	497	92
(iii) LDX 500		498	486
ACC .....	[1]	499	489
		500	496
(iv) LDI 500		501	497
ACC .....	[1]	502	499
		503	502



- (b) Each machine code instruction is encoded as 16-bits (8-bit op code followed by an 8-bit operand).

Write the machine code for the following instructions:

LDM #17

--	--	--	--	--	--	--	--

--	--	--	--	--	--	--	--

LDX #97

--	--	--	--	--	--	--	--

--	--	--	--	--	--	--	--

[3]

- (c) Using an 8-bit operand, state the maximum number of memory locations, in denary, that can be directly addressed.

.....[1]

- (d) Computer scientists often write binary representations in hexadecimal.

- (i) Write the hexadecimal representation for this instruction:

0	0	0	0	0	1	1	1
---	---	---	---	---	---	---	---

1	1	0	0	0	0	1	0
---	---	---	---	---	---	---	---

.....[2]

- (ii) A second instruction has been written in hexadecimal as:

05 3F

Write the equivalent assembly language instruction, with the operand in denary.

.....[2]

- 5 A computer receives data from a remote data logger. Each data block is a group of 8 bytes. A block is made up of seven data bytes and a parity byte.

Each data byte has a parity bit using odd parity. The parity byte also uses odd parity.

The following table shows a data block before transmission. Bit position 0 is the parity bit.

Bit position							
7	6	5	4	3	2	1	0
1	1	0	0	1	1	0	1
0	0	1	0	0	0	0	0
1	0	0	1	1	1	0	<b>A</b>
1	1	0	0	0	0	1	0
1	1	0	0	0	0	1	0
1	1	0	0	0	1	1	<b>B</b>
0	0	0	0	0	0	0	0

Data bytes

0	1	1	0	1	1	0	0
---	---	---	---	---	---	---	---

Parity byte

- (a) (i) Describe how the data logger calculates the parity bit for each of the bytes in the data block.

.....  
 .....  
 .....[2]

- (ii) State the two missing parity bits labelled **A** and **B**.

**A** = .....

**B** = .....

[1]

- (iii) Describe how the computer uses the parity byte to perform a further check on the received data bytes.

.....  
 .....  
 .....[2]

- (b) (i) A second data block is received as shown in the following table. There are errors in this data block.

Identify and then circle **two** bits in the table which must be changed to remove the errors.

Bit position							
7	6	5	4	3	2	1	0
1	0	0	0	1	1	0	0
0	0	1	0	0	0	0	0
0	0	1	1	0	1	0	1
1	1	1	1	0	0	0	1
1	1	0	0	0	0	1	0
0	0	1	0	0	1	0	0
0	0	0	0	0	0	0	1

0	1	0	1	1	0	0	0
---	---	---	---	---	---	---	---

[2]

- (ii) Explain how you arrived at your answers for **part (b)(i)**.

.....

.....

.....

.....[3]

- 6 (a) The operating system (OS) contains code for performing various management tasks.

The appropriate code is run when the user performs various actions.

Draw a line to link each OS management task to the appropriate user action.

OS management task	Action
Main memory management	The user moves the mouse on the desktop
Input/Output management	The user closes the spreadsheet program
Secondary storage management	The user selects the Save command to save their spreadsheet file
Human computer interface management	The user selects the Print command to output their spreadsheet document

[3]

- (b) A user has the following issues with the use of his PC.

State the utility software which should provide a solution.

- (i) The hard disk stores a large number of video files. The computer frequently runs out of storage space.

Utility software solution .....[1]

- (ii) The user is unable to find an important document. He thinks it was deleted in error some weeks ago. This must not happen again.

Utility software solution .....[1]

- (iii) The operating system reports 'Bad sector' errors.

Utility software solution .....[1]

- (iv) There have been some unexplained images and advertisements appearing on the screen. The user suspects it is malware.

Utility software solution .....[1]

7 The design of a web-based application can require the use of client-side scripting.

(a) Describe what is meant by **client-side scripting**.

.....

.....

.....

.....[2]

(b) A user requests a web page by keying the Uniform Resource Locator (URL) into the address bar of their web browser.

The requested page contains a client-side script.

Describe the sequence of steps leading to the display of the web page on the computer screen.

.....

.....

.....

.....

.....

.....

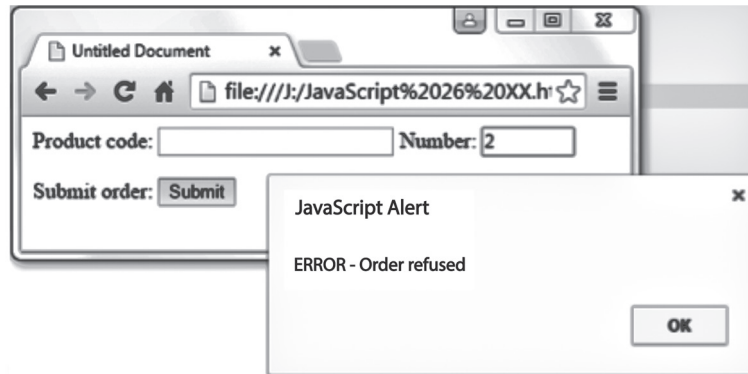
.....

.....

.....[4]

(c) A web page used for data capture consists of:

- two text boxes for the entry of:
  - a product code
  - the number of items to be purchased.
- a button which is clicked when the user wants to submit this order.



Study the following web page.

```

1  <html>
2  <head>
3  <title>Untitled Document</title>
4  <script language="JavaScript">
5
6  function myButton_onmousedown()
7  {
8  var Message1 = "ERROR - Order refused";
9  var Message2 = "Product code OK";
10 var x = document.forms["form1"]["txtProductCode"].value;
11   if (x == "")
12   {
13       alert(Message1)
14   }
15   else
16   {
17       alert(Message2)
18   }
19 }
20 </script>
21
22 </head>
23 <body>
24 <form name = form1>
25   <label>Product code: </label>
26   <input type="text" name="txtProductCode" >
27   <label>Number: </label>
28   <input type="text" name="txtNumber" size = "5" >
29   <p>
30     <label>Submit order: </label>
31     <input type="button" name="btnSubmit" Value = "Submit"
32
33     onMouseDown = "myButton_onmousedown()" >
34   </p>
35 </form>
36
37 </body>
38 </html>

```

- (i) The developer has used three variables in the JavaScript code. State the identifiers used.

1 .....

2 .....

3 ..... [2]

- (ii) The button has an event whose identifier is `onMouseDown`. When the submit button is clicked, some code is executed.

State the line numbers that contain this code.

From line ..... to line ..... [1]

- (iii) The JavaScript code uses a selection statement.

State the line number that contains the condition.

Line number: ..... [1]

- (iv) Describe the purpose of the validation check that the code performs.

.....

.....[1]

- (v) Name and describe **two** other types of validation check that could be appropriate for this data capture form.

Validation check: .....

Description .....

.....

Validation check: .....

Description .....

.....

[4]

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**COMPUTER SCIENCE**

9608/12

## Paper 1 Theory Fundamentals

May/June 2017

**1 hour 30 minutes**

Candidates answer on the Question Paper.

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No calculators allowed.

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- 1 Some shops belong to the Rainbow Retail buying group. They buy their goods from one or more suppliers.

Each shop has:

- a unique shop ID
- a single retail specialism (for example, food, electrical, garden).

Each supplier has:

- a unique supplier ID
- a similar single specialism recorded.

Rainbow Retail creates a relational database to record data about the shops and their suppliers.

The entity-relationship (E-R) diagram for the relationship between the `SHOP` and `SUPPLIER` tables is shown.



- (a) Explain what the degree of relationship is between the entities `SHOP` and `SUPPLIER`.

.....  
 .....[1]

The database design is as follows:

`SHOP(ShopID, ShopName, Location, RetailSpecialism)`

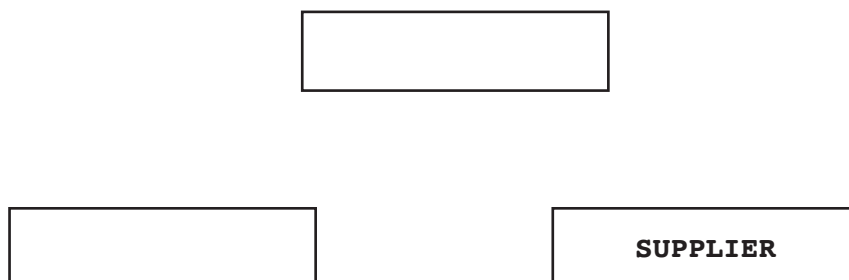
`SUPPLIER(SupplierID, SupplierName, ContactPerson, RetailSpecialism)`

`SHOP-SUPPLIER(ShopID, SupplierID)`

The `SHOP-SUPPLIER` table stores the suppliers that each shop has previously used.

Primary keys are not shown.

- (b) (i) Label the entities and draw the relationships to complete the revised E-R diagram.



[3]

(ii) Complete the following table to show for each database table:

- the primary key
- the foreign key(s) (if any):
  - Each table may contain none, one or more foreign key(s).
  - For a table with no foreign key, write 'None'.
- an explanation for the use of any foreign key.

Table	Primary key	Foreign key(s) (if any)	Explanation
SHOP			
SUPPLIER			
SHOP-SUPPLIER			

[5]

(iii) The database designer has implemented `SUPPLIER.ContactPerson` as a secondary key.

Describe the reason for this.

.....  
 .....  
 .....  
 .....[2]

(c) (i) Write an SQL query to display the shop ID and location of all shops with a 'GROCERY' specialism.

.....  
 .....  
 .....[3]

(ii) The existing shop with ID 8765 has just used the existing supplier SUP89 for the first time.

Write an SQL script to add this data to the database.

.....  
 .....  
 .....[3]

- 2 (a)** The first column of the following table gives features of different types of printer.

Put a tick (✓) in the cells to show which features describe a laser and an inkjet printer.

	Type of printer	
	Laser	Inkjet
Impact printer		
Non-impact printer		
Line printer		
Page printer		

[2]

- (b)** Two of the components of an inkjet printer are a stepper motor and a print head.

Describe how each component is used when printing a page.

(i) Print head .....

.....

---

---

---

---

.....[5]

(ii) Stepper motor

---

---

.....[2]

- (c) A student has an old working laptop computer. It has a small capacity internal disk drive with almost all the storage space taken up by the operating system and application programs.

She needs to buy an external storage device to store her data files.

- (i) List **two** suitable devices.

Device 1 .....

Device 2 .....

[2]

- (ii) Describe **one** advantage of choosing one of the devices.

Advantage of choosing device 1 / 2 (*circle*)

.....

.....[1]

- 3 (a) A computer has a microphone and captures a voice recording using sound editing software.

The user can select the sampling resolution before making a recording.

Define the term **sampling resolution**. Explain how the sampling resolution will affect the accuracy of the digitised sound.

Sampling resolution .....  
 .....  
 .....

Explanation .....  
 .....  
 ..... [3]

- (b) The computer also has bitmap software.

- (i) Define the term **image resolution**.

.....  
 ..... [1]

- (ii) A picture is drawn and is saved as a 16-colour bitmap image.

State how many bits are used to encode the data for one pixel.

..... [1]

- (iii) A second picture has width 8192 pixels and height 256 pixels. It is saved as a 256-colour bitmap.

Calculate the file size in kilobytes.

Show your working.

.....  
 .....  
 .....  
 .....  
 ..... [3]

- (iv) The actual bitmap file size will be larger than your calculated value as a bitmap file has a file header.

State **two** items of data that are stored in the file header.

1 .....  
 2 ..... [2]

- 4 (a) (i) Explain why a personal computer (PC) needs an operating system (OS).

.....

.....

.....[2]

- (ii) One of the tasks carried out by the OS is the management of the use of the processor.

Name and describe **two** other management tasks that the OS performs.

1 .....

.....

.....

2 .....

.....

.....

[4]

- (b) A user has the following issues with the use of their personal computer (PC).

For each case, state the utility software which should provide a solution.

- (i) The user wants to send a large file as an attachment to an email. The user knows that the recipient's Internet Service Provider (ISP) has a limit of 2MB for file attachments.

Utility software solution: .....[1]

- (ii) The user is writing a book and is worried that the document files could get damaged or deleted.

Utility software solution: .....[1]

- (iii) The computer has recently been slow to load large files. The user has deleted a large number of small files to try to solve the problem. A friend has advised that there is a procedure which should be regularly carried out to reorganise file storage on the hard disk.

Utility software solution: .....[1]

- (iv) The user clicked on an attachment in an unsolicited email. Since then, the computer has shown some unexplained behaviours.

Utility software solution: .....[1]

- 5 The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Op code (binary)	Explanation
Op code (mnemonic)	Operand		
LDD <address>		0001 0011	Direct addressing. Load the contents of the location at the given address to the Accumulator (ACC).
LDI <address>		0001 0100	Indirect addressing. The address to be used is at the given address. Load the contents of this second address to ACC.
LDX <address>		0001 0101	Indexed addressing. Form the address from <address> + the contents of the Index Register. Copy the contents of this calculated address to ACC.
LDM #n		0001 0010	Immediate addressing. Load the denary number n to ACC.
LDR #n		0001 0110	Immediate addressing. Load denary number n to the Index Register (IX).
STO <address>		0000 0111	Store the contents of ACC at the given address.

The following diagram shows the contents of a section of main memory and the Index Register (IX).

- (a) Show the contents of the Accumulator (ACC) after each instruction is executed.

IX	0	0	0	0	0	1	1	0
----	---	---	---	---	---	---	---	---

- (i) LDD 355

ACC ..... [1]

- (ii) LDM #355

ACC ..... [1]

- (iii) LDX 351

ACC ..... [1]

- (iv) LDI 355

ACC ..... [1]

Address	Main memory contents
350	
351	86
352	
353	
354	
355	351
356	
357	22
358	



- (b) Each machine code instruction is encoded as 16 bits (8-bit op code followed by an 8-bit operand).

Write the machine code for these instructions:

LDM #67

--	--	--	--	--	--	--	--

--	--	--	--	--	--	--	--

LDX #7

--	--	--	--	--	--	--	--

--	--	--	--	--	--	--	--

[3]

- (c) Computer scientists often write binary representations in hexadecimal.

- (i) Write the hexadecimal representation for the following instruction.

0	0	0	1	0	1	0	0
---	---	---	---	---	---	---	---

0	1	0	1	1	1	1	0
---	---	---	---	---	---	---	---

.....[2]

- (ii) A second instruction has been written in hexadecimal as:

16 4D

Write the assembly language for this instruction with the operand in denary.

.....[2]

6 Downloading a file from a website is an example of a client-server application.

(a) Describe what is meant by the term **client-server** for this application.

.....

.....

.....

.....[2]

(b) The following sequence of steps (1 to 5) describes what happens when someone uses their personal computer (PC) to request a web page. The web page consists of HTML tags and text content only. Four of the statements from **A**, **B**, **C**, **D**, **E** and **F** are used to complete the sequence.

<b>A</b>	Browser software interprets the script, renders the page and displays.
<b>B</b>	Browser software renders the page and displays.
<b>C</b>	Browser software compiles the script, renders the page and displays.
<b>D</b>	The web server retrieves the page.
<b>E</b>	The Domain Name Service (DNS) uses the domain name from the browser to look up the IP address of the web server.
<b>F</b>	The web server sends the web page content to the browser.

Write one of the letters A to F in the appropriate row to complete the sequence.

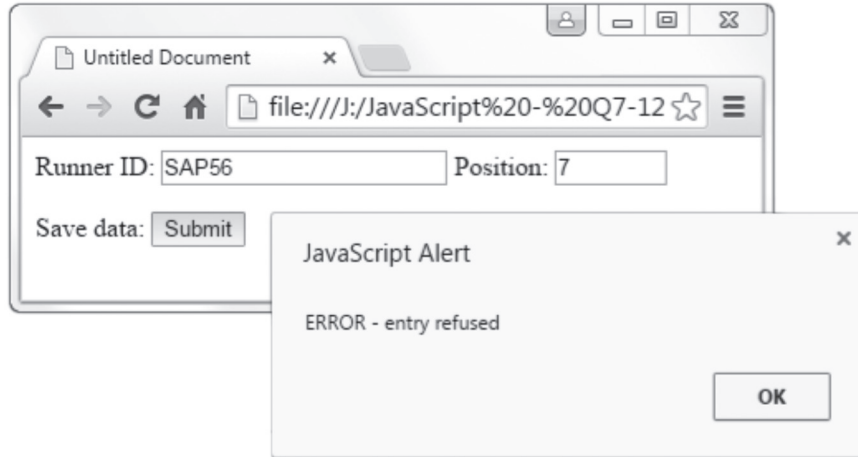
1. The user keys in the Uniform Resource Locator (URL) into the browser software.
2. ....
3. ....
4. ....
5. ....

[4]

**Question 6(c) begins on the next page.**

(c) The following web page used for data capture consists of:

- two text boxes for the entry of:
  - a race runner's ID code
  - their finishing position in a race.
- a button that the user clicks to submit this runner's result.



```

1  <html>
2  <head>
3  <title>Untitled Document</title>
4  <script language="JavaScript">
5
6  function myButton_onmousedown()
7  {
8  var Output1 = "Runner ID OK";
9  var Output2 = "ERROR - entry refused";
10
11 var Runner ID = document.forms["form1"]["txtRunnerID"].value;
12 //                               || in Javascript is the 'OR' operator
13 if (RunnerID.substr(0,3) == "VAR" || RunnerID.substr(0,3) == "CAM")
14 {
15     alert(Output1)
16 }
17 else
18 {
19     alert(Output2)
20 }
21 }
22 </script>
23
24 </head>
25 <body>
26 <form name = form1>
27   <label>Runner ID: </label>
28   <input type="text" name="txtRunnerID" >
29   <label>Position: </label>
30   <input type="text" name="txtPosition" size = "5" >
31   <p>
32     <label>Save data: </label>
33     <input type="button" name="btnSubmit" Value = "Submit"
34
35     onMouseDown = "myButton_onmousedown()" >
36   </p>
37 </form>
38
39 </body>
40 </html>

```

- (i) The developer has used three variables in the JavaScript code. State the identifiers used.

1. ....

2. ....

3. ....

[2]

- (ii) The button has an event whose identifier is `onMouseDown`. When the mouse button is clicked, some code is run.

State the line numbers which contain this code.

From line ..... to line .....

[1]

- (iii) The JavaScript code uses a selection statement.

State the line number which contains its condition.

Line number: .....

[1]

- (iv) Describe the purpose of the validation check that the code performs.

.....

.....[1]

- (v) Name and describe **two** other types of validation check which could be appropriate for this data capture form.

Validation check: .....

Description .....

.....

Validation check: .....

Description .....

.....

[4]





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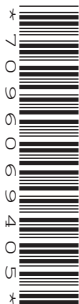
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**COMPUTER SCIENCE**

## Paper 1 Theory Fundamentals

9608/13

May/June 2017

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

## READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.

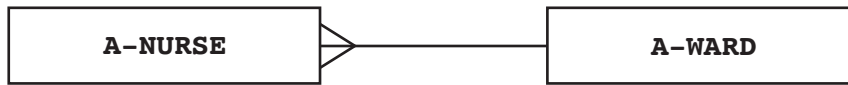
The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

This document consists of **15** printed pages and **1** blank page.

- 1 A hospital is divided into two areas, Area A and Area B. Each area has several wards. All the ward names are different.

A number of nurses are based in Area A. These nurses always work on the same ward. Each nurse has a unique Nurse ID of `STRING` data type.



- (a) Describe the relationship shown above.

.....  
 .....[1]

- (b) A relational database is created to store the ward and nurse data. The two table designs for Area A are:

A-WARD (WardName, NumberOfBeds)

A-NURSE (NurseID, FirstName, FamilyName, .....)

- (i) Complete the design for the A-NURSE table. [1]

- (ii) Explain how the relationship in **part (a)** is implemented.

.....  
 .....  
 .....  
 .....[2]

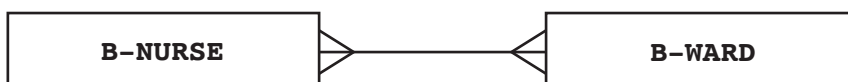
- (c) In Area B of the hospital, there are a number of wards and a number of nurses.

Each Area B ward has a specialism.

Each Area B nurse has a specialism.

A nurse can be asked to work in any of the Area B wards where their specialism matches with the ward specialism.

The relationship for Area B of the hospital is:



- (i) Explain what the degree of relationship is between the entities B-NURSE and B-WARD.

.....  
 .....[1]

- (ii) The design for the Area B data is as follows:

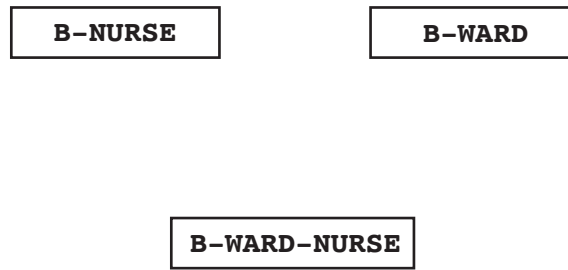
B-NURSE (NurseID, FirstName, FamilyName, Specialism)

B-WARD (WardName, NumberOfBeds, Specialism)

B-WARD-NURSE ( ..... )

Complete the attributes for the third table. Underline its primary key. [2]

- (iii) Draw the relationships on the entity-relationship (E-R) diagram.



[2]

- (d) Use the table designs in **part (c)(ii)**.

- (i) Write an SQL query to display the Nurse ID and family name for all Area B nurses with a specialism of 'THEATRE'.

.....  
 .....  
 ..... [3]

- (ii) Fatima Woo is an Area B nurse with the nurse ID of 076. She has recently married, and her new family name is Chi.

Write an SQL command to update her record.

UPDATE .....  
 SET .....  
 WHERE ..... [3]

- 2 (a) (i) The following sequence of steps (1 to 7) describe how a single page is printed on a laser printer.

The statements A, B, C and D are used to complete the sequence.

<b>A</b>	The paper passes through a fuser, which heats up the paper. The toner melts and forms a permanent image on the paper.
<b>B</b>	The electrical charge is removed from the drum and the excess toner is collected.
<b>C</b>	The image is converted on the drum into an electrostatic charge.
<b>D</b>	The oppositely-charged paper picks up the toner particles from the drum. After picking up the toner, the paper is discharged to stop it clinging to the drum.

Complete the sequence by writing one of the letters **A**, **B**, **C** or **D** on the appropriate row.

1. A laser beam and a rotating mirror are used to draw an image of the page on the photosensitive drum.
2. ....
3. Electrostatic charge attracts toner.
4. The charged paper is rolled against the drum.
5. ....
6. ....
7. .... [3]

- (ii) A computer user has a laser printer to print letters and documents. The user also prints digital photographs taken using a digital camera.

State the most suitable type of printer for printing the photographs.

.....[1]

- (b) The user is considering the purchase of a new laptop computer. She has read many product reviews and knows that there are different types of internal secondary storage available.

List **two** options for internal secondary storage.

Option 1 .....

Option 2 .....

Describe **one** advantage of one of the options.

Advantage of choosing option **1 / 2** (*circle*)

.....

.....[3]

**Question 3 begins on page 6.**

- 3 (a) A computer has a microphone and captures a voice recording using sound recording software.

Before making a recording, the user can select the sampling rate.

Define the term **sampling rate**. Explain how the sampling rate will influence the accuracy of the digitised sound.

Sampling rate .....

.....

.....

Explanation .....

.....

[2]

- (b) The computer also has bitmap software.

- (i) Define the terms **pixel** and **screen resolution**.

Pixel .....

.....

Screen resolution .....

.....

[2]

- (ii) A picture has been drawn and is saved as a monochrome bitmap image.

State how many pixels are stored in one byte.

.....[1]

- (iii) A second picture has width 2048 pixels and height 512 pixels. It is saved as a 256-colour image.

Calculate the file size in kilobytes.

Show your working.

.....

.....

.....

.....

.....

.....

[3]

- (iv) The actual bitmap file size will be larger than your calculated value.

State another data item that the bitmap file stores in addition to the pixel data.

.....  
.....[1]

- 4 The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC) and an Index Register (IX).

Instruction		Op code (binary)	Explanation
Op code (mnemonic)	Operand		
LDM #n		0000 0001	Immediate addressing. Load the denary number n to ACC.
LDD <address>		0000 0010	Direct addressing. Load the contents of the location at the given address to ACC.
LDI <address>		0000 0101	Indirect addressing. At the given address is the address to be used. Load the contents of this second address to ACC.
LDX <address>		0000 0110	Indexed addressing. Form the address from <address> + the contents of the Index Register (IX). Copy the contents of this calculated address to ACC.
LDR #n		0000 0111	Immediate addressing. Load number n to IX.
STO <address>		0000 1111	Store the contents of ACC at the given address.

The following diagram shows the contents of a section of main memory and the Index Register (IX).

- (a) Show the contents of the Accumulator (ACC) after each instruction is executed.

IX	0	0	0	0	0	0	1	1
----	---	---	---	---	---	---	---	---

		Address	Main Memory contents
(i) LDM #500			
ACC .....	[1]	495	13
(ii) LDD 500			
ACC .....	[1]	496	86
		497	92
(iii) LDX 500			
ACC .....	[1]	498	486
		499	489
		500	496
(iv) LDI 500			
ACC .....	[1]	501	497
		502	499
		503	502



- (b) Each machine code instruction is encoded as 16-bits (8-bit op code followed by an 8-bit operand).

Write the machine code for the following instructions:

LDM #17

--	--

LDX #97

--	--

[3]

- (c) Using an 8-bit operand, state the maximum number of memory locations, in denary, that can be directly addressed.

.....[1]

- (d) Computer scientists often write binary representations in hexadecimal.

- (i) Write the hexadecimal representation for this instruction:

0	0	0	0	0	1	1	1	1	1	0	0	0	0	1	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

.....[2]

- (ii) A second instruction has been written in hexadecimal as:

05 3F

Write the equivalent assembly language instruction, with the operand in denary.

.....[2]

- 5 A computer receives data from a remote data logger. Each data block is a group of 8 bytes. A block is made up of seven data bytes and a parity byte.

Each data byte has a parity bit using odd parity. The parity byte also uses odd parity.

The following table shows a data block before transmission. Bit position 0 is the parity bit.

Bit position							
7	6	5	4	3	2	1	0
1	1	0	0	1	1	0	1
0	0	1	0	0	0	0	0
1	0	0	1	1	1	0	<b>A</b>
1	1	0	0	0	0	1	0
1	1	0	0	0	0	1	0
1	1	0	0	0	1	1	<b>B</b>
0	0	0	0	0	0	0	0

Data bytes

0	1	1	0	1	1	0	0
---	---	---	---	---	---	---	---

Parity byte

- (a) (i) Describe how the data logger calculates the parity bit for each of the bytes in the data block.

.....  
 .....  
 .....[2]

- (ii) State the two missing parity bits labelled **A** and **B**.

**A** = .....

**B** = .....

[1]

- (iii) Describe how the computer uses the parity byte to perform a further check on the received data bytes.

.....  
 .....  
 .....[2]

- (b) (i) A second data block is received as shown in the following table. There are errors in this data block.

Identify and then circle **two** bits in the table which must be changed to remove the errors.

Bit position							
7	6	5	4	3	2	1	0
1	0	0	0	1	1	0	0
0	0	1	0	0	0	0	0
0	0	1	1	0	1	0	1
1	1	1	1	0	0	0	1
1	1	0	0	0	0	1	0
0	0	1	0	0	1	0	0
0	0	0	0	0	0	0	1

0	1	0	1	1	0	0	0
---	---	---	---	---	---	---	---

[2]

- (ii) Explain how you arrived at your answers for **part (b)(i)**.

.....

.....

.....

.....[3]

- 6 (a) The operating system (OS) contains code for performing various management tasks.

The appropriate code is run when the user performs various actions.

Draw a line to link each OS management task to the appropriate user action.

OS management task	Action
Main memory management	The user moves the mouse on the desktop
Input/Output management	The user closes the spreadsheet program
Secondary storage management	The user selects the Save command to save their spreadsheet file
Human computer interface management	The user selects the Print command to output their spreadsheet document

[3]

- (b) A user has the following issues with the use of his PC.

State the utility software which should provide a solution.

- (i) The hard disk stores a large number of video files. The computer frequently runs out of storage space.

Utility software solution .....[1]

- (ii) The user is unable to find an important document. He thinks it was deleted in error some weeks ago. This must not happen again.

Utility software solution .....[1]

- (iii) The operating system reports 'Bad sector' errors.

Utility software solution .....[1]

- (iv) There have been some unexplained images and advertisements appearing on the screen. The user suspects it is malware.

Utility software solution .....[1]

7 The design of a web-based application can require the use of client-side scripting.

(a) Describe what is meant by **client-side scripting**.

.....

.....

.....

.....[2]

(b) A user requests a web page by keying the Uniform Resource Locator (URL) into the address bar of their web browser.

The requested page contains a client-side script.

Describe the sequence of steps leading to the display of the web page on the computer screen.

.....

.....

.....

.....

.....

.....

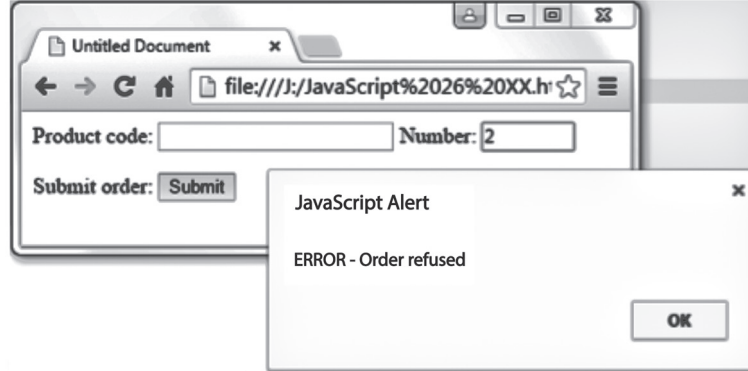
.....

.....

.....[4]

(c) A web page used for data capture consists of:

- two text boxes for the entry of:
  - a product code
  - the number of items to be purchased.
- a button which is clicked when the user wants to submit this order.



Study the following web page.

```

1  <html>
2  <head>
3  <title>Untitled Document</title>
4  <script language="JavaScript">
5
6  function myButton_onmousedown()
7  {
8  var Message1 = "ERROR - Order refused";
9  var Message2 = "Product code OK";
10 var x = document.forms["form1"]["txtProductCode"].value;
11   if (x == "")
12   {
13       alert(Message1)
14   }
15   else
16   {
17       alert(Message2)
18   }
19 }
20 </script>
21
22 </head>
23 <body>
24 <form name = form1>
25   <label>Product code: </label>
26   <input type="text" name="txtProductCode" >
27   <label>Number: </label>
28   <input type="text" name="txtNumber" size = "5" >
29   <p>
30     <label>Submit order: </label>
31     <input type="button" name="btnSubmit" Value = "Submit"
32
33     onMouseDown = "myButton_onmousedown()" >
34   </p>
35 </form>
36
37 </body>
38 </html>

```

- (i) The developer has used three variables in the JavaScript code. State the identifiers used.

1 .....

2 .....

3 ..... [2]

- (ii) The button has an event whose identifier is `onMouseDown`. When the submit button is clicked, some code is executed.

State the line numbers that contain this code.

From line ..... to line ..... [1]

- (iii) The JavaScript code uses a selection statement.

State the line number that contains the condition.

Line number: ..... [1]

- (iv) Describe the purpose of the validation check that the code performs.

.....

.....[1]

- (v) Name and describe **two** other types of validation check that could be appropriate for this data capture form.

Validation check: .....

Description .....

.....

Validation check: .....

Description .....

.....

[4]

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**COMPUTER SCIENCE**

9608/11

## Paper 1 Theory Fundamentals

October/November 2017

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

## READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

This document consists of **16** printed pages.

- 1 (a) Each of the following bytes represents an integer in two's complement form.

State the denary value.

(i) 0111 0111 Denary ..... [1]

(ii) 1000 1000 Denary ..... [1]

- (iii) Express the following integer in two's complement form.

-17

--	--	--	--	--	--	--	--

[1]

- (iv) State in denary, the range of integer values that it is possible to represent in two's complement integers using a single byte.

Lowest value .....

Highest value ..... [1]

- (b) (i) Convert the following denary integer into Binary Coded Decimal (BCD).

653

.....[1]

- (ii) A 3-digit BCD representation has been incorrectly copied. It is shown as:

0	1	0	0	1	1	1	0	0	0	1	0
---	---	---	---	---	---	---	---	---	---	---	---

State how you can recognise that this is not a valid BCD representation.

.....  
 .....[1]

- (iii) Describe a practical application where BCD is used.

.....  
 .....[1]

- 2 (a) The diagram shows three items of software that translate program code.

Draw **one** line from each context to the correct item of translation software.

**Context**

**Item of translation software**

A web page contains a client-side script.

Assembler

Each instruction in the source code consists of an op code and an operand.

Interpreter

The source code is required at run-time.

Compiler

When the source code is translated, copies of the executable program can be distributed without the need for the source code.

[4]

- (b) The Java programming language is said to be machine or platform independent.

- (i) Describe what is meant by **machine independent**.

.....  
 .....[1]

- (ii) Describe how a Java source code program is translated.

.....  
 .....  
 .....  
 .....[2]

- 3 A Local Area Network is used by staff in a hospital to access data stored in a Database Management System (DBMS).

(a) Name **two** security measures to protect computer systems.

1 .....

2 ..... [2]

(b) A frequent task for staff is to key in new patient data from a paper document. The document includes the patient's personal ID number.

(i) The Patient ID is a seven digit number. The database designer decides to use a check digit to verify each foreign key value that a user keys in for a Patient ID.

When a user assigns a primary key value to a Patient ID, the DBMS adds a modulus-11 check digit as an eighth digit. The DBMS uses the weightings 6, 5, 4, 3, 2 and 1 for calculating the check digit. It uses 6 as the multiplier for the most significant (leftmost) digit.

Show the calculation of the check digit for the Patient ID with the first six digits 786531.

Complete Patient ID ..... [4]

(ii) Name and describe **two** validation checks that the DBMS could carry out on each primary key value that a user keys in for a Patient ID.

1 Validation check .....

Description .....

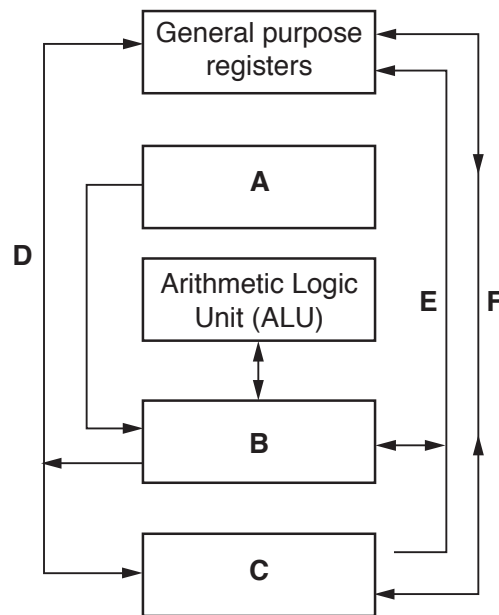
.....

2 Validation check .....

Description .....

..... [4]

- 4 (a) The diagram shows the components and buses found inside a typical Personal Computer (PC).



Some components and buses only have labels **A** to **F** to identify them.

For each label, choose the appropriate title from the following list. The title for label **D** is already given.

- Control bus
- System clock
- Data bus
- Control unit
- Main memory
- Secondary storage

**A** .....

**B** .....

**C** .....

**D** Address bus

**E** .....

**F** .....

[5]

- (b) The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Op code (binary)	Explanation
Op code (mnemonic)	Operand		
LDM	#n	1100 0001	Immediate addressing. Load number $n$ to ACC.
LDD	<address>	1100 0010	Direct addressing. Load the contents of the given address to ACC.
LDV	#n	1100 0011	Relative addressing. Move to the address $n$ locations from the address of the current instruction. Load the contents of this address to ACC.
STO	<address>	1100 0100	Store the contents of ACC at the given address.
DEC		1100 0101	Decrement the contents of ACC.
OUTCH		1100 0111	Output the character corresponding to the ASCII character code in ACC.
JNE	<address>	1110 0110	Following a compare instruction, jump to <address> if the compare was False.
JMP	<address>	1110 0011	(Unconditionally) jump to the given address.
CMP	#n	1110 0100	Compare the contents of ACC with number $n$ .

Complete the trace table for the following assembly language program.

Label	Instruction
StartProg:	LDV #CountDown
	CMP Num1
	JNE CarryOn
	JMP Finish
CarryOn:	OUTCH
	LDD CountDown
	DEC
	STO CountDown
	JMP StartProg
Finish:	LDM #88
	OUTCH
	END
CountDown:	15
	32
	51
	67
Num1:	32

ASCII code table (selected codes only)				
<Space>	3	B	C	X
32	51	66	67	88

Trace table:

ACC	CountDown	OUTPUT
	15	
67		C
15		

[5]

(c) The program given in **part (b)** is to be translated using a two-pass assembler.

The program has been copied here for you. The program now starts with a directive which tells the assembler to load the first instruction of the program to address 100.

**Label**

	ORG	#0100
StartProg:	LDV	#CountDown
	CMP	Num1
	JNE	CarryOn
	JMP	Finish
CarryOn:	OUTCH	
	LDD	CountDown
	DEC	
	STO	CountDown
	JMP	StartProg
Finish:	LDM	#88
	OUTCH	
	END	
CountDown:		15
		32
		51
		67
Num1:		32



On the first pass of the two-pass process, the assembler adds entries to a symbol table.

The following symbol table shows the first eleven entries, part way through the first pass.

The circular labels show the order in which the assembler made the entries to the symbol table.

**Symbol table**

Symbolic address		Absolute address	
StartProg	(1)	100	(2)
CountDown	(3)	UNKNOWN	(4)
Num1	(5)	UNKNOWN	(6)
CarryOn	(7)	UNKNOWN	(8) 104 (11)
Finish	(9)	UNKNOWN	(10)

Explain how the assembler made these entries to the symbol table.

.....

.....

.....

.....

.....

.....[3]

(d) The assembler software must then complete the second pass building up the executable file.

(i) Name the second table needed when the assembler software carries out the second pass.

.....[1]

The following shows two of the program instructions in machine code.

Instruction	Machine code	
	Binary	Hexadecimal
OUTCH	1100 0111	C7
JNE CarryOn	<b>A</b>	<b>B</b>

Each of the numbers **A** and **B** represents the complete instruction in two bytes, one byte for the op code and one byte for the operand.

(ii) Use the following instruction set to write the numbers for **A** and **B**.

**A** (binary) .....

**B** (hexadecimal) .....

[3]

Instruction		Op code (binary)	Explanation
Op code (mnemonic)	Operand		
LDM	#n	1100 0001	Immediate addressing. Load number <i>n</i> to ACC.
LDD	<address>	1100 0010	Direct addressing. Load the contents of the given address to ACC.
LDV	#n	1100 0011	Relative addressing. Move to the address <i>n</i> locations from the address of the current instruction. Load the contents of this address to ACC.
STO	<address>	1100 0100	Store the contents of ACC at the given address.
DEC		1100 0101	Decrement the contents of ACC.
OUTCH		1100 0111	Output the character corresponding to the ASCII character code in ACC.
JNE	<address>	1110 0110	Following a compare instruction, jump to <address> if the compare was False.
JMP	<address>	1110 0011	(Unconditionally) jump to the given address.
CMP	#n	1110 0100	Compare the contents of ACC with number <i>n</i> .

5 A Personal Computer (PC) has a number of input and output devices.

(a) (i) Name **three** components of a speaker.

- 1 .....
- 2 .....
- 3 ..... [3]

(ii) Explain the basic internal operation of a speaker.

- .....
- .....
- .....
- .....
- .....
- .....
- ..... [4]

(b) (i) The user is considering the purchase of a removable device for secondary storage.

Name **one** suitable device.

- ..... [1]

(ii) Describe **two** possible uses for this device on a home Personal Computer (PC).

- 1 .....
  - 2 .....
- ..... [2]

- 6 Raj has joined a software company as a trainee programmer. He was given the company's Code of Conduct document during his induction training. The handbook has a section headed 'Ethical Behaviour'.

(a) Describe what is meant by **ethics**.

.....

.....

.....[2]

(b) Raj is assigned to work as a new member of a development team.

In his first week, Raj feels uncomfortable working with one of his colleagues. He is unfamiliar with the programming language used by the team. Next week, he will be working on the site of one of the company's clients with a colleague. Raj is very nervous about working in an unfamiliar workplace.

Raj has a review with his manager after his first three weeks.

The Code of Conduct document was produced by the Human Resources section. It closely follows the ACM/IEEE Software Engineering Code of Ethics that uses these eight key principles:

Public	Client and Employer	Product	Judgement
Management	Profession	Colleagues	Self

There are issues Raj will want to raise with his manager.

- Describe **two** of these issues.
- Circle the key ACM/IEEE principle this comes under.
- Suggest what action should be taken to demonstrate ethical behaviour.

### Issue 1

Description .....

.....

.....

ACM/IEEE principle (Circle one only)

Public	Client and Employer	Product	Judgement
Management	Profession	Colleagues	Self

Possible action .....

.....

.....

**Issue 2**

Description .....

.....

.....

ACM/IEEE principle (Circle one only)

Public

Client and Employer

Product

Judgement

Management

Profession

Colleagues

Self

Possible action .....

.....

.....

[6]

**Question 7 begins on the next page.**

- 7 A clinic is staffed by several doctors. The clinic serves thousands of patients. Each day and at any one time, there is only one doctor in the clinic available for appointments.

The clinic stores patient, doctor and appointment data in a relational database.

- (a) (i) Underline the primary key for each table in the following suggested table designs.

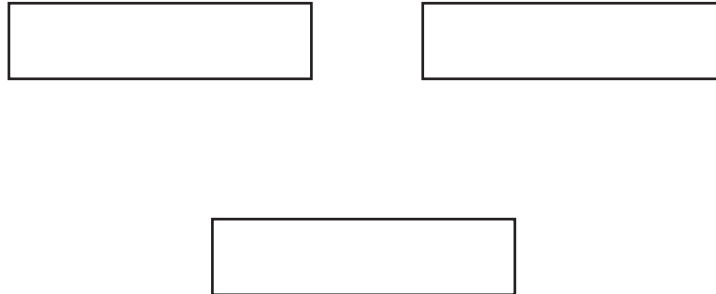
PATIENT(PatientID, PatientName, Address, Gender)

DOCTOR(DoctorID, Gender, Qualification)

APPOINTMENT(AppointmentDate, AppointmentTime, DoctorID, PatientID)

[2]

- (ii) Complete the following entity-relationship (E-R) diagram for this design.



[2]

- (b) The doctors are concerned that many patients make appointments but do not attend them.

Describe the changes to the table designs that could be made to store this information.

.....  
 .....[2]

- (c) The doctors are about to set up a new clinic in the neighbouring village, SITE-B.

The original location is identified as SITE-A.

A new table is designed to store the ID of the doctor who is able to work at each site.

DOCTOR-AVAILABILITY (DoctorID, Site)

Five entries stored in the table are:

DoctorID	Site
098	SITE-A
074	SITE-A
117	SITE-B
098	SITE-B
033	SITE-B

- (i) State what this data shows about the availability of the doctor with the ID of 098.

.....  
 .....[1]

- (ii) Opening a new clinic in the neighbouring village will not require any additional table for storing appointments. It will need a change to the existing appointment table design.

Show the revised APPOINTMENT table.

APPOINTMENT ( .....  
 ..... ) [1]

- (d) The doctor with the ID of 117 has recently been allocated a new DoctorID of 017.

- (i) Write an SQL script to update this doctor's record in the database.

UPDATE .....  
 SET .....  
 WHERE ..... [3]

- (ii) Describe why this update could cause problems with the existing data stored.

.....  
 .....  
 .....[2]

- (e) Write an SQL script to display the date and time of all appointments made by the patient with the `PatientID` of 556.

.....

.....

.....[3]

---

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**COMPUTER SCIENCE**

9608/12

## Paper 1 Theory Fundamentals

October/November 2017

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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Answer **all** questions.

No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

This document consists of **12** printed pages.

- 1 One of the tasks of the operating system (OS) is the management of the main memory of the computer system.

State and describe **three** other operating system management tasks.

1 .....

.....

.....

2 .....

.....

.....

3 .....

.....

.....

[6]

- 2 (a) The diagram shows three items of software that translate program code.

Draw **one** line from each context to the correct item of translation software.

Context	Item of translation software
The source code is written in a high-level language. An executable file is produced.	Assembler
The source code uses instructions from the processor's instruction set.	Interpreter
The source code and translation software must both be in main memory at execution time.	Compiler
A web page contains some JavaScript code.	

[4]

- (b) A programmer is developing software and has both a compiler and interpreter for the high-level language used.

Describe **two** benefits of using each form of translation software.

- (i) Benefits of a compiler

- 1 .....
- 2 .....

[2]

- (ii) Benefits of an interpreter

- 1 .....
- 2 .....

[2]

- 3 A Local Area Network is used by school staff who access data stored in a Database Management System (DBMS).

(a) (i) Explain the difference between security and privacy of data.

.....

.....

.....

.....

.....

.....[3]

(ii) Give an example for this application where privacy of data is a key concern.

.....

.....[1]

(b) Name and describe **two** security measures the Network Manager has in place to protect the security of the data held in the DBMS.

1 .....

.....

.....

.....

.....

2 .....

.....

.....

.....

.....[4]

(c) A task for staff at the start of the school year is to key in new pupil data from a paper document.

The data is entered to a screen form and includes the data verification of some fields.

Describe what is meant by **verification**.

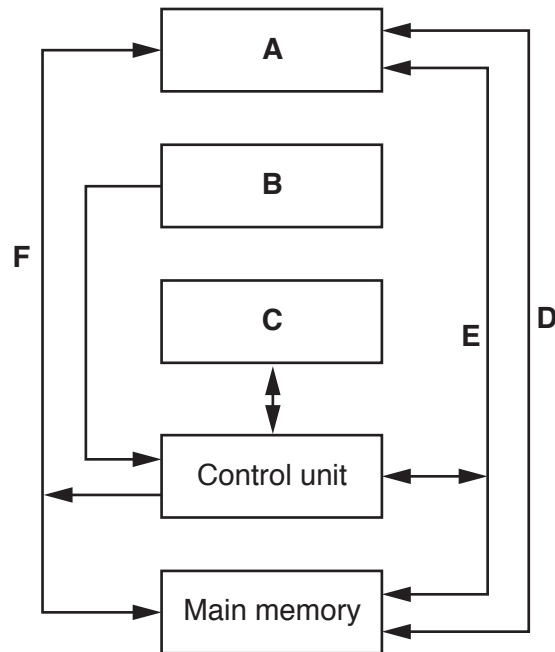
.....

.....

.....

.....[2]

- 4 The following diagram shows the components and buses found inside a typical personal computer (PC).



- (a) Some components and buses only have labels **A** to **F** to identify them.

For each label, choose the appropriate title from the following list. The title for label **D** is already given.

- Control bus
- Address bus
- Arithmetic Logic Unit (ALU)
- General purpose registers
- Secondary storage
- System clock

**A** .....

**B** .....

**C** .....

**D** Data bus

**E** .....

**F** .....

[5]

- (b) Clock speed is a factor that affects the performance of a PC. Explain this statement.

.....

.....

.....[2]

(c) An assembly language program can contain both **macros** and **directives**.

(i) Explain what is meant by these terms.

Macro .....

.....

.....

Directive .....

.....

.....

[3]

(ii) Give an example of the use of a directive.

.....

.....[1]

(d) The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Op code (mnemonic)	Operand	
LDD	<address>	Direct addressing. Load the contents of the given address to ACC.
LDV	#n	Relative addressing. Move to the address n locations from the address of the current instruction. Load the contents of this address to ACC.
STO	<address>	Store the contents of ACC at the given address.
INC		Increment the contents of ACC.
OUTCH		Output the character corresponding to the ASCII character code in ACC.
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True.
JMP	<address>	Jump to the given address.
CMP	#n	Compare the contents of ACC with number n.

Complete the trace table for the following assembly language program.

Label	Instruction
StartProg:	LDV #Offset
	CMP Value
	JPE EndProg
	OUTCH
	LDD Offset
	INC
	STO Offset
	JMP StartProg
EndProg:	END
Offset:	10
	50
	65
	89
	32
Value:	32

ASCII code table (selected codes only)				
<Space>	2	A	B	Y
32	50	65	66	89

Trace table:

ACC	Offset	OUTPUT
	10	
50		2
10		

[5]

- (e) The program given in **part (d)** is to be translated using a two-pass assembler. The program has been copied here for you.

Label	Instruction
StartProg:	LDV #Offset
	CMP Value
	JPE EndProg
	OUTCH
	LDD Offset
	INC
	STO Offset
	JMP StartProg
EndProg:	END
Offset:	10
	50
	65
	89
	32
Value:	32

On the first pass, the assembly process adds entries to a symbol table.

The following symbol table shows the first five entries, part way through the first pass.

The circular labels show the order in which the assembler made the entries to the symbol table.

Complete the symbol table. Use circular labels to show the order in which the assembler makes the entries.

**Symbol table**

Symbolic address	Relative address
StartProg (1)	0 (2)
Offset (3)	UNKNOWN (4)
Value (5)	

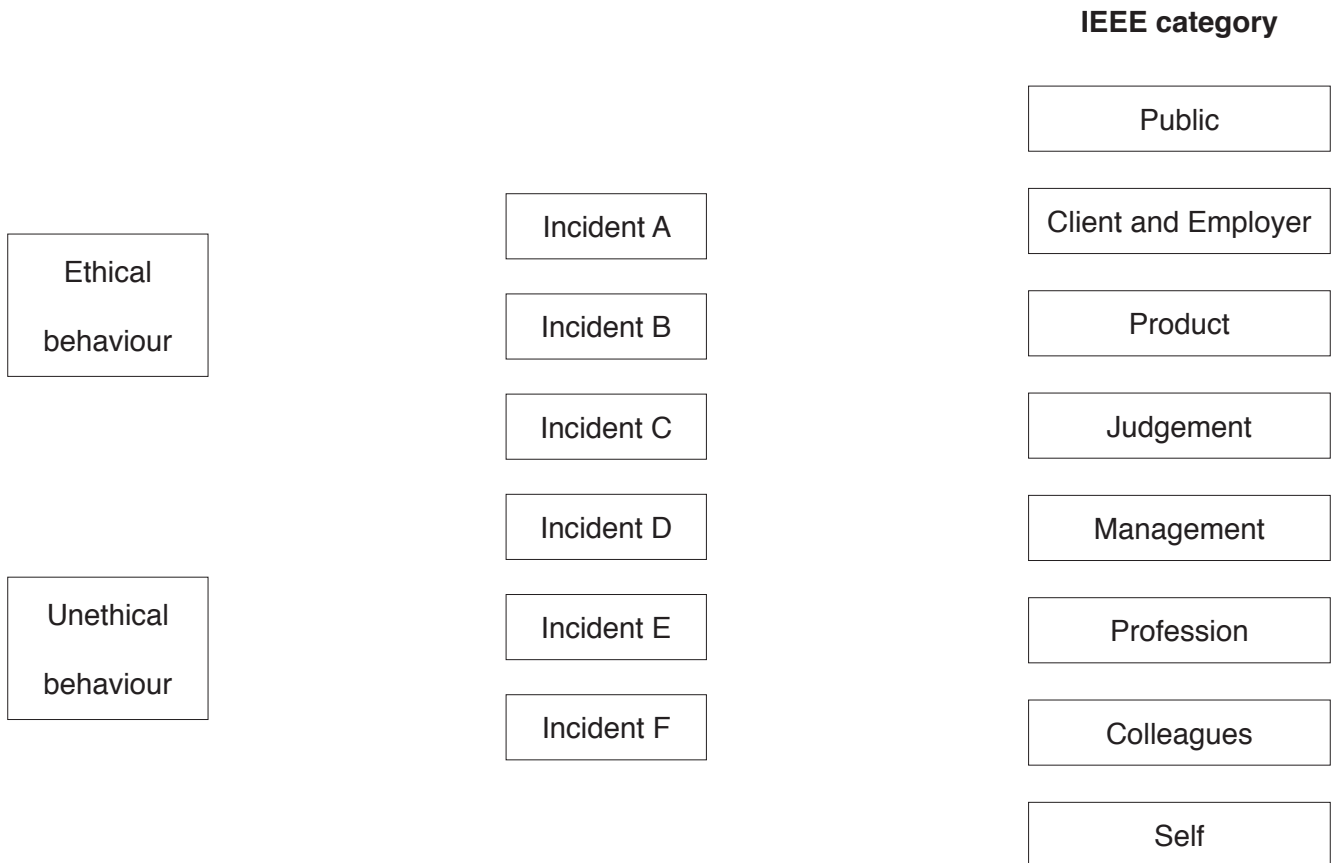
[6]



- 5 The IEEE Software Engineering Code of Ethics uses eight key principles shown in the right-hand column of the following diagram.

Tom is employed as a tester with a software company. He is keen to become a trainee programmer.

The middle column in the diagram labels six incidents which have happened to Tom this week. The table that follows the diagram describes each incident.



Incident	Description
A	Tom has received some phishing emails. He reported this to the bank they were supposed to have come from.
B	Tom has asked his manager if they will pay for him to attend a programming course.
C	Tom is testing beta versions of new games software at work. He copies the software on to CD-Rs and sells them to his friends.
D	Tom has completed the application forms to join the Chartered Institute for IT.
E	Tom finds it difficult to work with one of his colleagues. His way of dealing with this has been to refuse to speak with the colleague.
F	Tom's manager had considered the testing of a new game was completed. Tom reported to his manager that he thought there were still bugs which needed to be rectified.

- (a) Draw a line on the diagram to link each of the six incidents to either ethical behaviour or unethical behaviour. [2]

- (b) Consider each incident you have identified as **ethical behaviour**.

Draw a line from each incident to indicate the IEEE category it maps to.

[4]

- 6 (a)** A personal computer (PC) is extensively used for a wide range of applications, including the three shown in the following table.

Write in the table, a suitable input device, output device, or both needed for each application.

Do not give a monitor, keyboard or mouse in your answers.

Application	Input device	Output device
Capture the text from a paper document, in order that the text can be word processed		
Producing a replica of a small plastic component from a washing machine		
A museum has interactive information facilities throughout the building		

[3]

- (b)** Explain the basic internal operation of a hard disk drive.

[4]

**7** A company takes customer service for its clients very seriously.

The client

- The client names are unique.

A visit

- The company arranges a date for a visit to gather feedback from a client.
- A visit to a client never takes more than one day.
- Over time, the client receives many visits.

Staff (Interviewers)

- One or more staff attend the visit.
- If there is more than one staff member visiting, each performs a separate interview.

Interviews

- Each interview is classified as either 'general' or by some specialism, for example, marketing, customer service or sales.
- A report is produced for each interview, InterviewText.
- Each interview is conducted by a single staff member.

The client, visit, staff and interview data will be stored in a relational database.

**(a) (i)** Underline the primary key for each table in the following suggested table designs.

STAFF(StaffID, StaffName, Department)

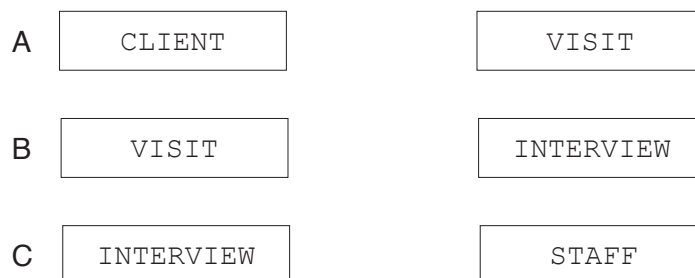
CLIENT(ClientName, Address, Town)

VISIT(ClientName, VisitDate)

INTERVIEW(ClientName, VisitDate, StaffID, SpecialistFocus, InterviewText)

[3]

**(ii)** For each of the pairs of entities, A, B and C, draw the relationship between the two entities.



[3]

- (b) The company decides to produce a visit report, `VisitReportText`, for each visit made.

This text will be produced from the one or more interview texts obtained at the visit.

State how one or more of the given table designs can be changed to add this attribute.

.....  
 .....[1]

- (c) Client ABC Holdings are now trading under the name of Albright Holdings.

- (i) Write an SQL script to update this client's record in the database.

UPDATE .....  
 SET .....  
 WHERE .....  
 .....[3]

- (ii) Describe why this update could cause problems with the existing data stored.

.....  
 .....  
 .....[2]

- (d) Write an SQL script to display the Staff ID of each member of staff who performed an interview when they visited New Age Toys on 13/10/2016.

.....  
 .....  
 .....[3]

- (e) At present, all interviews are performed in the UK. Many clients now operate in other countries in Europe. The company wants to perform interviews with the client's staff in other countries. Not all interview staff are willing to travel outside of the UK.

State how one or more of the table designs should be revised to store this information.

.....  
 .....[1]

---

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## COMPUTER SCIENCE

**9608/13**

## Paper 1 Theory Fundamentals

October/November 2017

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

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Answer **all** questions.

No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

This document consists of **16** printed pages.

- 1 (a) Each of the following bytes represents an integer in two's complement form.

State the denary value.

(i) 0111 0111 Denary ..... [1]

(ii) 1000 1000 Denary ..... [1]

- (iii) Express the following integer in two's complement form.

-17

--	--	--	--	--	--	--	--

[1]

- (iv) State in denary, the range of integer values that it is possible to represent in two's complement integers using a single byte.

Lowest value .....

Highest value ..... [1]

- (b) (i) Convert the following denary integer into Binary Coded Decimal (BCD).

653

.....[1]

- (ii) A 3-digit BCD representation has been incorrectly copied. It is shown as:

0	1	0	0	1	1	1	0	0	0	1	0
---	---	---	---	---	---	---	---	---	---	---	---

State how you can recognise that this is not a valid BCD representation.

.....  
 .....[1]

- (iii) Describe a practical application where BCD is used.

.....  
 .....[1]

- 2 (a) The diagram shows three items of software that translate program code.

Draw **one** line from each context to the correct item of translation software.

**Context**

**Item of translation software**

A web page contains a client-side script.

Assembler

Each instruction in the source code consists of an op code and an operand.

Interpreter

The source code is required at run-time.

Compiler

When the source code is translated, copies of the executable program can be distributed without the need for the source code.

[4]

- (b) The Java programming language is said to be machine or platform independent.

- (i) Describe what is meant by **machine independent**.

.....  
 .....[1]

- (ii) Describe how a Java source code program is translated.

.....  
 .....  
 .....  
 .....[2]

- 3 A Local Area Network is used by staff in a hospital to access data stored in a Database Management System (DBMS).

(a) Name **two** security measures to protect computer systems.

1 .....

2 ..... [2]

(b) A frequent task for staff is to key in new patient data from a paper document. The document includes the patient's personal ID number.

(i) The Patient ID is a seven digit number. The database designer decides to use a check digit to verify each foreign key value that a user keys in for a Patient ID.

When a user assigns a primary key value to a Patient ID, the DBMS adds a modulus-11 check digit as an eighth digit. The DBMS uses the weightings 6, 5, 4, 3, 2 and 1 for calculating the check digit. It uses 6 as the multiplier for the most significant (leftmost) digit.

Show the calculation of the check digit for the Patient ID with the first six digits 786531.

Complete Patient ID ..... [4]

(ii) Name and describe **two** validation checks that the DBMS could carry out on each primary key value that a user keys in for a Patient ID.

1 Validation check .....

Description .....

.....

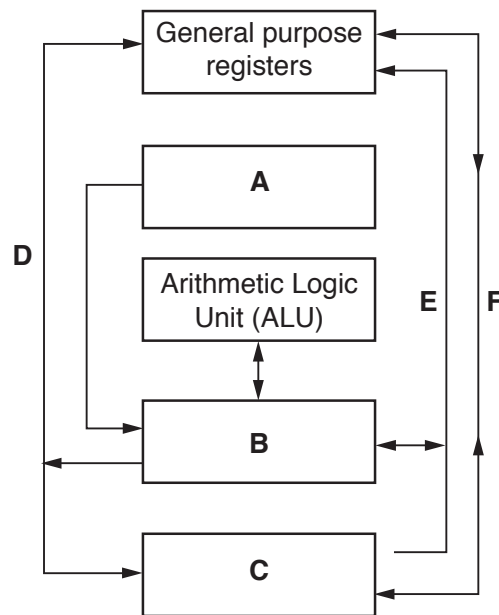
2 Validation check .....

Description .....

..... [4]



- 4 (a) The diagram shows the components and buses found inside a typical Personal Computer (PC).



Some components and buses only have labels **A** to **F** to identify them.

For each label, choose the appropriate title from the following list. The title for label **D** is already given.

- Control bus
- System clock
- Data bus
- Control unit
- Main memory
- Secondary storage

**A** .....

**B** .....

**C** .....

**D** Address bus

**E** .....

**F** .....

[5]

- (b) The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Op code (binary)	Explanation
Op code (mnemonic)	Operand		
LDM	#n	1100 0001	Immediate addressing. Load number $n$ to ACC.
LDD	<address>	1100 0010	Direct addressing. Load the contents of the given address to ACC.
LDV	#n	1100 0011	Relative addressing. Move to the address $n$ locations from the address of the current instruction. Load the contents of this address to ACC.
STO	<address>	1100 0100	Store the contents of ACC at the given address.
DEC		1100 0101	Decrement the contents of ACC.
OUTCH		1100 0111	Output the character corresponding to the ASCII character code in ACC.
JNE	<address>	1110 0110	Following a compare instruction, jump to <address> if the compare was False.
JMP	<address>	1110 0011	(Unconditionally) jump to the given address.
CMP	#n	1110 0100	Compare the contents of ACC with number $n$ .

Complete the trace table for the following assembly language program.

Label	Instruction
StartProg:	LDV #CountDown
	CMP Num1
	JNE CarryOn
	JMP Finish
CarryOn:	OUTCH
	LDD CountDown
	DEC
	STO CountDown
	JMP StartProg
Finish:	LDM #88
	OUTCH
	END
CountDown:	15
	32
	51
	67
Num1:	32

ASCII code table (selected codes only)				
<Space>	3	B	C	X
32	51	66	67	88

Trace table:

ACC	CountDown	OUTPUT
	15	
67		C
15		

[5]

(c) The program given in **part (b)** is to be translated using a two-pass assembler.

The program has been copied here for you. The program now starts with a directive which tells the assembler to load the first instruction of the program to address 100.

**Label**

	ORG	#0100
StartProg:	LDV	#CountDown
	CMP	Num1
	JNE	CarryOn
	JMP	Finish
CarryOn:	OUTCH	
	LDD	CountDown
	DEC	
	STO	CountDown
	JMP	StartProg
Finish:	LDM	#88
	OUTCH	
	END	
CountDown:		15
		32
		51
		67
Num1:		32

On the first pass of the two-pass process, the assembler adds entries to a symbol table.

The following symbol table shows the first eleven entries, part way through the first pass.

The circular labels show the order in which the assembler made the entries to the symbol table.

**Symbol table**

Symbolic address		Absolute address	
StartProg	(1)	100	(2)
CountDown	(3)	UNKNOWN	(4)
Num1	(5)	UNKNOWN	(6)
CarryOn	(7)	UNKNOWN	(8) 104 (11)
Finish	(9)	UNKNOWN	(10)

Explain how the assembler made these entries to the symbol table.

.....

.....

.....

.....

.....

.....[3]

(d) The assembler software must then complete the second pass building up the executable file.

(i) Name the second table needed when the assembler software carries out the second pass.

.....[1]

The following shows two of the program instructions in machine code.

Instruction	Machine code	
	Binary	Hexadecimal
OUTCH	1100 0111	C7
JNE CarryOn	<b>A</b>	<b>B</b>

Each of the numbers **A** and **B** represents the complete instruction in two bytes, one byte for the op code and one byte for the operand.

(ii) Use the following instruction set to write the numbers for **A** and **B**.

**A** (binary) .....

**B** (hexadecimal) .....

[3]

Instruction		Op code (binary)	Explanation
Op code (mnemonic)	Operand		
LDM	#n	1100 0001	Immediate addressing. Load number <i>n</i> to ACC.
LDD	<address>	1100 0010	Direct addressing. Load the contents of the given address to ACC.
LDV	#n	1100 0011	Relative addressing. Move to the address <i>n</i> locations from the address of the current instruction. Load the contents of this address to ACC.
STO	<address>	1100 0100	Store the contents of ACC at the given address.
DEC		1100 0101	Decrement the contents of ACC.
OUTCH		1100 0111	Output the character corresponding to the ASCII character code in ACC.
JNE	<address>	1110 0110	Following a compare instruction, jump to <address> if the compare was False.
JMP	<address>	1110 0011	(Unconditionally) jump to the given address.
CMP	#n	1110 0100	Compare the contents of ACC with number <i>n</i> .

5 A Personal Computer (PC) has a number of input and output devices.

(a) (i) Name **three** components of a speaker.

- 1 .....
- 2 .....
- 3 ..... [3]

(ii) Explain the basic internal operation of a speaker.

- .....
- .....
- .....
- .....
- .....
- .....
- ..... [4]

(b) (i) The user is considering the purchase of a removable device for secondary storage.

Name **one** suitable device.

- ..... [1]

(ii) Describe **two** possible uses for this device on a home Personal Computer (PC).

- 1 .....
- .....
- 2 .....
- ..... [2]

- 6 Raj has joined a software company as a trainee programmer. He was given the company's Code of Conduct document during his induction training. The handbook has a section headed 'Ethical Behaviour'.

(a) Describe what is meant by **ethics**.

.....

.....

.....[2]

(b) Raj is assigned to work as a new member of a development team.

In his first week, Raj feels uncomfortable working with one of his colleagues. He is unfamiliar with the programming language used by the team. Next week, he will be working on the site of one of the company's clients with a colleague. Raj is very nervous about working in an unfamiliar workplace.

Raj has a review with his manager after his first three weeks.

The Code of Conduct document was produced by the Human Resources section. It closely follows the ACM/IEEE Software Engineering Code of Ethics that uses these eight key principles:

Public	Client and Employer	Product	Judgement
Management	Profession	Colleagues	Self

There are issues Raj will want to raise with his manager.

- Describe **two** of these issues.
- Circle the key ACM/IEEE principle this comes under.
- Suggest what action should be taken to demonstrate ethical behaviour.

### Issue 1

Description .....

.....

.....

ACM/IEEE principle (Circle one only)

Public	Client and Employer	Product	Judgement
Management	Profession	Colleagues	Self

Possible action .....

.....

.....



**Issue 2**

Description .....

.....

.....

ACM/IEEE principle (Circle one only)

Public

Client and Employer

Product

Judgement

Management

Profession

Colleagues

Self

Possible action .....

.....

.....

[6]

**Question 7 begins on the next page.**

- 7 A clinic is staffed by several doctors. The clinic serves thousands of patients. Each day and at any one time, there is only one doctor in the clinic available for appointments.

The clinic stores patient, doctor and appointment data in a relational database.

- (a) (i) Underline the primary key for each table in the following suggested table designs.

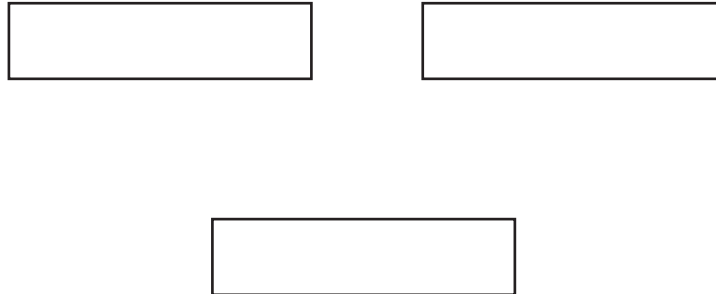
PATIENT(PatientID, PatientName, Address, Gender)

DOCTOR(DoctorID, Gender, Qualification)

APPOINTMENT(AppointmentDate, AppointmentTime, DoctorID, PatientID)

[2]

- (ii) Complete the following entity-relationship (E-R) diagram for this design.



[2]

- (b) The doctors are concerned that many patients make appointments but do not attend them.

Describe the changes to the table designs that could be made to store this information.

.....  
 .....[2]

- (c) The doctors are about to set up a new clinic in the neighbouring village, SITE-B.

The original location is identified as SITE-A.

A new table is designed to store the ID of the doctor who is able to work at each site.

DOCTOR-AVAILABILITY (DoctorID, Site)

Five entries stored in the table are:

DoctorID	Site
098	SITE-A
074	SITE-A
117	SITE-B
098	SITE-B
033	SITE-B

- (i) State what this data shows about the availability of the doctor with the ID of 098.

.....  
 .....[1]

- (ii) Opening a new clinic in the neighbouring village will not require any additional table for storing appointments. It will need a change to the existing appointment table design.

Show the revised APPOINTMENT table.

APPOINTMENT ( .....  
 ..... ) [1]

- (d) The doctor with the ID of 117 has recently been allocated a new DoctorID of 017.

- (i) Write an SQL script to update this doctor's record in the database.

UPDATE .....  
 SET .....  
 WHERE ..... [3]

- (ii) Describe why this update could cause problems with the existing data stored.

.....  
 .....  
 .....[2]

- (e) Write an SQL script to display the date and time of all appointments made by the patient with the `PatientID` of 556.

.....

.....

.....[3]

---

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NAME

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CENTRE  
NUMBER

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CANDIDATE  
NUMBER

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**COMPUTER SCIENCE**

9608/11

## Paper 1 Theory Fundamentals

May/June 2018

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

## READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

This document consists of **15** printed pages and **1** blank page.

**Question 1 begins on the next page.**

- 1 Four communication media and five features are shown.

Draw one or more lines from each communication media to the appropriate feature(s).

**Communication media**

**Feature**

Fibre-optic cable	Can be twisted pair or co-axial
Radio waves	Transmits light pulses
Copper cable	Large range of wavelengths
Satellite	Least likely to have interference
	Wireless transmission

[6]

2 A logo is designed as a bitmap image.

(a) Describe what is meant by a **bitmap image**.

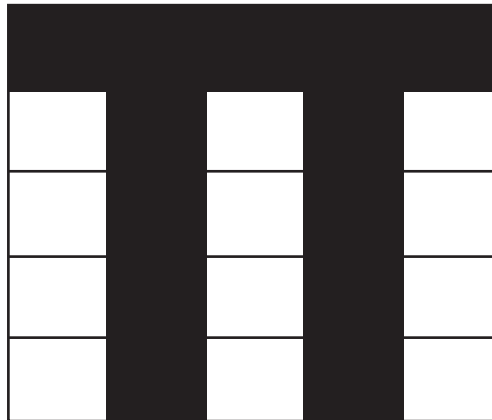
.....

.....

.....

.....[2]

(b) A black and white bitmap image is shown.



(i) Explain how a computer can store this bitmap image.

.....

.....

.....

.....[2]

(ii) The image is compressed before it is attached to an email.

Explain how run-length encoding (RLE) will compress the image.

.....

.....

.....

.....[2]



- (c) The finished logo is 500 pixels by 1000 pixels and uses 35 different colours.

Estimate the file size for the logo. Give your answer in kilobytes. Show your working.

Working .....

.....

.....

.....

.....

Answer .....

[4]

- (d) The logo is redesigned as a vector graphic.

State **two** benefits of a vector graphic compared to a bitmap image. Give a reason for each benefit.

Benefit 1 .....

.....

Reason 1 .....

.....

Benefit 2 .....

.....

Reason 2 .....

.....

[4]

3 An operating system (OS) is usually pre-installed on a new computer.

(a) The OS performs a number of different tasks such as memory management and security management.

(i) State **three** memory management tasks the OS performs.

- 1 .....
- .....
- 2 .....
- .....
- 3 .....
- .....

[3]

(ii) State **three** security management tasks the OS performs.

- 1 .....
- .....
- 2 .....
- .....
- 3 .....
- .....

[3]

(iii) State **two** tasks, other than memory management and security management that are carried out by an OS.

- 1 .....
- .....
- 2 .....
- .....

[2]

- (b) Utility software is usually pre-installed on a new computer.

The following table lists four programs. Put **one** tick (✓) in each row to indicate whether or not the program is utility software.

Program	True	False
Disk Defragmenter		
Word Processor		
Library Program		
Compression Software		

[4]

- 4 (a) An alarm system (X) is enabled and disabled using either a switch (A) or a remote control (B). There are **two** infra-red sensors (C, D) and **one** door pressure sensor (E).

Parameter	Description of parameter	Binary value	Condition
A	Switch	1	Switch enabled
		0	Switch disabled
B	Remote control	1	Remote enabled
		0	Remote disabled
C	Infra-red sensor	1	Activated
		0	Not activated
D	Infra-red sensor	1	Activated
		0	Not activated
E	Door pressure sensor	1	Activated
		0	Not activated

The alarm sounds ( $X = 1$ ) if the alarm is enabled **and** any one or more of the sensors is activated.

Draw a logic circuit to represent the alarm system.



[3]

(b) Complete the truth table for the logic expression:  $X = A \text{ OR } (B \text{ XOR } C)$

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

5 A college has a client-server network.

**(a)** The college has a file server and other servers.

State the purpose of **two** other servers in the college network.

Server 1 .....

Server 2 .....

[2]

**(b)** The students use the network to access the Internet.

One student stated, ‘*The Internet and the World Wide Web are the same thing*’.

Tick (✓) **one** box to indicate whether this statement is true or false.

True	False

Justify your choice.

[5]

- (c) Students use the college's learning resource website. Several of the web pages include PHP script.

Describe the sequence of events when a student requests a web page with embedded server-side code.

.....

.....

.....

.....

.....

.....

.....

.....[4]

6 Parity bits can be used to verify data.

(a) The following binary number is transmitted using **even** parity.

Add the missing parity bit.

**Parity  
bit**

	1	0	1	1	0	1	0
--	---	---	---	---	---	---	---

[1]

(b) In the following parity block, the first column contains the parity bits, and the last row contains the parity byte. A device transmits the data using **even** parity.

(i) Circle the error in the data transmitted.

	<b>Parity bit</b>	<b>Data</b>						
	<b>1</b>	1	0	1	0	1	1	1
	<b>1</b>	0	0	0	1	1	1	0
	<b>0</b>	1	0	0	1	0	1	1
	<b>1</b>	1	1	0	1	1	1	1
<b>Parity byte</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>

[1]

(ii) Explain how you identified the error.

.....

.....

.....

.....

.....[2]

(c) The data received can contain errors that are not detected using parity bits.

Explain how this can happen.

.....

.....

.....

.....[2]



(d) Parity is not the only method to verify the data has been sent correctly.

Name **and** describe **one** other method of data verification during data transfer.

Name .....

Description .....

.....

.....

.....

.....

.....

[3]

7 A student plays computer games on a games console.

(a) Identify **two** input devices and **one** output device used in a games console.

Input device 1 .....

Input device 2 .....

Output device .....

[3]

(b) The games console has random access memory (RAM) and read only memory (ROM).

(i) State **two** differences between RAM and ROM.

Difference 1 .....

.....

Difference 2 .....

.....

[2]

(ii) Give **one** use for RAM in the games console.

.....

.....[1]

(iii) Give **one** use for ROM in the games console.

.....

.....[1]

8 The Von Neumann model uses a series of registers.

(a) Explain what is meant by the term **register**.

.....

.....

.....

.....[2]

(b) (i) Explain the purpose of the Memory Data Register (MDR).

.....

.....

.....

.....[2]

(ii) Name **two** registers, other than the MDR, that are used in the fetch-execute cycle.

Register 1 .....

Register 2 ..... [2]

(c) X is a register. The current contents of X are:

1	0	0	0	0	1	1	1
---	---	---	---	---	---	---	---

(i) The current contents of register X represent an unsigned binary integer.

Convert the value in X into denary.

.....[1]

(ii) The current contents of register X represent a Binary Coded Decimal.

Convert the value in X into denary.

.....[1]

(iii) The current contents of register X stores a two's complement binary integer.

Convert the value in X into denary.

.....[1]

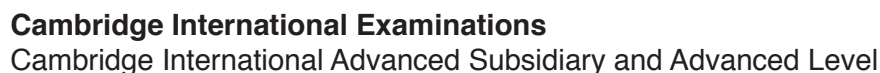
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## 9608/12

May/June 2018

**1 hour 30 minutes**

No Additional Materials are required.

No calculators allowed.

**READ THESE INSTRUCTIONS FIRST**

Write in dark blue or black pen.

You may use an HB pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

This document consists of **14** printed pages and **2** blank pages.

1 An operating system (OS) is usually pre-installed on a new computer.

(a) The OS performs a number of different tasks such as file management and peripheral management.

(i) State **three** file management tasks the OS performs.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(ii) State **three** printer management tasks the OS performs.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(b) Utility software is usually pre-installed on a new computer.

(i) The following table lists four programs. Put **one** tick (✓) in each row to indicate whether or not the program is utility software.

Program	True	False
Database		
Virus checker		
Web browser		
Backup software		

[4]

(ii) Name **two** other utility programs.

Program 1 .....

Program 2 .....

[2]

**Question 2 begins on the next page.**

- 2 (a) A greenhouse control system has four input parameters (H, D, T, W) and two outputs (X, Y).

Parameter	Description of parameter	Binary value	Condition
H	Humidity	0	Too low
		1	Acceptable
D	Day	0	Night
		1	Day
T	Temperature	0	Too high
		1	Acceptable
W	Windows	0	Closed
		1	Open

The watering system turns on ( $X = 1$ ) if:

**either** it is daytime **and** the temperature is too high

**or** the humidity is too low.

The fan turns on ( $Y = 1$ ) if the temperature is too high **and** the windows are closed.

Draw a logic circuit to represent the greenhouse control system.



[6]



(b) Complete the truth table for the logic expression:  $X = \text{NOT } A \text{ AND } (B \text{ NAND } C)$

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

3 Parity bits can be used to verify data.

(a) The following binary number is transmitted using **odd** parity.

Add the missing parity bit.

**Parity  
bit**

	0	1	0	0	0	0	0
--	---	---	---	---	---	---	---

[1]

(b) In the following data transmitted, the first column contains the parity bits, and the last row contains the parity byte. A device transmits the data using **even** parity.

**Circle** the error in the data transmitted.

	<b>Parity bit</b>	<b>Data</b>						
	<b>1</b>	0	1	0	1	1	1	1
	<b>0</b>	1	1	0	0	1	1	0
	<b>1</b>	1	0	0	0	0	0	0
	<b>0</b>	1	0	0	0	0	0	0
<b>Parity byte</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>

[1]

(c) The following table shows five error detection measures.

Put **one** tick (✓) in each row to indicate whether the measure is validation or verification.

<b>Measure</b>	<b>Validation</b>	<b>Verification</b>
Checksum		
Format check		
Range check		
Double entry		
Check digit		

[5]

- 4 (a) The Accumulator is a register. The current contents of the Accumulator are:

1	1	0	1	1	0	1	1
---	---	---	---	---	---	---	---

The current contents of the Accumulator represent an unsigned binary integer.

- (i) Convert the value in the Accumulator into denary.

.....[1]

- (ii) Convert the value in the Accumulator into hexadecimal.

.....[1]

- (iii) The current contents of the Accumulator represent a two's complement binary integer.

Convert the value in the Accumulator into denary.

.....[1]

- (b) The binary integer represents a character from the computer's character set.

- (i) Define the term **character set**.

.....  
 .....[1]

- (ii) Explain the differences between the **ASCII** and **Unicode** character sets.

.....  
 .....  
 .....  
 .....[2]

- (iii) The ASCII code for 'A' is 41 in hexadecimal.

Calculate the ASCII code in hexadecimal for 'Z'. Show your working.

Working .....  
 .....  
 .....

ASCII code in hexadecimal for 'Z' .....  
 [2]

5 A student has recorded a sound track for a short film.

(a) Explain how an analogue sound wave is sampled to convert it into digital format.

.....

.....

.....

.....

.....

.....[3]

(b) Explain the effects of increasing the sampling resolution on the sound file.

.....

.....

.....

.....[2]

(c) The original sound was sampled at 44.1 kHz. The sample rate is changed to 22.05 kHz.

Explain the effects of this change on the sound file.

.....

.....

.....

.....

.....

.....

.....

.....[3]

- (d) The student uses sound editing software to edit the sound file.

Name **two** features of sound editing software the student can use to edit the sound file.

Describe the purpose of each feature.

Feature 1 .....

Purpose .....

.....

.....

Feature 2 .....

Purpose .....

.....

.....

[4]

**Question 6 begins on the next page.**

6 A web page includes the following HTML and JavaScript code.

```

01  <html>
02  <body>
03
04  <p>Enter your mark</p>
05  <input id="Mark" value="0">
06  <button onclick="calcGrade()">Enter</button>
07
08  <script>
09      function calcGrade() {
10          var mark, grade;
11          mark = document.getElementById("Mark").value;
12          if (mark >= 90) {
13              grade = "A"
14          } else if (mark >= 80) {
15              grade = "B"
16          } else if (mark >= 70) {
17              grade = "C"
18          } else if (mark >= 60) {
19              grade = "D"
20          } else if (mark >= 50) {
21              grade = "E"
22          } else {
23              grade = "U"
24          }
25          alert("Your grade is " + grade)
26      }
27  </script>
28
29  </body>
30  </html>

```

(a) Give the identifier of **two** variables used in the JavaScript code.

- 1 .....
- 2 ..... [2]

(b) Give the line number where the JavaScript code produces an output.

..... [1]

(c) Describe the purpose of the statement on line 11.

.....

..... [2]

- (d) (i) State whether this JavaScript code will be run client-side or server-side.

.....[1]

- (ii) Explain the difference between **client-side** scripting and **server-side** scripting.

.....  
.....  
.....  
.....  
.....  
.....[3]

- 7 A social media website has a relational database, `WEBDATA`, that stores the site's information.

The database has three tables to store users' details, and details of the images and text that they post.

`USER(UserName, FirstName, SecondName, DateOfBirth)`

`PHOTO(PhotoID, UserName, Comment, UploadDate)`

`TEXTPOST(PostID, UserName, DateOfPost, TheText)`

- (a) (i) Explain how the relationship between the tables `USER` and `PHOTO` has been implemented.

.....

.....

.....

.....[2]

- (ii) Draw the entity-relationship (E-R) diagram to show the relationships between the three tables.

[2]

- (b) A database administrator decides to enforce referential integrity.

Use an example from the database `WEBDATA` to explain what is meant by **referential integrity**.

.....

.....

.....

.....

.....

.....[3]



- (c) The database has been normalised to Third Normal Form (3NF).

Define the three stages of database normalisation.

1NF .....

.....

2NF ..... (in 1NF and)

.....

3NF ..... (in 2NF and)

.....

[3]

- (d) The following shows sample data from the `USER` table.

<code>UserName</code>	<code>FirstName</code>	<code>SecondName</code>	<code>DateOfBirth</code>
gem123	John	Smith	01/01/1995
purpleSky	Muhammed	Ali	23/02/1956
OpenWindow	Sunny	Amir	03/03/1997
bluebird127	Raziya	Bello	04/03/1982

- (i) Write an SQL script to create the `USER` table.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[5]

- (ii) The database administrator needs to alter the `USER` table. A new field, `Country`, needs to be added.

Write an SQL script to add the field `Country` to the `USER` table.

.....

.....

.....

.....[2]



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NUMBER

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**COMPUTER SCIENCE**

9608/11

## Paper 1 Theory Fundamentals

October/November 2018

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

## READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

This document consists of **15** printed pages and **1** blank page.

1 A student is creating a short video and needs to record music to play in the background.

(a) The student uses a microphone to capture the music.

Explain how the microphone captures the music.

.....

.....

.....

.....

.....

.....[3]

(b) An analogue-to-digital converter uses sampling to encode the sound.

Explain how different sampling resolutions affect the sound file and the sound it represents.

.....

.....

.....

.....

.....

.....[3]

(c) The student needs to edit the sound file.

Describe **two** features of sound editing software that can be used to edit the sound file.

Feature 1 .....

.....

.....

.....

Feature 2 .....

.....

.....

.....

[4]

(d) The video is recorded with a frame rate of 60 frames per second (fps) and uses progressive encoding.

(i) Describe what is meant by **a frame rate of 60 fps**.

.....  
.....[1]

(ii) Describe what is meant by **progressive encoding** in video recording.

.....  
.....  
.....  
.....[2]

(e) MP4 multimedia container format is used to save the video.

State what is meant by **multimedia container format**.

.....  
.....[1]

2 Computer **A** needs to access a web page.

- (a) State how Computer **A** could access the web page without using a Domain Name Service (DNS).

.....  
 .....[1]

- (b) (i) The following table shows four IPv6 addresses.

State if each address is valid or invalid.

IP address	Valid or invalid
21E5:69AA:FFFF:1:E100:B691:1285:F56E	
::255.255.255.255	
59FB::1005:CC57:6571	
56FE::2159:5BBC::6594	

[4]

- (ii) The following table shows four statements about either public or private IP addresses.

Tick (✓) **one** box in each row to indicate whether each statement refers to a public or a private IP address.

Statement	Public	Private
192.168.2.1 is an example of this type of address		
Assigned by the Internet Service Provider (ISP)		
IP address cannot be duplicated in different networks		
Network Address Translation (NAT) is necessary to access the Internet directly		

[4]

- (c) One type of transmission media is copper cable.

Give **two** additional types of transmission media.

1 .....

2 .....

[2]



- 3 Hugo has produced a program (app) for mobile phones. He needs to decide whether to use an Open Source licence or to distribute the app as shareware.

(a) Describe what is meant by **Open Source licence** and **shareware**.

Open Source .....

.....

.....

.....

Shareware .....

.....

.....

.....

[4]

(b) Tick (✓) **one** box to indicate the licence Hugo should use. Justify your choice.

Open Source	
Shareware	

Justification .....

.....

.....

.....

.....

[2]

- 4 The table shows assembly language instructions for a processor which has one general purpose register, the Accumulator (ACC) and an index register (IX).

Instruction		Explanation
Op code	Operand	
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC.
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the Index Register. Copy the contents of this calculated address to ACC.
LDR	#n	Immediate addressing. Load the number n to IX.
STO	<address>	Store contents of ACC at the given address.
ADD	<address>	Add the contents of the given address to ACC.
INC	<register>	Add 1 to the contents of the register (ACC or IX).
DEC	<register>	Subtract 1 from the contents of the register (ACC or IX).
CMP	<address>	Compare contents of ACC with contents of <address>.
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True.
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False.
JMP	<address>	Jump to the given address.
OUT		Output to the screen the character whose ASCII value is stored in ACC.
END		Return control to the operating system.

- (a) (i) State what is meant by **direct addressing** and **indirect addressing**.

Direct addressing .....

.....

Indirect addressing .....

.....

[2]

- (ii) Explain how the instruction `ADD 20` can be interpreted as either direct or indirect addressing.

Direct addressing .....

.....

Indirect addressing .....

.....

[2]

- (b) The assembly language instructions in the following table use either symbolic addressing or absolute addressing.

Tick (✓) **one** box in each row to indicate whether the instruction uses symbolic or absolute addressing.

Instruction	Symbolic	Absolute
ADD 90		
CMP found		
STO 20		

[2]

- (c) The current contents of a general purpose register (X) are:

X	1	0	1	1	1	0	1	0
---	---	---	---	---	---	---	---	---

- (i) The contents of X represent an unsigned binary integer.

Convert the value in X into denary.

.....[1]

- (ii) The contents of X represent an unsigned binary integer.

Convert the value in X into hexadecimal.

.....[1]

- (iii) The contents of X represent a two's complement binary integer.

Convert the value in X into denary.

.....[1]

- (d) The current contents of the main memory, Index Register (IX) and selected values from the ASCII character set are provided with a copy of the instruction set.

**Address      Instruction**

70	LDX 200
71	OUT
72	STO 203
73	LDD 204
74	INC ACC
75	STO 204
76	INC IX
77	LDX 200
78	CMP 203
79	JPN 81
80	OUT
81	LDD 204
82	CMP 205
83	JPN 74
84	END
...	
200	130
201	133
202	130
203	0
204	0
205	2
IX	0

**ASCII code table (selected codes only)**

ASCII code	Character
127	?
128	!
129	"
130	*
131	\$
132	&
133	%
134	/

**Instruction set**

Instruction		Explanation
Op code	Operand	
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC.
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the Index Register. Copy the contents of this calculated address to ACC.
LDR	#n	Immediate addressing. Load the number n to IX.
STO	<address>	Store contents of ACC at the given address.
ADD	<address>	Add the contents of the given address to ACC.
INC	<register>	Add 1 to the contents of the register (ACC or IX).
DEC	<register>	Subtract 1 from the contents of the register (ACC or IX).
CMP	<address>	Compare contents of ACC with contents of <address>.
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True.
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False.
JMP	<address>	Jump to the given address.
OUT		Output to the screen the character whose ASCII value is stored in ACC.
END		Return control to the operating system.

Complete the trace table for the given assembly language program.

[illegible]

[8]

5 For each of the following scenarios, tick (✓) **one** box for each scenario to indicate whether you think the person's behaviour is ethical or unethical. Justify your choice.

- (a) Kevin is a software engineer who has recently started a job with a new company. He is using program code from his previous employer in his new employer's programs.

Ethical	
Unethical	

Justification .....

.....

.....

.....[2]

- (b) Nadya is a software developer. She has accepted a new job. She has never worked with the programming languages used by this new company. Nadya is planning to increase her knowledge of these programming languages before she starts her new job.

Ethical	
Unethical	

Justification .....

.....

.....

.....[2]

- (c) Maria finds that one of her team members has produced some inventive code. She presents this to her manager, stating that it was produced by the team. She does not mention the individual's name.

Ethical	
Unethical	

Justification .....

.....

.....

.....[2]

6 A web page includes the following PHP and HTML code.

```

01 <?php
02     if(isset($_GET['age'])) {
03         echo "Result: ", allowed($_GET['age']);
04     } else {
05     ?>
06
07 <form action="#" method="get">
08     Enter Age: <input type="text" name="age" /><br/>
09     <input type="submit" value="Calculate" />
10 </form>
11
12 <?php
13     }
14     function allowed($age) {
15         if($age <= 16) $message = "You need permission";
16         else if($age > 30) $message = "You are too old";
17         else $message = "Allowed";
18         return $message;
19     }
20 ?>

```

(a) Name **two** identifiers used in the PHP code.

- 1 .....
- 2 ..... [2]

(b) Write the value assigned to `$message` if the user types 30 in the text box.

..... [1]

(c) Explain the purpose of the code in line 18.

.....

.....

.....

..... [2]

- (d) The PHP code in a web page uses server-side scripting.

List the sequence of events that take place when a user requests a web page containing PHP code.

.....

.....

.....

.....

.....

.....

.....

.....[4]



**Question 7 begins on the next page.**

- 7 A movie theatre has a relational database that stores the movie schedule, and information about the movies. The theatre has several screens that play movies at the same time.

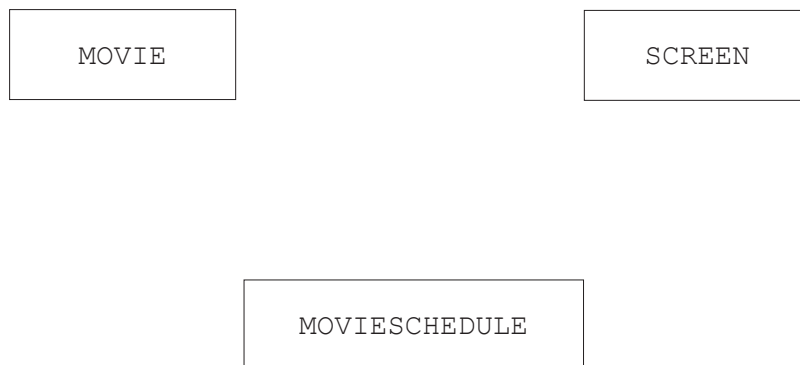
The database has three tables to store information about the movies, the screens and the movie schedule.

MOVIE(MovieID, Title, Length, Rating)

SCREEN(ScreenNumber, NumberSeats)

MOVIESCHEDULE(ScheduleID, MovieID, ScreenNumber, Time)

- (a) Complete the entity-relationship (E-R) diagram to show the relationships between these tables.



[2]

- (b) Explain how primary and foreign keys are used to link the tables in the movie theatre database.

.....

.....

.....

.....

.....

.....

.....[4]

- (c) The database needs to store the name of the company that produced each movie, for example, *Rocking Movies*.

Write an SQL script to add the attribute `ProductionCompany` to the `MOVIE` table.

.....

.....

.....

.....

.....[2]

- (d) Write an SQL script to display the title and rating of all movies scheduled to play on screen number 3.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[4]

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## COMPUTER SCIENCE

9608/12

## Paper 1 Theory Fundamentals

October/November 2018

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

## READ THESE INSTRUCTIONS FIRST

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DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

This document consists of **13** printed pages and **3** blank pages.

1 A company is designing a website.

(a) The company creates a 4-colour bitmap image for the website as shown.

Each colour is represented by a letter, for example, G = grey, K = black.

G	R	G	K	W	R
G	R	G	K	W	R
G	R	G	K	W	R
G	R	G	K	W	R
G	G	G	K	K	R
W	W	W	W	K	R

(i) State the minimum number of bits needed to represent each pixel in the image in **part (a)**.

..... [1]

(ii) Calculate the minimum file size of the image shown in **part (a)**. Show your working.

Working .....

.....

.....

.....

File size .....

[3]

(b) The company takes a photograph of their office to put on the website. The photograph has a resolution of 1000 pixels by 1000 pixels. Two bytes per pixel are used to represent the colours.

(i) Estimate the file size of the photograph in megabytes. Show your working.

Working .....

.....

.....

.....

Estimated file size .....

[4]

- (ii) The file size of the photograph needs to be reduced before it is placed on the website.

Draw lines to link each method of reducing the file size of the image to:

- its description and
- its compression type, where appropriate.

Description	Method	Compression type
Removes pixels	Crop the photograph	Lossy
Reduces number of pixels per inch	Use run-length encoding	Lossless
Uses fewer bits per pixel	Use fewer colours	
Stores colour code and count of repetitions		

[5]

- (c) The company has created a logo for the website. The logo is a vector graphic.

Describe **two** reasons why a vector graphic is a sensible choice for the logo.

Reason 1 .....

.....

.....

.....

Reason 2 .....

.....

.....

.....

[4]

2 Gopal types the Uniform Resource Locator (URL) of a website into a web browser.

(a) The following sequence (1 to 5) describes the steps that take place. There are three missing statements.

1 Gopal types into the web browser.

2 .....

3 DNS looks up the URL in table

4 .....

5 .....

Three statements **A**, **B** and **C** are used to complete the sequence.

<b>A</b>	DNS finds corresponding IP address
<b>B</b>	Web browser sends URL to Domain Name Service (DNS)
<b>C</b>	DNS returns IP address to web browser

Write one of the letters **A** to **C** in the appropriate rows (2, 4 and 5) to complete the sequence. [2]

(b) Describe the purpose of an IP address.

.....  
 .....  
 .....  
 ..... [2]

(c) A telecommunications operator has installed fibre-optic cables in Gopal's neighbourhood.

(i) Give **three** benefits of fibre-optic cable over copper cable.

1 .....  
 .....  
 2 .....  
 .....  
 3 .....  
 ..... [3]



(ii) Give **two** drawbacks of fibre-optic cable over copper cable.

1 .....

.....

2 .....

.....

[2]

- 3 The following table shows assembly language instructions for a processor which has one general purpose register, the Accumulator (ACC) and an Index Register (IX).

Instruction		Explanation
Op code	Operand	
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC.
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the Index Register. Copy the contents of this calculated address to ACC.
LDR	#n	Immediate addressing. Load the number n to IX.
STO	<address>	Store contents of ACC at the given address.
ADD	<address>	Add the contents of the given address to ACC.
INC	<register>	Add 1 to the contents of the register (ACC or IX).
DEC	<register>	Subtract 1 from the contents of the register (ACC or IX).
CMP	<address>	Compare contents of ACC with contents of <address>.
JPE	<address>	Following compare instruction, jump to <address> if the compare was True.
JPN	<address>	Following compare instruction, jump to <address> if the compare was False.
JMP	<address>	Jump to the given address.
OUT		Output to the screen the character whose ASCII value is stored in ACC.
END		Return control to the operating system.

- (a) (i) State what is meant by **absolute addressing** and **symbolic addressing**.

Absolute addressing .....

.....

Symbolic addressing .....

.....

[2]

- (ii) Give an example of an ADD instruction using both absolute addressing and symbolic addressing.

Absolute addressing .....

Symbolic addressing .....

[2]

- (b) (i) State what is meant by **indexed addressing** and **immediate addressing**.

Indexed addressing .....

.....

Immediate addressing .....

.....

[2]

- (ii) Give an example of an instruction that uses:

Indexed addressing .....

Immediate addressing .....

[2]

- (c) The current contents of a general purpose register (X) are:

X	1	1	0	0	0	0	0	1
---	---	---	---	---	---	---	---	---

- (i) The contents of X represent an unsigned binary integer.

Convert the value in X into denary.

..... [1]

- (ii) The contents of X represent an unsigned binary integer.

Convert the value in X into hexadecimal.

..... [1]


- (iii) The contents of X represent a two's complement binary integer.

Convert the value in X into denary.

..... [1]

- (d) The current contents of the main memory, Index Register (IX) and selected values from the ASCII character set are:

**Address      Instruction**

40	LDD 100
41	CMP 104
42	JPE 54
43	LDX 100
44	CMP 105
45	JPN 47
46	OUT
47	LDD 100
48	DEC ACC
49	STO 100
50	INC IX
51	JMP 41
52	
53	
54	END
...	
100	2
101	302
102	303
103	303
104	0
105	303

**ASCII code table (selected codes only)**

ASCII code	Character
300	/
301	*
302	-
303	+
304	^
305	=

IX

This is a copy of the instruction set.

Instruction		Explanation
Op code	Operand	
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC.
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the Index Register. Copy the contents of this calculated address to ACC.
LDR	#n	Immediate addressing. Load the number n to IX.
STO	<address>	Store contents of ACC at the given address.
ADD	<address>	Add the contents of the given address to ACC.
INC	<register>	Add 1 to the contents of the register (ACC or IX).
DEC	<register>	Subtract 1 from the contents of the register (ACC or IX).
CMP	<address>	Compare contents of ACC with contents of <address>.
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True.
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False.
JMP	<address>	Jump to the given address.
OUT		Output to the screen the character whose ASCII value is stored in ACC.
END		Return control to the operating system.

Complete the trace table for the given assembly language program.

[illegible]

[7]

- 4 A student has written the steps of the fetch stage of the fetch-execute (FE) cycle in register transfer notation. The student has made some errors.

```
Line 1      MDR ← [PC]
Line 2      PC ← PC + 1
Line 3      MDR ← [MAR]
Line 4      CIR ← PC
```

- (a) Identify the line numbers of **three** errors that the student has made. Write the correct notation for each error.

Line number of error	Correct notation

[3]

- (b)** One stage of the FE cycle includes checking for interrupts.

- (i) Give **three** different events that can generate an interrupt.

- 1 .....
- 2 .....
- 3 .....

[3]

- (ii) Explain how interrupts are handled during the fetch-execute cycle.

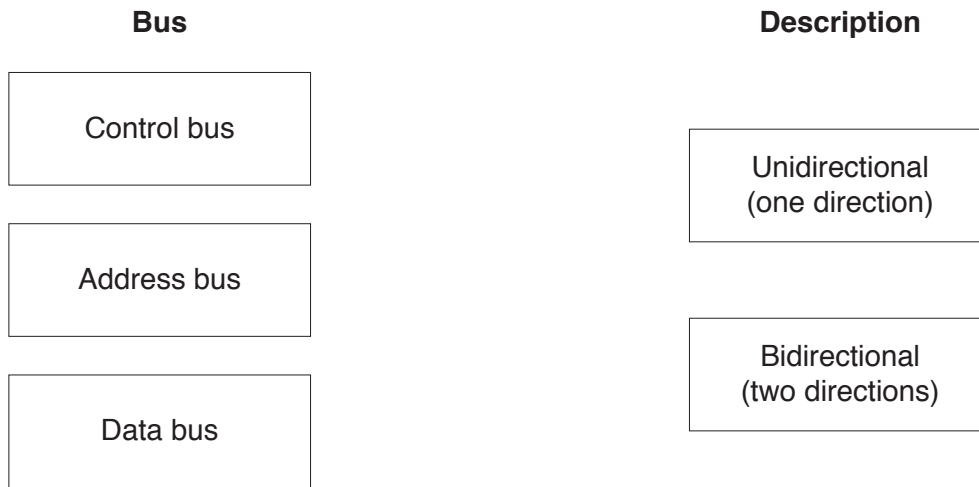
..... [5]

[5]

- (c) The processor uses buses in the FE cycle.

The diagram shows three buses and two descriptions.

Draw **one** line from each bus to its appropriate description.



[2]

- 5 This question presents three scenarios. For each scenario, tick (✓) **one** box to show whether you think the person's behaviour is ethical or unethical. Justify your choice.

- (a) Wendy is a software engineer who is developing a program for her company. Her friend, Noah, is developing a program for a different company. Wendy looks at the code that Noah is writing to get ideas for her own program.

Ethical	<input type="checkbox"/>
Unethical	<input type="checkbox"/>

Justification .....

.....

.....

..... [2]

- (b) Amit is fixing some bugs in the computer system of a large multinational company. He is asked to sign a confidentiality agreement. He sees some confidential information which contains the names of other multinational companies that have broken the law. He copies this information and releases it on the Internet.

Ethical	
Unethical	

Justification .....

.....

.....

..... [2]

- (c) Farah is providing a company with an estimate for the cost of writing a program. The company she works for is in financial difficulty so she increases the estimate by 10%.

Ethical	
Unethical	

Justification .....

.....

.....

..... [2]

6 Kim is using her laptop computer to write a program in a high-level language.

- (a) Kim needs to make sure the program is secure against unauthorised access. She has already set up a username and password on her laptop.

Identify **two** additional electronic measures that Kim can use to keep the program secure.

1 .....

2 ..... [2]

- (b) Kim will use library routines in her program.

- (i) Describe what is meant by a **library routine**.

.....

.....

.....

..... [2]



- (ii) Describe **one** benefit and **one** drawback of using library routines.

Benefit .....

.....

.....

.....

Drawback .....

.....

.....

.....

[4]

- (c) Kim develops her program and makes it ready for use. To do this, she uses first an interpreter and then a compiler.

Explain why Kim needs to use both an interpreter and a compiler.

Interpreter .....

.....

.....

.....

Compiler .....

.....

.....

.....

[4]





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## COMPUTER SCIENCE

**9608/13**

## Paper 1 Theory Fundamentals

October/November 2018

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

## READ THESE INSTRUCTIONS FIRST

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Write in dark blue or black pen.

You may use an HB pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

This document consists of **14** printed pages and **2** blank pages.

1 A product designer is creating a poster.

(a) The designer creates a 6-colour bitmap image for the poster as shown.

Each colour is represented by a letter, for example, R = red, B = blue.

R	R	P	P	P	G
B	R	R	P	G	G
B	W	B	B	O	O
B	W	W	P	P	O
B	B	R	P	G	O
B	R	R	P	G	O

(i) State the minimum number of bits needed to represent each pixel in the image in **part (a)**.

.....[1]

(ii) Calculate the minimum file size of the image shown in **part (a)**. Show your working.

Working .....

.....

.....

File size .....

[3]

(b) (i) The designer takes a photograph to put on the poster. The photograph has a resolution of 50 000 pixels by 50 000 pixels. The colours are represented using 4 bytes per pixel.

Estimate the file size of the photograph in gigabytes. Show your working.

Working .....

.....

.....

.....

Estimated file size .....

[4]

- (ii) The photograph needs to be sent by email but the file size is too big. It needs to be compressed.

The table lists several methods of making an image file size smaller.

Tick (✓) **one** box on each row to indicate whether each method is lossy or lossless.

Compression method	Lossy	Lossless
Cropping the image		
Reducing the resolution of the image		
Using run-length encoding (RLE)		
Reducing the colour depth of the image		

[4]

- (c) Explain how run-length encoding would compress the image in **part (a)**.

.....

.....

.....

.....

.....

.....[3]

- 2 The following table shows assembly language instructions for a processor which has one general purpose register, the Accumulator (ACC) and an Index Register (IX).

Instruction		Explanation
Op code	Operand	
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC.
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the Index Register. Copy the contents of this calculated address to ACC.
LDR	#n	Immediate addressing. Load the number n to IX.
STO	<address>	Store contents of ACC at the given address.
ADD	<address>	Add the contents of the given address to ACC.
INC	<register>	Add 1 to the contents of the register (ACC or IX).
DEC	<register>	Subtract 1 from the contents of the register (ACC or IX).
CMP	<address>	Compare contents of ACC with contents of <address>.
JPE	<address>	Following compare instruction, jump to <address> if the compare was True.
JPN	<address>	Following compare instruction, jump to <address> if the compare was False.
JMP	<address>	Jump to the given address.
OUT		Output to the screen the character whose ASCII value is stored in ACC.
END		Return control to the operating system.

- (a) State what is meant by **relative addressing** and **indexed addressing**.

Relative addressing .....

.....

.....

Indexed addressing .....

.....

.....

[2]



(b) The current contents of a general purpose register (X) are:

X	1	1	1	1	0	0	1	0
---	---	---	---	---	---	---	---	---

(i) The contents of X represent an unsigned binary integer.

Convert the value in X into denary.

.....[1]

(ii) The contents of X represent an unsigned binary integer.

Convert the value in X into hexadecimal.

.....[1]

(iii) The contents of X represent a two's complement binary integer.

Convert the value in X into denary.

.....[1]


(iv) Show the result on the general purpose register (X) after the following instruction is run.

INC X

--	--	--	--	--	--	--	--

[1]

- (c) The current contents of the main memory, Index Register (IX) and selected values from the ASCII character set are provided with a copy of the instruction set.

Address	Instruction
20	LDD 96
21	CMP 97
22	JPE 32
23	LDX 86
24	CMP 98
25	JPN 27
26	OUT
27	LDD 96
28	INC ACC
29	STO 96
30	INC IX
31	JMP 21
32	END
...	
93	453
94	453
95	452
96	8
97	10
98	453
IX	8

ASCII code table (selected codes only)

ASCII code	Character
450	<
451	>
452	=
453	&
454	(
455	)

Instruction set

Instruction		Explanation
Op code	Operand	
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC.
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the Index Register. Copy the contents of this calculated address to ACC.
LDR	#n	Immediate addressing. Load the number n to IX.
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DEC	<register>	Subtract 1 from the contents of the register (ACC or IX).
CMP	<address>	Compare contents of ACC with contents of <address>.
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True.
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False.
JMP	<address>	Jump to the given address.
OUT		Output to the screen the character whose ASCII value is stored in ACC.
END		Return control to the operating system.

Complete the trace table for the given assembly language program.

[illegible]

[7]

- 3** This question presents three scenarios. Tick (✓) **one** box for each scenario to indicate whether you think the person's behaviour is ethical or unethical. Justify your choice.

**(a)** Mason is using his work computer to book a holiday whilst at work.

Ethical	
Unethical	

Justification .....

.....

.....

.....[2]

**(b)** Ethan is supervising a trainee. The trainee asks Ethan for a reference for another job. Ethan does not want to lose the trainee, so refuses to give him a reference.

Ethical	
Unethical	

Justification .....

.....

.....

.....[2]

**(c)** Margarita finds that one of her team members has produced some inventive code. She presents this to her manager, praising the individual by name.

Ethical	
Unethical	

Justification .....

.....

.....

.....[2]

4 Ava needs to view a website and she knows the Uniform Resource Locator (URL).

(a) Complete the series of steps that take place.

Write the **letter** of the appropriate statement in each space.

<b>A</b>	DNS finds corresponding IP
<b>B</b>	DNS looks up URL in table
<b>C</b>	Ava types the URL into a web browser

1 .....

2 Web browser sends URL to Domain Name Service (DNS)

3 .....

4 .....

5 DNS returns IP address to web browser

[2]

(b) (i) An IPv4 address has been entered as 12.258.3

Give **two** reasons why this IP address is invalid.

1 .....

.....

2 .....

.....

[2]

(ii) An IPv6 address has been entered as 15EF:5L63::2014:BB::60AA

Give **two** reasons why this IP address is invalid.

1 .....

.....

2 .....

.....

[2]

(c) The table shows four descriptions of IP addresses.

Tick (✓) **one** box in each row to identify whether each description applies to a public or private IP address.

Description	Public	Private
The address can be reached over the Internet.		
The address is more secure.		
The address can only be accessed through the same LAN.		
The address can be duplicated in different networks.		

[4]

- 5 Arnold is a software developer. He has created a computer game for people to download over the Internet. Arnold is considering releasing the game as a piece of commercial software.

(a) (i) Describe what is meant by a **commercial licence**.

.....

.....

.....

..... [2]

(ii) Name and describe **one** other type of licence that Arnold can consider using.

Licence type .....

Description .....

.....

.....

..... [3]

(b) Users need to enter their name and email address to create an account. The information is stored in a database on Arnold's computer.

Give **three** ways that Arnold can ensure users' details are kept secure.

1 .....

2 .....

3 .....

[3]

6 The fetch-execute (FE) cycle uses special purpose registers.

(a) The stages in the FE cycle are shown in register transfer notation.

MAR  $\leftarrow$  [.....]

PC  $\leftarrow$  PC + 1

.....  $\leftarrow$  [ [MAR] ]

.....  $\leftarrow$  [MDR]

(i) The steps shown in **part (a)** are incomplete.

Write the missing register names in the spaces in **part (a)**.

[3]

(ii) The third instruction [ [MAR] ] has double brackets.

State the purpose of the double brackets.

.....  
 .....[1]

(b) One stage of the FE cycle includes checking for interrupts.

State what is meant by an **interrupt**.

.....  
 .....  
 .....  
 .....[2]

(c) There are two types of RAM: dynamic RAM (DRAM) and static RAM (SRAM).

The following table shows **five** statements about DRAM and SRAM.

Tick (✓) **one** box in each row to indicate whether the statement applies to DRAM or SRAM.

Statement	DRAM	SRAM
Does not need to be refreshed as the circuit holds the data while the power supply is on		
Mainly used in cache memory of processors where speed is important		
Has less complex circuitry		
Requires higher power consumption under low levels of access, which is significant when used in battery-powered devices		
Requires data to be refreshed occasionally so it retains the data		

[5]



- 1 The network manager of a Local Area Network (LAN) has replaced the Ethernet cables with a wireless network.

(a) Give **three** benefits of a wireless network compared to a wired network.

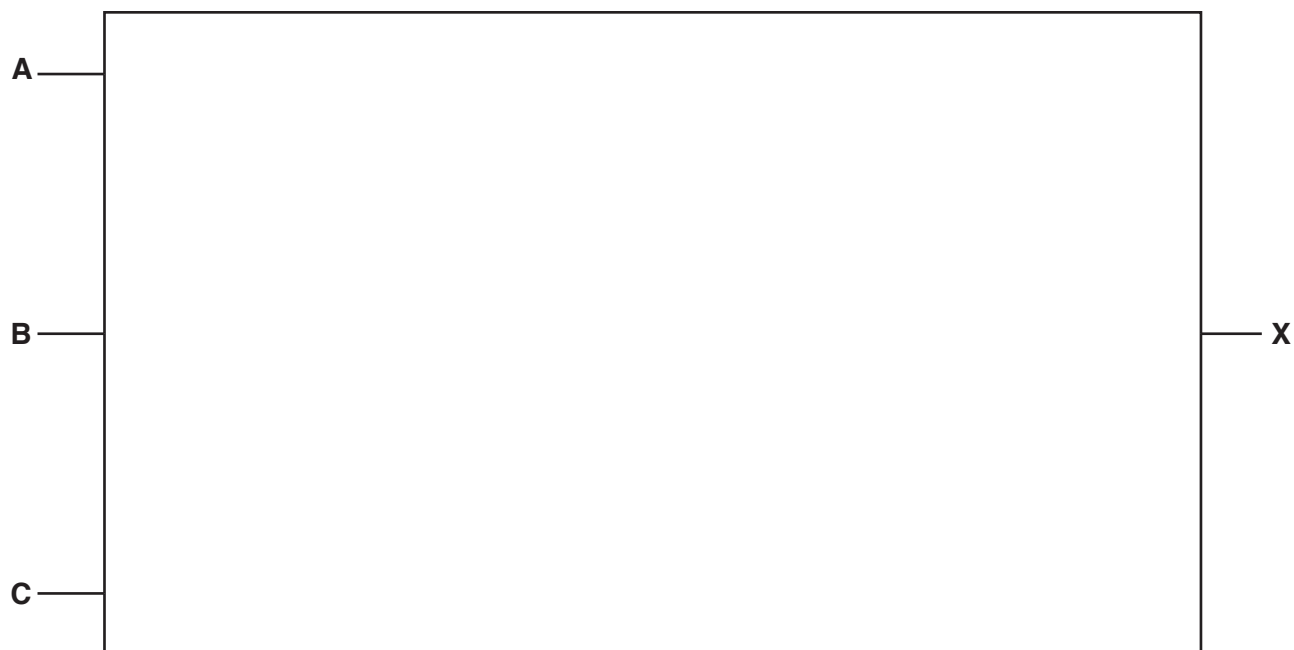
- 1 .....
- .....
- 2 .....
- .....
- 3 .....
- .....
- [3]

(b) Give **one** drawback of a wireless network compared to a wired network.

- .....
- .....[1]

- 8 (a) Draw a logic circuit to represent the logic expression:

$$X = (A \text{ XOR } B) \text{ OR } (\text{NOT}(C \text{ AND } A))$$



[4]

- (b) Complete the truth table for the logic expression in **part (a)**.

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]



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## COMPUTER SCIENCE

9608/11

## Paper 1 Theory Fundamentals

May/June 2019

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

## READ THESE INSTRUCTIONS FIRST

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The maximum number of marks is 75.

This document consists of **13** printed pages and **3** blank pages.

**1** Devices connected to the Internet have IP (Internet Protocol) addresses.

**(a)** Three IPv4 addresses are given.

Circle either Valid or Invalid to indicate whether each address is valid or invalid. Explain your decision.

Address 1:    **3A.21.2H.1**                      Valid / Invalid

Explanation .....

.....

Address 2:    **299.53.2.2**                      Valid / Invalid

Explanation .....

.....

Address 3:    **192.2.1.0**                      Valid / Invalid

Explanation .....

.....

[3]

**(b)** A website can be accessed using either the Uniform Resource Locator (URL) or the IP address.

Describe how a URL is converted into its matching IP address.

.....

.....

.....

.....

.....

..... [3]

**(c)** People use the Internet to stream media.

Complete the following statements by filling in the names of the missing methods of bit streaming.

..... bit streaming is used when watching a live stream of events that are currently taking place. The event is captured live with a video camera connected to a computer, and it cannot be paused or rewind.

..... bit streaming is used when watching an event that has taken place in the past. Existing media are encoded to bit streaming format and uploaded to a server. It can be paused and rewind.

[2]

(d) A recording of a concert is stored as a file. The file is compressed using lossy compression before it is streamed to users.

(i) State why this file needs to be compressed.

.....  
..... [1]

(ii) Define the term **lossy compression**.

.....  
..... [1]

(iii) The file could be compressed using lossless compression.

Explain why lossy compression is a more appropriate compression technique than lossless for this file.

.....  
.....  
.....  
.....  
.....  
..... [3]

2 A software company produces software and distributes it under different software licences.

(a) Four descriptions of software licences are given.

Write the type of software licence that best fits each description. Use a different type of licence for each description.

1. The software can be legally used, only after a fee has been paid.

Licence type .....

2. The source code comes with the software. If the software is modified, the edited source code must be released under the same conditions as the original software.

Licence type .....

3. The software is free for a trial period and then a fee is requested, or expected, if the user wants to continue to use the software.

Licence type .....

4. The source code comes with the software. The software is free to be downloaded, edited, and distributed, possibly without restriction.

Licence type .....

[4]

(b) The software company stores information about customers and the software licences they have purchased. The company considers a file-based approach for the storage and retrieval of data.

(i) Give **three** limitations of a file-based approach to store the data.

1 .....

.....

2 .....

.....

3 .....

.....

[3]



- (ii) The software company decides to use a database to overcome the limitations of a file-based system. Some of these limitations are addressed through the logical schema.

Name **and** describe **two** levels of the schema of a database.

Name 1 .....

Description .....

.....

Name 2 .....

Description .....

.....

[4]

(c) The database has the following tables:

CUSTOMER (CustomerID, CompanyName)

SOFTWARE (SoftwareID, SoftwareName, OperatingSystem, Description)

LICENCE (LicenceID, CustomerID, SoftwareID, DateOfPurchase,  
LicenceType, Cost, ExpiryDate)

(i) Identify the type of relationship that exists between the tables CUSTOMER and LICENCE.

.....  
..... [1]

(ii) Describe how the relationship is created between the tables CUSTOMER and LICENCE.

.....  
.....  
.....  
..... [2]

(iii) The company needs a list of all software licences that have an expiry date on or before 31/12/2019.

Write an SQL query to return the fields CustomerID, SoftwareID, LicenceType, Cost and ExpiryDate for all licences that expire on, or before 31/12/2019. Group the output by CustomerID, and in ascending order of cost.

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
..... [5]

3 Kimmy has written a program in a high-level language.

(a) Kimmy has used library routines in the program.

(i) Describe **two** advantages of using library routines in the program.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

(ii) Describe what is meant by a **Dynamic Link Library** (DLL).

.....

.....

.....

..... [2]

(b) Three translators are compilers, interpreters, and assemblers.

(i) State **one** benefit of Kimmy using an **interpreter** during the development of the program.

.....

..... [1]

(ii) State **three** benefits of Kimmy using a **compiler** when the program is complete.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

4 A software developer works in a team for a large software development company.

(a) Two principles of the ACM/IEEE Software Engineering Code of Ethics are:

- developers must act consistently with the public interest
- developers must act in the best interest of their client and employer.

Name **and** describe **three** other principles in the ACM/IEEE Software Engineering Code of Ethics.

Principle 1 .....

Description .....

.....

.....

Principle 2 .....

Description .....

.....

.....

Principle 3 .....

Description .....

.....

.....

[6]

(b) The software development company uses data backup and disk-mirroring to keep their data secure.

Explain how data backup and disk-mirroring allow the company to recover from data loss.

Data backup .....

.....

.....

.....

Disk-mirroring .....

.....

.....

.....

[4]

5 A simple program written in assembly language is translated using a two-pass assembler.

(a) The table contains some of the tasks performed by a two-pass assembler.

Tick (✓) **one** box in each row to indicate whether the task is performed at the first or second pass. The first row has been completed for you.

Task	First pass	Second pass
Creation of symbol table	✓	
Expansion of macros		
Generation of object code		
Removal of comments		

[2]

(b) The processor's instruction set can be grouped according to their function. For example, one group is modes of addressing.

Identify **two** other groups of instructions.

1 .....

.....

2 .....

.....

[2]

- (c) The table shows assembly language instructions for a processor which has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Op code	Operand	
LDM	#n	Immediate addressing. Load the denary number n to ACC.
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC.
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the Index Register. Copy the contents of this calculated address to ACC.
LDR	#n	Immediate addressing. Load the denary number n to IX.
STO	<address>	Store contents of ACC at the given address.
ADD	<address>	Add the contents of the given address to ACC.
INC	<register>	Add 1 to the contents of the register (ACC or IX).
CMP	#n	Compare contents of ACC with denary number n.
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True.
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False.
JMP	<address>	Jump to the given address.
OUT		Output to screen the character whose ASCII value is stored in ACC.
END		Return control to the operating system.

The current contents of the main memory, Index Register (IX) and selected values from the ASCII character set are:

Address	Instruction
20	LDM #0
21	STO 300
22	CMP #0
23	JPE 28
24	LDX 100
25	ADD 301
26	OUT
27	JMP 30
28	LDX 100
29	OUT
30	LDD 300
31	INC ACC
32	STO 300
33	INC IX
34	CMP #2
35	JPN 22
36	END
...	
100	65
101	67
102	69
103	69
104	68
...	
300	
301	33
IX	0

ASCII code table (Selected codes only)

ASCII Code	Character
65	A
66	B
67	C
68	D
69	E
97	a
98	b
99	c
100	d
101	e

Trace the program currently in memory using the following trace table. The first instruction has been completed for you.

[illegible]

[8]

6 A student records a video using a digital camera.

(a) The recording uses interlaced encoding.

Describe **interlaced encoding**.

.....

.....

.....

.....

.....

.....

..... [3]

(b) State **one** benefit of using interlaced encoding compared to progressive encoding.

.....

..... [1]

(c) A video can be compressed using spatial redundancy or temporal redundancy.

Explain how **temporal redundancy** compresses a video.

.....

.....

.....

.....

..... [2]

(d) A sound track is recorded for the video.

(i) Describe how a computer encodes the sound track.

.....

.....

.....

.....

.....

..... [3]



- (ii) Explain how the sampling rate and sampling resolution affect the file size of the sound track.

Sampling rate .....

.....

Sampling resolution .....

.....

[2]





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**COMPUTER SCIENCE**

## Paper 1 Theory Fundamentals

9608/12

May/June 2019

**1 hour 30 minutes**

Candidates answer on the Question Paper.

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No calculators allowed.

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The maximum number of marks is 75.

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1 Computers on the Internet have IP addresses.

(a) IP addresses can be in either IPv4 or IPv6 format.

(i) Give an example of a valid IPv4 address.

.....  
 ..... [1]

(ii) State why there is a need for IPv6 addressing.

.....  
 ..... [1]

(iii) A computer's IPv6 address is:

C100:2235::1000:25AA:AA50

Explain why this IPv6 address would be an invalid IPv4 address.

.....  
 .....  
 .....  
 ..... [2]

(b) A company has computers in two separate buildings that communicate using the Internet over a Public Switched Telephone Network (PSTN).

(i) Describe the transmission of data using a PSTN.

.....  
 .....  
 .....  
 ..... [2]

(ii) The company wants to install a dedicated line between the two buildings.

Identify **one** benefit and **one** drawback of installing a dedicated line between the two buildings.

Benefit .....

.....

Drawback .....

.....

[2]

- (c) A network can use routers and gateways.

Explain the role of routers **and** gateways in a network.

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (d) The company has an email server.

Identify **three** other types of server.

1 .....

2 .....

3 ..... [3]

2 Biyu is writing a computer program in a high-level language.

(a) Biyu uses a language translator.

(i) State the purpose of a language translator.

.....  
 ..... [1]

(ii) Biyu uses an interpreter.

State **two** benefits of Biyu using an interpreter instead of a compiler while writing the program.

1 .....  
 .....  
 2 .....  
 ..... [2]

(iii) Name a translator other than an interpreter and a compiler.

..... [1]

(b) Biyu uses library files in the program.

Explain why software is often developed using library files.

.....  
 .....  
 .....  
 ..... [2]



**3** The fetch-execute cycle is shown in register transfer notation.

```

01      MAR ← [PC]
02      PC ← [PC] - 1
03      MDR ← [MAR]
04      CIR ← [MAR]

```

**(a)** There are **three** errors in the fetch-execute cycle shown.

Identify the line number of each error and give the correction.

Line number .....

Correction .....

Line number .....

Correction .....

Line number .....

Correction .....

[3]

**(b)** A processor's instruction set can be grouped according to their function. For example, one group is the input and output of data.

Identify **two** other groups of instructions.

1 .....

.....

2 .....

.....

[2]

- (c) The following table shows assembly language instructions for a processor which has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Op code	Operand	
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LDR	#n	Immediate addressing. Load the denary number n to IX
STO	<address>	Store contents of ACC at the given address
ADD	<address>	Add the contents of the given address to ACC
INC	<register>	Add 1 to the contents of the register (ACC or IX)
CMP	#n	Compare contents of ACC with denary number n
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False
JMP	<address>	Jump to the given address
OUT		Output to the screen the character whose ASCII value is stored in ACC
END		Return control to the operating system

The current contents of the main memory, Index Register (IX) and selected values from the ASCII character set are:

Address	Instruction
50	LDM #0
51	STO 401
52	LDX 300
53	CMP #0
54	JPE 62
55	ADD 400
56	OUT
57	LDD 401
58	INC ACC
59	STO 401
60	INC IX
61	JMP 52
62	END
...	
300	2
301	5
302	0
303	4
...	
400	64
401	
IX	0

ASCII code table (Selected codes only)

ASCII code	Character
65	A
66	B
67	C
68	D
69	E

Trace the program currently in memory using the following trace table. The first instruction has been completed for you.

[illegible]

[8]

(d) The ASCII character code for 'A' is 65 in denary.

(i) Convert the denary ASCII character code for 'A' into 8-bit binary.

--	--	--	--	--	--	--	--

[1]

(ii) Convert the denary ASCII character code for 'A' into hexadecimal.

..... [1]

(iii) The Unicode character code for 'G' is 0047 in hexadecimal.

State, in hexadecimal, the Unicode character code for 'D'.

..... [1]

- 4 Shazia is creating a computer program that will be released to the public. The program includes a video.

(a) Shazia uses a microphone to record a sound track for the video.

(i) Describe the internal operation of a microphone.

.....

.....

.....

.....

.....

..... [3]

(ii) The script for the sound track is printed using a laser printer.

Describe the internal operation of a laser printer.

.....

.....

.....

.....

.....

..... [3]

(b) The video is recorded using progressive encoding.

Describe **progressive encoding**.

.....

.....

.....

..... [2]

- (c) Shazia's computer has Dynamic RAM (DRAM) and Static RAM (SRAM).

Explain the differences between Dynamic RAM and Static RAM.

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (d) Shazia wants to make sure her computer program is copyrighted.

- (i) Define the term **copyright**.

.....

..... [1]

- (ii) Shazia does not want to release the software as open source.

Explain why Shazia does **not** want to use an open source licence.

.....

.....

.....

..... [2]

- (iii) Name **and** describe **two** software licences, other than open source that Shazia could use.

Licence 1 .....

.....

.....

Licence 2 .....

.....

.....

[2]

5 Moheem is creating a relational database to store data about his customers.

(a) Moheem has been told a relational database addresses some of the limitations of a file-based approach by reducing data redundancy.

(i) State what is meant by the term **data redundancy**.

.....  
 ..... [1]

(ii) Explain **how** a relational database can help to reduce data redundancy.

.....  
 .....  
 .....  
 .....  
 .....  
 ..... [3]

(b) Moheem uses a Database Management System (DBMS) to ensure the security and integrity of the data.

(i) Explain the difference between security and integrity.

.....  
 .....  
 .....  
 ..... [2]

(ii) Name **and** describe **two** security features provided by a DBMS.

Feature 1 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 Feature 2 .....  
 .....  
 .....  
 .....  
 ..... [4]

- (iii) The DBMS provides software tools for the database developer.

Fill in the names of the missing software tools in the following statements.

A ..... allows a developer to extract data from a database.

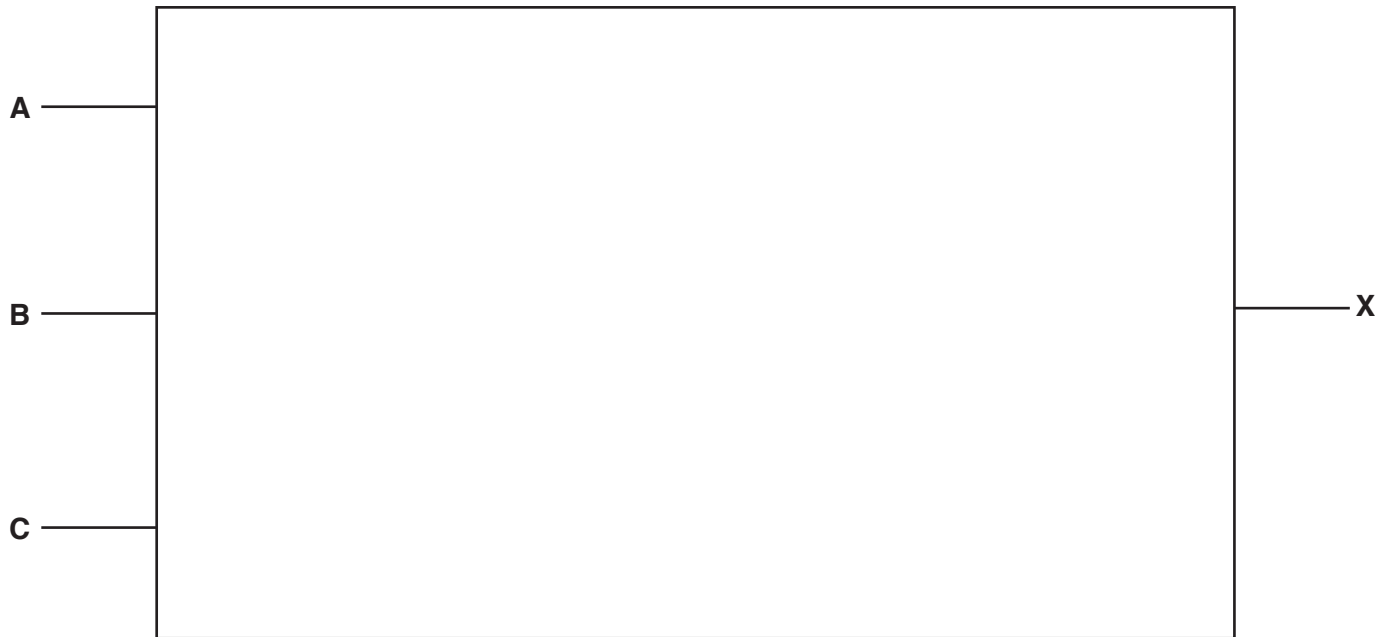
A ..... enables a developer to create user-friendly forms and reports.

[2]



- 6 (a) Draw a logic circuit to represent the logic expression:

$$X = A \text{ OR } (B \text{ AND NOT } C) \text{ OR } (A \text{ AND } B)$$



[5]

- (b) Complete the truth table for the logic expression in **part (a)**.

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]





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**COMPUTER SCIENCE**

## Paper 1 Theory Fundamentals

9608/13

May/June 2019

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

## READ THESE INSTRUCTIONS FIRST

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DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

This document consists of **14** printed pages and **2** blank pages.

1 A computer has an operating system (OS) and utility software.

- (a) The following table lists key management tasks performed by an operating system and their descriptions.

Complete the table by writing the missing management task names and descriptions.

Management task	Description
Memory management	
	Provides user accounts and passwords
	Handles the signals sent when the attention of the processor is required elsewhere
Provision of a software platform	

[4]

- (b) A hard disk formatter and a hard disk defragmenter are two examples of utility software.

- (i) Describe the actions performed by a hard disk formatter and a hard disk defragmenter.

Hard disk formatter .....

.....

.....

.....

Hard disk defragmenter .....

.....

.....

.....

[4]

(ii) Identify **three other** examples of utility software that can be installed on the computer.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

- 2 Frankie is a software developer. He is developing a program to manage customer records for a client with an online retail business. He must ensure that data stored about each customer are both secure and private.

(a) State the difference between security and privacy.

.....

.....

.....

..... [2]

(b) Computer systems can be protected by physical methods such as locks.

Describe **two** non-physical methods used to improve the security of computer systems.

1 .....

.....

.....

.....

.....

.....

.....

2 .....

.....

.....

.....

.....

.....

[6]



- (c) A computer uses parity blocks to check the data that has been received is the same as the data that has been transmitted.

The following is an example of a parity block.

	Parity bit	Data						
	1	1	1	1	0	0	0	1
	0	0	0	0	1	1	1	0
	1	1	0	1	1	0	0	1
Parity byte	1	1	0	1	1	0	0	1

- (i) Describe how a parity block check can identify a bit that has been corrupted during transmission.

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (ii) Give a situation where a parity block check **cannot** identify corrupted bits.

.....

..... [1]

- (d) One principle of the ACM/IEEE Software Engineering Code of Ethics is to always act in the best interest of the client.

Explain how Frankie can ensure that he is acting in the best interest of his client.

.....

.....

.....

.....

.....

.....

.....

..... [3]

- (e) When the program is complete, Frankie uses a compiler to prepare the program for the client.

Explain why Frankie uses a compiler instead of an interpreter.

.....

.....

.....

.....

.....

.....

.....

.....

..... [3]

- 3** A company uses a relational database, `EMPLOYEES`, to store data about its employees and departments.

**(a)** The company uses a Database Management System (DBMS).

**(i)** The DBMS has a data dictionary.

Describe what the data dictionary stores.

.....

.....

.....

..... [2]

**(ii)** The DBMS has a query processor.

Describe the purpose of a query processor.

.....

.....

.....

..... [2]

**(b)** Relationships are created between tables using primary and foreign keys.

Describe the role of a **primary** and a **foreign key** in database relationships.

.....

.....

.....

..... [2]

(c) In the company:

- An employee can be a manager.
- A department can have several managers and several employees.
- An employee can only belong to one department.

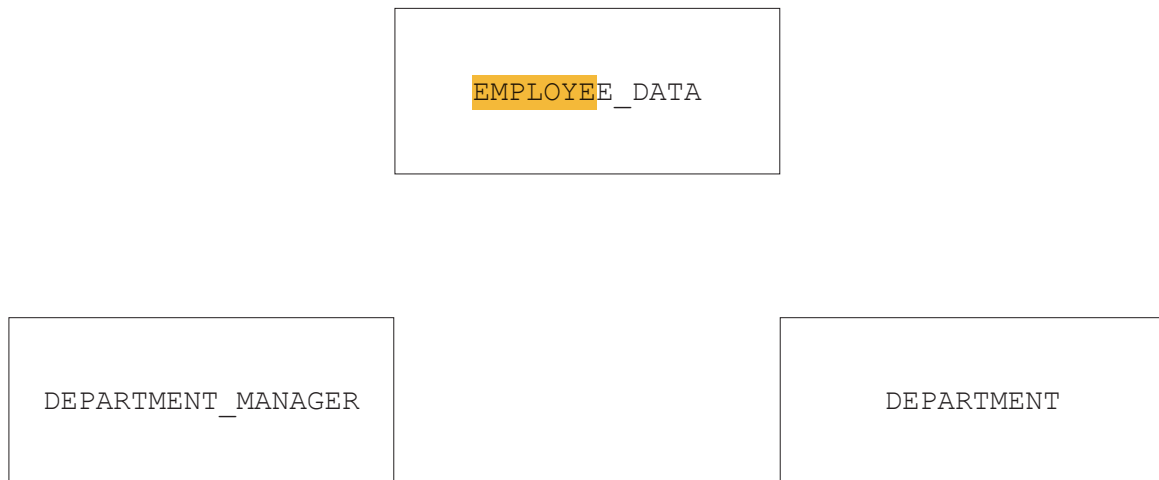
The EMPLOYEES database has three tables:

```
EMPLOYEE_DATA(EmployeeID, FirstName, LastName, DateOfBirth, Gender,
              DepartmentNumber)
```

```
DEPARTMENT(DepartmentNumber, DepartmentName)
```

```
DEPARTMENT_MANAGER(DepartmentNumber, EmployeeID, role)
```

Complete the entity-relationship (E-R) diagram for the EMPLOYEES database.



[3]

(d) Give **three** reasons why the EMPLOYEES database is **fully normalised**.

- 1 .....
- 2 .....
- 3 .....

[3]

(e) Part of the `EMPLOYEE_DATA` table is shown.

EmployeeID	FirstName	LastName	DateOfBirth	Gender	DepartmentNumber
156FJEK	Harvey	Kim	12/05/1984	Male	S1
558RRKL	Catriona	Moore	03/03/1978	Female	F2
388LMDV	Oscar	Ciao	01/01/1987	Male	F2

(i) Write a Data Definition Language (DDL) statement to create the `EMPLOYEES` database.

.....  
 ..... [1]

(ii) Write a DDL statement to define the table `EMPLOYEE_DATA`, and declare `EmployeeID` as the primary key.

.....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 ..... [5]

- (iii) Write a Data Manipulation Language (DML) statement to return the first name and last name of all female employees in the department named Finance.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

4 A program is written in assembly language.

- (a) The op codes `LDM` and `LDD` are used to load a register. The op code `LDM` uses immediate addressing, and the op code `LDD` uses direct addressing.

Describe what happens when the following instructions are run.

`LDM #300`

.....

.....

`LDD 300`

.....

.....

[2]

- (b) Assembly language instructions can be grouped by their purpose.

The following table shows four assembly language instructions.

Tick (✓) **one** box in each row to indicate the group each instruction belongs to.

Instruction	Description	Jump instruction	Arithmetic operation	Data movement
<code>LDR #3</code>	Load the number 3 to the Index Register			
<code>ADD #2</code>	Add 2 to the Accumulator			
<code>JPN 22</code>	Move to the instruction at address 22			
<code>DEC ACC</code>	Subtract 1 from the Accumulator			

[3]

(c) The processor handles interrupts within the fetch-execute cycle.

(i) Give **one** example of a hardware interrupt and **one** example of a software interrupt.

Hardware .....

.....

Software .....

.....

[2]

(ii) Explain how the processor handles an interrupt.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]



5 Xander creates a presentation that includes images, video and sound.

- (a) The images are bitmap images. A bitmap image can be made up of any number of colours. Each colour is represented by a unique binary number.

Draw **one** line from **each** box on the left, to the correct box on the right to identify the minimum number of bits needed to store each maximum number of colours.

**Maximum number of colours**

68

256

127

2

249

**Minimum number of bits**

1

2

3

7

8

9

[3]

(b) One of the videos has a frame rate of 40 fps (frames per second).

(i) State what is meant by **40 fps**.

.....  
 ..... [1]

(ii) One video uses interlaced encoding, and a second video uses progressive encoding.

Describe **two** differences between interlaced and progressive encoding.

1 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 ..... [4]

(c) The sound track has a sampling rate of 88.2 kHz and a sampling resolution of 32 bits.

State what is meant by a **sampling rate of 88.2 kHz** and a **sampling resolution of 32 bits**.

Sampling rate of 88.2 kHz .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 ..... [2]



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**COMPUTER SCIENCE**

9608/11

## Paper 1 Theory Fundamentals

October/November 2019

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

This document consists of **14** printed pages and **2** blank pages.

1 Von Neumann is an example of a computer architecture.

- (a) The diagram has registers used in Von Neumann architecture on the left and descriptions on the right.

Draw **one** line to match each register with its correct description.

Register	Description
Current Instruction Register	Stores the data that has just been read from memory, or is about to be written to memory
Memory Address Register	Stores the instruction that is being decoded and executed
Program Counter	Stores the address of the input device from which the processor accesses the instruction
Memory Data Register	Stores the address of the next instruction to be read
	Stores the address of the memory location about to be written to or read from

[4]

(b) Many components of the computer system transfer data between them using buses. One example of a bus is an address bus.

(i) Name **two** other buses that exist within a computer and give the purpose of each.

Bus 1 .....

Purpose .....

.....

.....

Bus 2 .....

Purpose .....

.....

.....

[4]

(ii) State the benefit of increasing the address bus width from 16 bits to 32 bits.

.....

..... [1]

(c) The following statements describe features of a low-level language.

Complete the statements by writing the appropriate terms in the spaces.

A ..... is a sequence of instructions that are given an identifier. These instructions may need to be executed several times.

A ..... is an instruction that tells the assembler to do something. It is not a program instruction.

The processor's instruction set can be put into several groups. One of these groups is

.....

[3]

2 Aaron uses a desktop computer to do school work.

(a) Aaron has a mouse and keyboard that he can use as input devices and a monitor as an output device.

(i) Identify **two** additional input devices Aaron could use with his desktop computer.

1 .....

2 ..... [2]

(ii) Identify **two** additional output devices Aaron could use with his desktop computer.

1 .....

2 ..... [2]

(iii) Aaron needs to store a large number of applications and data on his computer. He needs at least 50GB of secondary storage space.

Identify **one** internal secondary storage device for Aaron's computer.

.....

..... [1]

(iv) Describe the internal operation of a trackerball mouse.

.....

.....

.....

.....

.....

..... [3]



- (b) Aaron's computer has an operating system (OS). The OS manages the running processes and provides a user interface.

Describe these OS management tasks.

Process management .....

.....

.....

.....

.....

.....

Provision of a user interface .....

.....

.....

.....

.....

.....

[6]

- (c) Aaron's computer has a virus checker and backup software.

Describe these utility programs.

Virus checker .....

.....

.....

.....

Backup software .....

.....

.....

.....

[4]

- (d) Aaron creates a web page using JavaScript code and HTML tags.

Describe how the JavaScript code is translated using an interpreter.

.....

.....

.....

..... [2]

- 3 (a) A bank approves a customer for an account based on the criteria in the following table.

Parameter	Description of parameter	Binary value	Condition
<b>A</b>	Employed	1	True
		0	False
<b>B</b>	Self-employed	1	True
		0	False
<b>C</b>	Over 21	1	True
		0	False
<b>D</b>	Earn more than 30 000	1	True
		0	False
<b>E</b>	Another account	1	True
		0	False

A customer is approved ( $X = 1$ ) if the person:

- is over 21 **and** employed  
**or**
- is over 21 **and** self-employed **and**
  - **either** earns more than 30 000  
**or**
  - has another account.

Draw a logic circuit to represent the model.



[5]

(b) Complete the truth table for the logic expression:

$$X = (A \text{ AND } C) \text{ OR } (\text{NOT } A \text{ AND } (B \text{ XOR } C))$$

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

4 Customers of a bank can access their account information by logging in on the bank's website.

(a) The bank has a client-server model of networked computers.

(i) Describe, using the bank as an example, the key features of a client-server model.

.....

.....

.....

.....

.....

..... [3]

(ii) Give **two** other examples of applications that can use the client-server model.

1 .....

.....

2 .....

..... [2]

(b) The bank's customers log in to the website using a web application.

Explain why the web application uses server-side scripting.

.....

.....

.....

.....

.....

..... [3]

(c) The bank is upgrading its local area network (LAN) copper cables to fibre-optic cables.

(i) State **two** benefits to the bank of upgrading to fibre-optic cable from copper cable.

1 .....

.....

2 .....

.....

[2]

(ii) State **two** drawbacks of upgrading to fibre-optic cables.

1 .....

.....

2 .....

.....

[2]

- (d) The bank uses a relational database, `ACCOUNTS`, to store the information about customers and their accounts.

The database stores the customer's first name, last name and date of birth.

The bank has several different types of account. Each account type has a unique ID number, name (for example, regular or saving) and bonus (for example, \$5.00, \$10.00 or \$15.00).

A customer can have more than one account.

Each customer's account has its own ID number and stores the amount of money the customer has in that account.

The bank creates a normalised, relational database to store the required information. There are three tables:

- `CUSTOMER`
- `ACCOUNT_TYPE`
- `CUSTOMER_ACCOUNT`

- (i) Write the attributes for each table to complete the database design for the bank.

`CUSTOMER` ( .....  
 .....  
 ..... )  
  
`ACCOUNT_TYPE` ( .....  
 .....  
 ..... )  
  
`CUSTOMER_ACCOUNT` ( .....  
 .....  
 ..... )

[3]

- (ii) Identify the primary key for each table that you designed in **part (d)(i)**.

`CUSTOMER` .....  
`ACCOUNT_TYPE` .....  
`CUSTOMER_ACCOUNT` .....

[2]

- (iii) Identify **one** foreign key in one of the tables that you designed in **part (d)(i)**.

Table name .....  
 Foreign key .....

[1]

(iv) The following table has definitions of database terms.

Write the correct database term in the table for each definition.

Definition	Term
All the data about one entity	
The data in one row of a table	
A column or field in a table	

[3]



- 5 (a) The bit depth of an image dictates how many different colours can be represented by each pixel.

(i) State the number of different colours that can be represented by a bit depth of 8 bits.

..... [1]

(ii) One binary colour is represented by 0100 1110

Convert the unsigned binary number 0100 1110 into denary.

..... [1]

(b) Convert the denary number –194 into 12-bit two’s complement.

..... [1]

(c) (i) Convert the Binary Coded Decimal (BCD) value 0110 1001 into denary.

..... [1]

(ii) Identify **one** practical application where BCD is used.

.....

..... [1]

(d) One example of a character set used by computers is ASCII.

Describe how one character is represented in a character set.

.....

.....

.....

..... [2]

(e) Data can be compressed using either lossy or lossless compression.

Tick (✓) **one** box in each scenario to identify whether lossy or lossless compression should be used. Justify your choice.

(i) A program written in a high-level language.

Lossy	Lossless

Justification .....

.....

..... [2]

(ii) A photograph that needs to be emailed to a friend.

Lossy	Lossless

Justification .....

.....

..... [2]

(iii) You need to upload a video that you have created to a website.

Lossy	Lossless

Justification .....

.....

..... [2]



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## COMPUTER SCIENCE

9608/12

## Paper 1 Theory Fundamentals

October/November 2019

**1 hour 30 minutes**

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The maximum number of marks is 75.

This document consists of **14** printed pages and **2** blank pages.

- 1 (a) The diagram shows different types of software on the left, and descriptions on the right.

Draw a line from each type of software to its correct description.

Type of software	Description
Operating system	Provides a ready-built routine that can be imported into a program
Utility program	Provides an interface between the user and the hardware
Library program	Converts source code into a low-level language
Compiler	Creates a new document for the user to edit
	An additional program that helps to maintain or configure the system

[4]

- (b) Describe the purpose of disk repair software.

.....

.....

.....

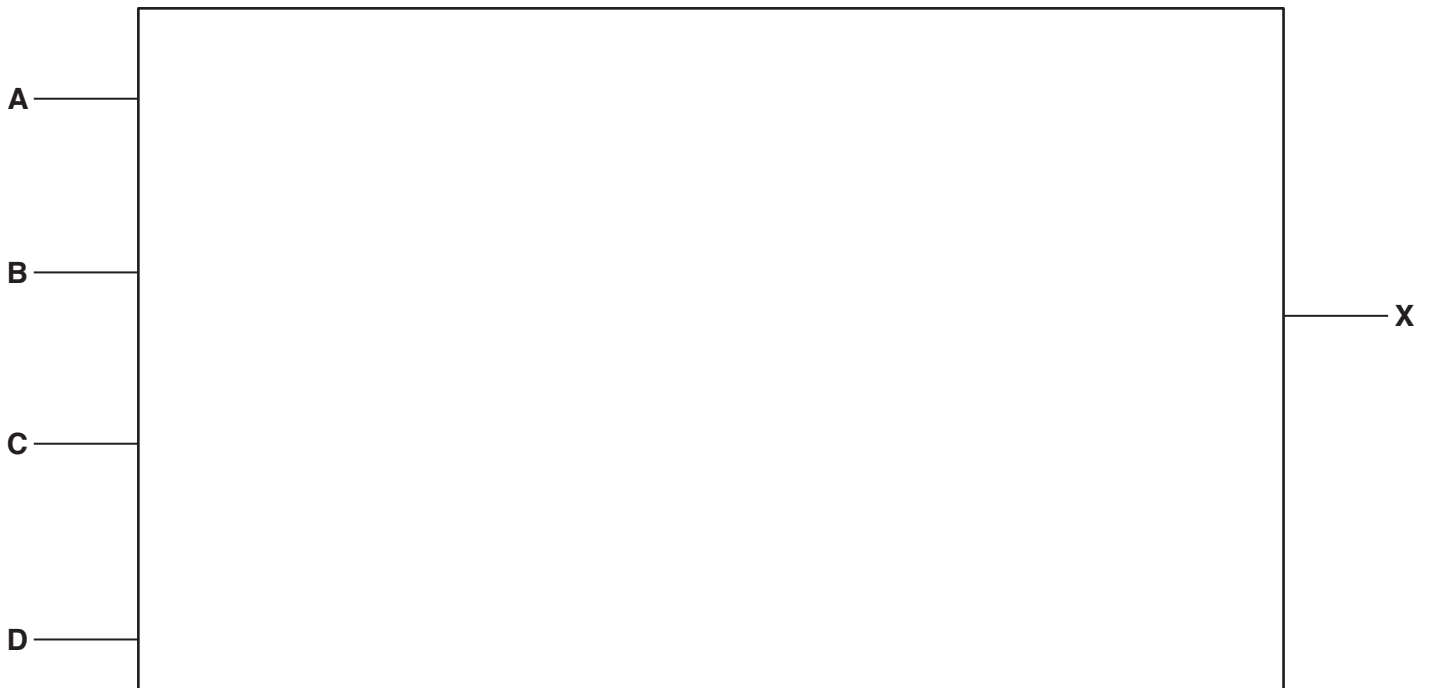
.....

.....

..... [3]

- 2 (a) Draw a logic circuit to represent the following logic expression:

$$X = \text{NOT } (A \text{ AND } B) \text{ AND } (C \text{ XOR } D)$$



[4]

- (b) Complete the truth table for the logic expression:

$$X = \text{NOT } (A \text{ AND } B) \text{ OR } (A \text{ AND } (B \text{ XOR } C))$$

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

**3** A web page includes the following JavaScript and HTML code.

```

01  <html>
02  <body>
03
04  <form>
05      <p><input type="text" id="textBox1"></p>
06      <button id = "button1" onclick="multiply()">First</button>
07      <button id = "button2" onclick="addition()">Second</button>
08  </form>
09
10  </body>
11  <script>
12      function multiply() {
13          value1 = document.getElementById("textBox1").value;
14          value1++;
15          alert(parseInt(value1) * parseInt(value1));
16      }
17
18      function addition() {
19          value1 = document.getElementById("textBox1").value;
20          alert(parseInt(value1) + parseInt(value1));
21      }
22  </script>
23  </html>

```

**(a)** Name **two** identifiers used in the JavaScript code.

- 1 .....
- 2 ..... [2]

**(b)** The number 9 is typed into `textBox1`.

Write the value that is output after `button1` is pressed.

..... [1]

**(c)** State the purpose of the code in line 14.

.....

..... [1]



(d) Line 20 is replaced with:

```
20 alert(value1 + value1);
```

Describe how this will affect the program.

.....

.....

.....

..... [2]

4 Anushka needs to store information about bookings at a sports club.

(a) Anushka has a file-based storage system. She wants a relational database.

- (i) Describe the features of a relational database that address the limitations of Anushka's file-based system.

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (ii) The relational database design needs to be normalised. The following statements describe the three stages of database normalisation.

Complete the statements by filling in the missing words.

For a database to be in First Normal Form (1NF) there must be no ..... groups of attributes.

For a database to be in Second Normal Form (2NF), it must be in 1NF, and contain no ..... key dependencies.

For a database to be in Third Normal Form (3NF), it must be in 2NF, and all attributes must be fully dependent on the ..... .

[4]

(b) The **normalised** relational database, `SPORTS_CLUB`, has the following table design.

`MEMBER` (MemberID, FirstName, LastName, MembershipType)

`SESSION` (SessionID, Description, SessionDate, SessionTime, NumberMembers)

`TRAINER` (TrainerID, TrainerFirstName, TrainerLastName)

`MEMBER_SESSION` (MemberID, SessionID)

`SESSION_TRAINER` (SessionID, TrainerID)

(i) Anushka has designed an entity-relationship (E-R) diagram for `SPORTS_CLUB`.

Complete the entity-relationship (E-R) diagram.



[2]

(ii) Anushka first needs to create the database that she has designed.

Write a Data Definition Language (DDL) statement to create the `SPORTS_CLUB` database.

.....  
 ..... [1]

(iii) The table shows some sample data for the table `SESSION`.

<code>SessionID</code>	<code>Description</code>	<code>SessionDate</code>	<code>SessionTime</code>	<code>NumberMembers</code>
21PL	Pilates junior	04/04/2020	18:00	15
13AE	Aerobics senior	04/04/2020	19:00	20
33WG	Weightlifting advanced	04/04/2020	10:00	10

Write a DDL script to create the table `SESSION`.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

(iv) Write a Data Manipulation Language (DML) script to return the first name and last name of all members who have `Peak` membership type.

.....

.....

.....

.....

.....

..... [3]

- 5 Mica has created some software and has copyrighted it. She wants to stop other people from copying and changing it illegally.

(a) Identify **two** ways Mica can prevent illegal copies of the software being installed.

- 1 .....
- .....
- 2 .....
- .....
- [2]

(b) Identify **one** way Mica can distribute the software without the source code.

- .....
- ..... [1]

(c) Mica is releasing the software under a commercial licence.

(i) Give **two** benefits to Mica of using a commercial licence.

- 1 .....
- .....
- 2 .....
- .....
- [2]

(ii) Name **two** other types of software licence.

- 1 .....
- .....
- 2 .....
- .....
- [2]

- 6 Dominic uses a tablet computer to complete work. He records videos of his work to send to his colleagues to watch at a later date.

(a) The tablet computer has input and output devices.

(i) The table lists four devices built into the tablet.

Tick (✓) one or more boxes for each device to identify whether it is an input device, an output device or both.

Device	Input	Output
Touchscreen		
Webcam		
Microphone		
Fingerprint scanner		

[2]

- (ii) An external speaker is plugged into the tablet computer.

The sequence of steps 1 to 7 describes the internal operation of the speaker.

The statements **A**, **B**, **C**, **D** and **E** are used to complete the sequence.

Letter	Statement
<b>A</b>	Changes in the audio signal cause the direction of the electrical current to change. This determines the polarity of the electromagnet.
<b>B</b>	The vibration creates sound waves.
<b>C</b>	An electric current is sent to the speaker.
<b>D</b>	The electromagnet is repelled by, or attracted to the permanent magnet.
<b>E</b>	The electric current passes through the coil.

Write **one** of the letters **A** to **E** in each appropriate row to complete the sequence.

- 1 .....
- 2 .....
- 3 The current in the coil creates an electromagnetic field.
- 4 .....
- 5 .....
- 6 The movement of the coil causes the diaphragm to vibrate.
- 7 .....

[4]

(b) The tablet computer's secondary storage is solid state (flash) memory.

(i) Give **one** reason why the tablet computer needs secondary storage.

.....  
 ..... [1]

(ii) Describe solid state memory.

.....  
 .....  
 .....  
 .....  
 .....  
 ..... [3]

(c) The tablet computer has RAM and ROM memory.

State the purpose of RAM and ROM memory in the computer.

RAM .....  
 .....  
 ROM .....  
 ..... [2]

(d) Dominic's tablet captures a video of Dominic to send to other people. The video is made of a sequence of images and a sound file.

(i) Describe how the images and sound are encoded into a digital form.

Images .....  
 .....  
 .....  
 .....  
 .....  
 Sound .....  
 .....  
 .....  
 ..... [4]



- (ii) The sequence of images and the sound file create a video. This is sent over the Internet as a video stream. The video stream can use interlaced encoding or progressive encoding.

Describe the terms **interlaced encoding** and **progressive encoding**.

Interlaced encoding .....

.....

.....

.....

Progressive encoding .....

.....

.....

.....

[4]

- (e) Dominic sends his videos to his colleagues over the Internet using bit streaming.

- (i) Describe how the video is sent using bit streaming.

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (ii) Circle either Real-time or on-demand to identify whether the video will be sent using real-time or on-demand bit streaming. Justify your choice.

Real-time / on-demand

Justification .....

.....

.....

.....

[2]

(iii) Describe the following video terms.

Temporal redundancy .....

.....

.....

.....

Spatial redundancy .....

.....

.....

.....

[2]



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**COMPUTER SCIENCE**

9608/13

## Paper 1 Theory Fundamentals

October/November 2019

**1 hour 30 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

**READ THESE INSTRUCTIONS FIRST**

Write your centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

This document consists of **14** printed pages and **2** blank pages.

- 1 In a supermarket, a self-checkout machine allows customers to scan the barcodes of products and then pay for their shopping. These are an alternative to the traditional cashier-staffed checkout.



(a) The self-checkout machine has a touchscreen.

(i) Identify **two** other input devices that self-checkout machines have.

1 .....

2 ..... [2]

(ii) Identify **two** other output devices that self-checkout machines have.

1 .....

2 ..... [2]

- (iii) The touchscreen uses capacitive technology.

The sequence of steps 1 to 6 describes the internal operation of the touchscreen.

The statements **A**, **B**, **C** and **D** are used to complete the sequence.

<b>A</b>	Charge is drawn to the point of contact.
<b>B</b>	The screen has a layer that stores an electrical charge.
<b>C</b>	There is a change in the electrostatic field.
<b>D</b>	The coordinates are sent to the touchscreen driver.

Write **one** of the letters **A** to **D** in each appropriate row to complete the sequence.

- 1 .....
- 2 When the user touches the screen
- 3 .....
- 4 .....
- 5 The coordinates of the point of contact can be calculated.
- 6 .....

[2]

- (b) The self-checkout machines have primary storage.

- (i) Give **two** reasons why the self-checkout machine needs primary storage.

- 1 .....  
.....
- 2 .....  
.....

[2]

- (ii) The self-checkout machines use Static RAM (SRAM) for their cache.

The following table has statements about SRAM or Dynamic RAM (DRAM).

Tick (✓) **one** box in each row to identify whether the statement is about SRAM or DRAM.

Statement	SRAM	DRAM
More expensive to make		
Requires refreshing (recharging)		
Made from flip-flops		

[2]

- (c) The self-checkout machines connect to a server that stores all the data for the supermarket. This is a client-server network.

- (i) Describe, using an example for the supermarket, the client-server network model.

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (ii) The supermarket is concerned about the security and integrity of the data on the server.

Identify **two** methods that can be used to minimise the security risk to the data, and **one** method to protect the integrity of the data.

Security 1 .....

.....

Security 2 .....

.....

Integrity .....

.....

[3]



**2** Leonardo's mobile phone has an operating system (OS).

- (a)** Describe the following key management tasks that the mobile phone operating system carries out.

Process management .....

.....

.....

.....

.....

.....

Memory management .....

.....

.....

.....

.....

.....

[6]

- (b)** Leonardo uses the mobile phone to record his voice.

- (i)** Describe how sound sampling is used by the mobile phone to encode the sound.

.....

.....

.....

.....

[2]

- (ii) Leonardo records his voice twice. Each recording is the same length and has the same sampling resolution.

The first recording has a sampling rate of 44 100 Hz. The second recording has a sampling rate of 21 000 Hz.

Describe how the different sampling rates will affect the recording and the sound file.

.....

.....

.....

..... [2]

- (iii) Leonardo transfers the recordings to his laptop computer. He uses sound editing software to delete some sections of the recordings, and copy and paste to replicate other sections.

Describe **two** other features of sound editing software Leonardo can use to edit the recordings.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

**3** A hotel needs to record information about customers and their bookings.

- (a)** The hotel has two types of room: double and family. Each room has a unique room number.

The hotel stores information about the customers including their name, address and contact details.

When a customer books a room, they give the start date and the number of nights they want to stay. If a customer wants more than one room, each room must have a separate booking. Each booking has an ID number.

The hotel creates a normalised, relational database to store the required information. There are three tables:

- CUSTOMER
- ROOM
- BOOKING

- (i)** Complete the database design for the hotel by writing the attributes for each table.

CUSTOMER ( .....  
 .....  
 ..... )

ROOM ( .....  
 .....  
 ..... )

BOOKING ( .....  
 .....  
 ..... )

[3]

- (ii)** Identify the primary key for each table that you designed in **part (a)(i)**.

CUSTOMER .....

ROOM .....

BOOKING .....

[2]

(iii) Identify **one** foreign key in the tables that you designed in **part (a)(i)**.

Table name .....

Foreign key .....

[1]

(b) The hotel wants to use a Database Management System (DBMS) to set up and manage the database.

Describe, using examples, how the hotel can use the following DBMS tools:

Developer interface .....

.....

.....

.....

.....

Query processor .....

.....

.....

.....

.....

[5]

(c) The following table has four SQL scripts.

Tick (✓) **one** box in each row to identify whether the script is an example of a Data Definition Language (DDL) statement or a Data Manipulation Language (DML) statement.

Script	DDL	DML
CREATE TABLE FILMS		
SELECT FilmID FROM FILMS		
ALTER TABLE FILMS ADD PRIMARY KEY (FilmID)		
CREATE DATABASE MYDATA		

[2]

- 4 (a) Convert the unsigned binary number 0101 1111 1100 into denary.

..... [1]

- (b) Convert the denary number –239 into 12-bit two's complement.

..... [1]

- (c) Convert the two's complement number 0110 0101 into denary.

..... [1]

- (d) Convert the Binary Coded Decimal (BCD) value 0110 0101 into denary.

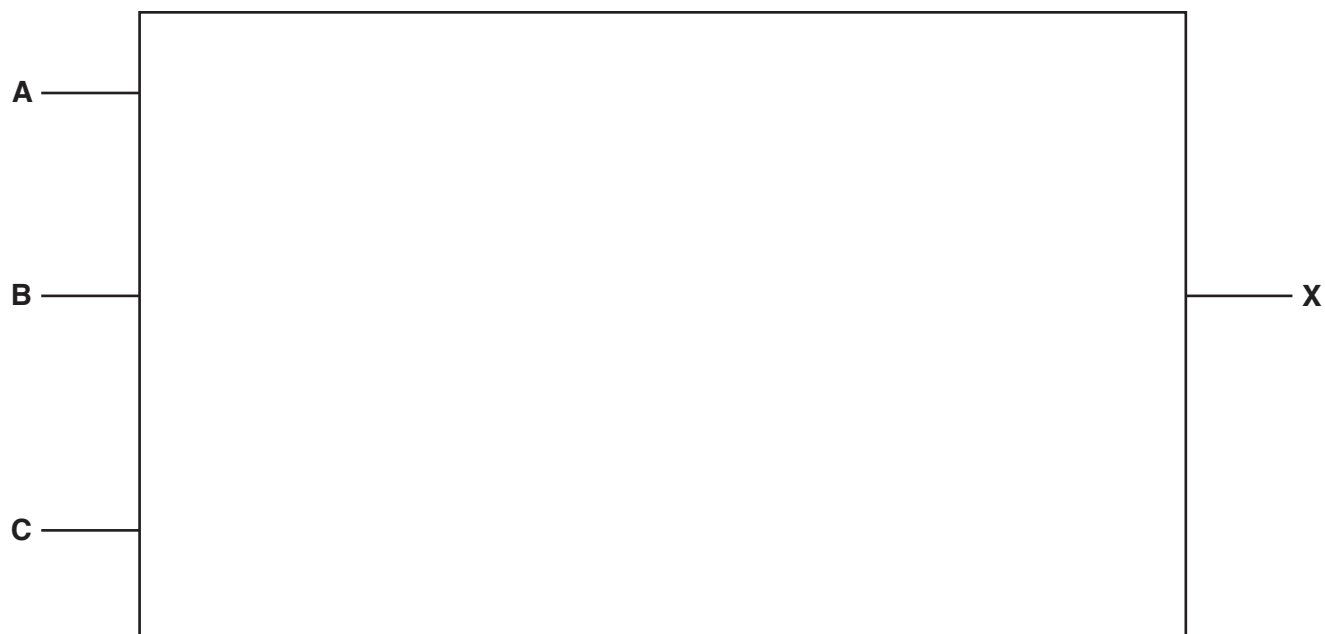
..... [1]

- (e) Convert the denary number 222 into hexadecimal.

..... [1]

- 5 (a) Draw a logic circuit to represent the logic expression:

$$X = \text{NOT } (A \text{ OR } C) \text{ OR } (A \text{ AND NOT } B)$$



[5]

- (b) Complete the truth table for the logic expression:

$$X = \text{NOT } (A \text{ OR } C) \text{ OR } (A \text{ AND NOT } B)$$

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

**Question 6 begins on the next page.**

## 6 Willow is creating a website.

One of the web pages includes the following JavaScript code and HTML tags.

```

01 <html>
02 <body>
03 <form>
04   <p id="displayQuestion"></p>
05   <input type="text" id="answer">
06   <button id="submit" onclick="checkAnswer()"> Submit </button>
07 </form>
08 </body>
09 <script>
10   val1 = Math.floor((Math.random() * 10) + 1);
11   val2 = Math.floor((Math.random() * 10) + 1);
12   document.getElementById("displayQuestion").innerHTML = "What is" +
    val1.toString() + "*" + val2.toString() + "?";
13   function checkAnswer(){
14     userAnswer = document.getElementById("answer").value;
15     answer = val1 * val2
16     if (userAnswer == answer.toString()){
17       alert("Correct, well done");
18     }else{
19       alert("Sorry that's incorrect");
20     }
21   }
22 </script>
23 </html>

```

(a) (i) Name **three** functions in the JavaScript code.

- 1 .....
- 2 .....
- 3 ..... [3]

(ii) Identify **every line number** of the JavaScript code that generates an output.

- ..... [2]
- .....

(iii) Identify the line number of the JavaScript code that takes data the user has input and stores it in a variable.

- ..... [1]



(iv) Describe the purpose of the code on line 16.

.....

.....

.....

..... [2]

(b) Willow used functions from a JavaScript program library in the web page.

Describe the benefits to Willow of using program libraries to create the web page.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

7 The following table has descriptions of modes of addressing.

Complete the table by writing the name of the addressing mode for each description.

Addressing mode	Description
	Form the address by adding the given number to a base address. Load the contents of the calculated address to the Accumulator (ACC).
	Load the contents of the address held at the given address to ACC.
	Load the contents of the given address to ACC.
	Form the address from the given address + the contents of the Index Register. Load the contents of the calculated address to ACC.
	Load the given value directly to ACC.

[5]



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## 9608/11

May/June 2020

**1 hour 30 minutes**

You must answer on the question paper.

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **16** pages. Blank pages are indicated.

1 A computer program makes use of data validation routines and verification of data input.

(a) Complete these **two** sentences about data validation and verification.

1. .... checks that the data entered is reasonable. One example is  
.....

2. .... checks that the data entered is the same as the original. One  
example is .....

[4]

(b) The program is installed on a computer system that has security measures in place to protect its data.

Complete the following table.

Security measure	Description
..... .....	Data are written on two or more disks simultaneously.
Encryption	..... ..... ..... .....
..... .....	A copy of the data is taken and stored in another location.

[3]

2 Kal teaches Computer Science and uses different devices when teaching his students.

- (a) Tick (✓) **one or more** boxes on each row to indicate whether each device is an input device, an output device, or both.

Device	Input	Output
LCD monitor		
Microphone		
Keyboard		
Touchscreen		

[2]

- (b) Kal has built a 3D printer to show students how it works.

- (i) The steps 1 to 9 describe the basic internal operation of a 3D printer.

The following five statements are used to complete the sequence of steps.

<b>A</b>	A stepper motor moves the nozzle into position
<b>B</b>	A fan cools the layer
<b>C</b>	The software splits the object into slices
<b>D</b>	The nozzle extrudes the molten plastic
<b>E</b>	The data about the slices is sent to the printer

Write one of the letters **A**, **B**, **C**, **D** or **E** in the appropriate step to complete the sequence.

1. The object is designed using Computer Aided Design (CAD) software
2. ....
3. ....
4. The solid plastic is melted and transferred to the nozzle
5. ....
6. ....
7. The steps 5 to 6 are repeated until the layer is complete
8. ....
9. The steps 4 to 8 are repeated for each subsequent layer

[4]

- (ii) The 3D printer has both RAM and ROM.

Describe the purpose of RAM and ROM in a **3D printer**.

RAM .....

.....

.....

.....

ROM .....

.....

.....

.....

[4]



3 Lana creates a website. The web pages of the website contain JavaScript and PHP code.

(a) Describe the purpose of the following JavaScript statement.

```
document.getElementById("text 2").innerHTML = 10 + 2;
```

.....

.....

.....

..... [2]

(b) Describe the purpose of the following JavaScript code.

```
function calculateValue(value1, value2){}
```

.....

.....

.....

..... [2]

(c) Describe the purpose of the following PHP code.

```
$number1 = 2;
```

```
echo $number1 ** 3;
```

.....

.....

.....

..... [2]

- 4 A digital camera takes a bitmap image. The image is 2000 pixels wide by 1000 pixels high with a colour depth of 24-bits.

- (a) Calculate an estimate of the file size for the image. Give your answer in megabytes. Show your working.

Working .....

.....

.....

.....

.....

Answer ..... MB

[3]

- (b) A second image is taken, this time in black and white. It has the same number of pixels, but the file size is smaller.

Explain why the file size is smaller.

.....

.....

.....

..... [2]

- (c) The digital camera allows a user to add text to an image. The text is encoded as ASCII values.

The table shows the ASCII denary values for five characters.

Character	ASCII denary value
a	97
b	98
c	99
d	100
e	101

- (i) Give the 8-bit binary value for the ASCII character 'b'.

.....

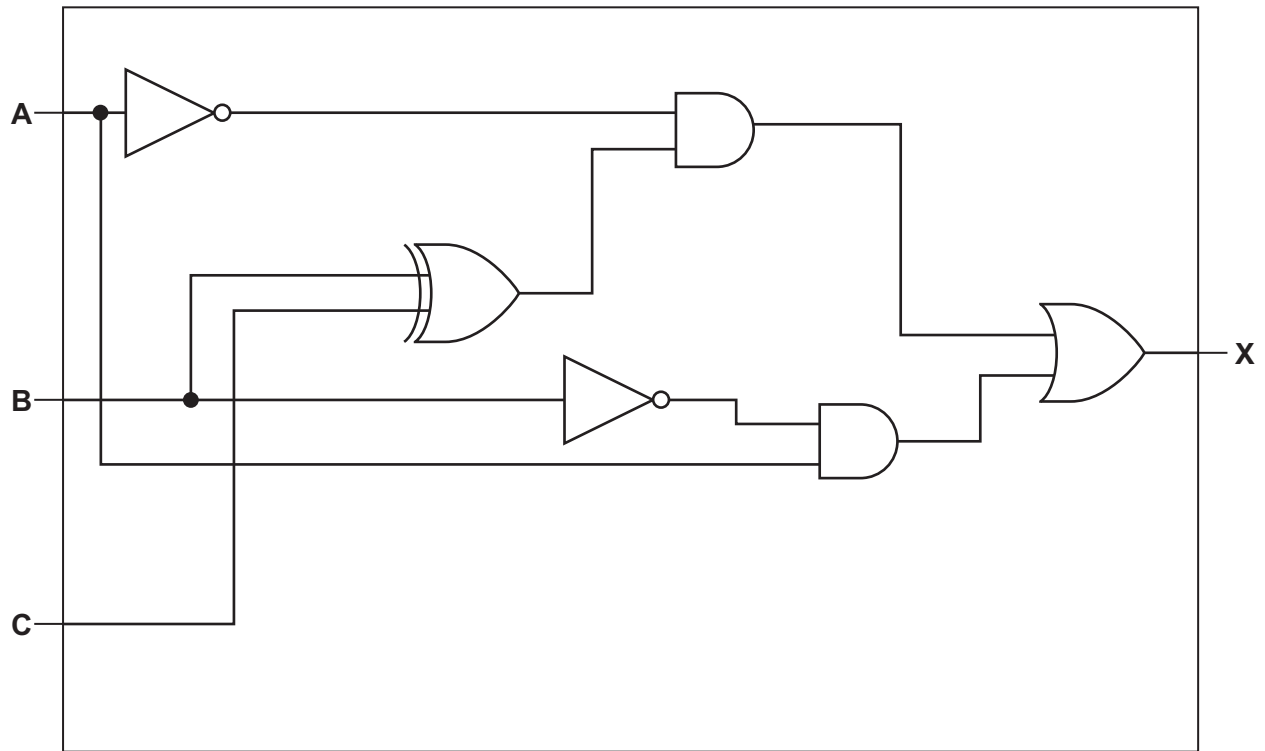
..... [1]

- (ii) Complete the table by writing the ASCII denary value for the character 't' **and** its hexadecimal equivalent.

Character	t
ASCII denary value	
Hexadecimal value	

[2]

5 (a) A logic circuit is given:



Complete the following truth table for the logic circuit.

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

(b) Identify **one** logic gate not used in the logic circuit in **part (a)**.

Draw the symbol for this logic gate **and** complete its truth table.

Logic gate: .....

Symbol:

Truth table:

Input		Output
A	B	
0	0	
0	1	
1	0	
1	1	

[3]

- 6 A processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

- (a) The table gives **three** assembly language instructions for loading data into the ACC. It also identifies the addressing mode used for each instruction.

	Instruction	Addressing mode
<b>A</b>	LDM #193	Immediate
<b>B</b>	LDD 193	Direct
<b>C</b>	LDX 193	Indexed

- (i) State the contents of the Accumulator after each of the instructions **A**, **B** and **C** are run.

**A** .....

.....

**B** .....

.....

**C** .....

.....

[3]

- (ii) Name **two** other addressing modes.

1 .....

2 .....

[2]

- (b) The ACC is a general purpose register. The IX is a special purpose register.

Identify **two** other special purpose registers used in the fetch-execute cycle **and** describe their role in the cycle.

Register 1 .....

Role .....

.....

.....

Register 2 .....

Role .....

.....

.....

[4]

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- 7 A driving school teaches people how to drive cars. The school has a relational database, DRIVING\_SCHOOL, to store information about instructors, students, lessons and the cars used by instructors.

INSTRUCTOR(InstructorID, FirstName, LastName, DateOfBirth, Level)

CAR(Registration, Make, Model, EngineSize)

INSTRUCTOR\_CAR(InstructorID, Registration)

STUDENT(StudentID, FirstName, LastName, DateOfBirth, Address1)

LESSON(LessonID, StudentID, InstructorID, LessonDate, LessonTime)

- (a) Give **two** benefits to the **driving school** of using a relational database instead of a flat file.

1.....

.....

2.....

.....

[2]

- (b) Complete the entity-relationship diagram for the database DRIVING\_SCHOOL.



[4]



- (c) The table shows some sample data for the table `INSTRUCTOR`.

<code>InstructorID</code>	<code>FirstName</code>	<code>LastName</code>	<code>DateOfBirth</code>	<code>Level</code>
Ins01	Jayden	Han	05/06/1974	1
Ins02	Freda	Choi	06/02/1978	2
Ins03	Kelly	Kim	01/12/1966	1
Ins04	Santana	Thompson	09/09/1985	3

Complete the Data Definition Language (DDL) statement to create the table `INSTRUCTOR`.

```

..... TABLE INSTRUCTOR (

    InstructorID VARCHAR(5),

    FirstName VARCHAR(15),

    LastName VARCHAR(15),

    DateOfBirth DATE,

    Level ..... ,

    ..... (InstructorID)

);

```

[3]

- (d) The table `STUDENT` needs an additional field to store the student's telephone number, for example 012-3456.

Write a Data Definition Language (DDL) statement to add the new field to the table `STUDENT`.

```

.....

.....

.....

..... [2]

```

- (e) Write a Data Manipulation Language (DML) statement to return the date and time of all future lessons booked with the instructor whose `InstructorID` is Ins01.

```

.....

.....

.....

.....

.....

.....

..... [4]

```

- 8 Bart plays computer games on his stand-alone games console.

The games console has an operating system.

- (a) Describe the tasks performed by the operating system to manage the **main memory** in the games console.

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (b) The computer games are written in a high-level language. Bart does not need a compiler or an interpreter to run the games he buys for his console.

Explain why the games run without the need for a compiler or an interpreter.

.....

.....

.....

..... [2]

- (c) When Bart is at work, he connects his work laptop to his employer's Local Area Network (LAN). The LAN has both a router and a gateway.

Give **two** similarities and **one** difference between a router and a gateway.

Similarity 1 .....

.....

Similarity 2 .....

.....

Difference .....

.....

.....

[3]

9 Utility programs are examples of system software.

(a) Complete the table by writing the name of the utility program for each description.

Description	Utility program
Reorganises files on a disk to improve efficiency	
Scans a hard disk to identify bad sectors	
Prepares a hard disk for first use	

[3]

(b) File compression is one example of a utility program.

Tick (✓) **one** box on each row to indicate whether the action is an example of lossy compression or lossless compression.

Action	Lossy	Lossless
Reducing the resolution of an image		
Using run-length encoding on a text file		
Reducing the sampling rate of a sound file		

[1]

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## 9608/12

May/June 2020

**1 hour 30 minutes**

You must answer on the question paper.

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **16** pages. Blank pages are indicated.



1 Samira is creating an interactive, multimedia presentation for the entrance to her hotel.

(a) The presentation will be on a device that has a resistive touchscreen for user input.

Complete the following paragraph about the basic operation of a resistive touchscreen.

The resistive touchscreen has two layers with ..... between the layers. When a finger touches the screen, the ..... moves to touch the ..... ; this creates a point of contact.

The ..... and ..... position of this point is calculated.

[4]

(b) Samira uses a computer to draw a logo for her hotel and saves it as a vector graphic. The logo will be placed on the multimedia presentation and elsewhere, such as on signs at the entrance of the hotel.

Samira emails the logo to a company that prints signs, and other documentation for the hotel.

(i) Describe how the logo is represented by the computer.

.....

.....

.....

.....

.....

.....

.....

..... [3]

(ii) State **two** reasons why the hotel **logo** is saved as a vector graphic instead of a bitmapped graphic.

1 .....

.....

2 .....

.....

[2]

2 Amir has created a sound file using his desktop computer.

(a) Complete the table by writing the missing definitions and term about sound.

Term	Definition
Sampling	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
..... .....	The number of samples per unit time
Sampling resolution	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>

[3]

(b) The file is too large to be emailed and the file size needs to be reduced.

(i) Name **one** lossless compression technique that can be used to reduce the size of the sound file.

.....

..... [1]

(ii) Describe **one** lossy compression technique that can be used to reduce the size of the sound file.

.....

.....

.....

..... [2]



(c) Amir's computer has system software, including utility software and an operating system.

- (i) Explain how the disk formatter, disk contents analysis and disk repair utilities work together.

.....

.....

.....

.....

.....

..... [3]

- (ii) Amir's computer has several peripheral devices connected to it.

State **three peripheral** management tasks performed by the operating system.

Task 1 .....

.....

Task 2 .....

.....

Task 3 .....

..... [3]

- (iii) The peripheral devices are plugged into USB ports of the computer.

Describe **two** benefits of connecting the peripheral devices using a USB port.

1 .....

.....

.....

.....

2 .....

.....

.....

..... [4]

- 3 The following is a logic expression.

$$X = \text{NOT } (A \text{ AND } B) \text{ OR NOT } (\text{NOT } B \text{ OR } C)$$

Draw the logic circuit for the given expression using a maximum of **four** gates.



4 Sophie is about to start a new job as a junior software developer.

(a) She is worried about joining a new team of people.

(i) State **one ethical** action that Sophie can take to help her to feel more confident about starting work.

.....  
 ..... [1]

(ii) State **two ethical** actions that Sophie's manager can take to help Sophie to feel more confident about starting work.

1 .....  
 .....

2 .....  
 ..... [2]

(iii) State **one ethical** action that Sophie's new colleagues can take to help Sophie to feel more confident about starting work.

.....  
 ..... [1]

(b) Explain why Sophie is asked to sign a professional code of conduct before starting work.

.....  
 .....  
 .....  
 .....  
 .....  
 ..... [3]

- 5 (a) The steps 1 to 6 describe the first pass of a two-pass assembler.

The following three statements are used to complete the sequence of steps.

<b>A</b>	If it is already in the symbol table, it checks to see if the absolute address is known
<b>B</b>	When it meets a symbolic address, it checks to see if it is already in the symbol table
<b>C</b>	If it is known, it is entered

Write one of the letters **A**, **B** or **C** in the appropriate step to complete the sequence.

1. The assembler reads the assembly language instructions
2. ....
3. If it is not, it adds it to the symbol table
4. ....
5. ....
6. If it is not known, it is marked as unknown.

[2]

- (b) The assembler translates assembly code into machine code.

The table shows the denary values for three assembler op codes.

Op code	Denary value
LDD	194
ADD	200
STO	205

- (i) Convert the denary value for the op code LDD into 8-bit binary.

--	--	--	--	--	--	--	--

[1]

- (ii) Convert the denary value for the op code STO into hexadecimal.

..... [1]

- (iii) State why the denary value for the op code ADD cannot be represented in 8-bit two's complement form. Justify your answer.

.....

.....

.....

..... [2]

- (c) The table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Op code	Operand	
LDM	#n	Immediate addressing. Load the denary number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the Index Register. Copy the contents of this calculated address to ACC
LDR	#n	Immediate addressing. Load the denary number n to IX
STO	<address>	Store contents of ACC at the given address
ADD	<address>	Add the contents of the given address to ACC
INC	<register>	Add 1 to the contents of the register (ACC or IX)
CMP	<address>	Compare contents of the address given with the contents of ACC
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False
JMP	<address>	Jump to the given address
OUT		Output to screen the character whose ASCII value is stored in ACC
END		Return control to the operating system

Complete the trace table for the following assembly language program. The first instruction has been completed for you.

Address	Instruction
20	LDD 103
21	CMP 101
22	JPE 30
23	LDD 100
24	ADD 101
25	STO 100
26	LDD 103
27	INC ACC
28	STO 103
29	JMP 20
30	END
...	
100	1
101	2
102	3
103	0

[illegible]

- 6 A software development company has a relational database, SOFTWARE\_MANAGEMENT. The database stores details of the customers who have purchased software, as well as the software and licences that customers have purchased.

The SOFTWARE\_MANAGEMENT database has the following tables:

CUSTOMER\_DETAILS (CustomerID, CompanyName, Address1, Address2, City)

SOFTWARE\_PURCHASED (SoftwareName, SoftwareDescription, CustomerID,  
LicenceType, LicenceCost, RenewalDate)

- (a) Explain why this database is **not** in Third Normal Form (3NF). Refer to the tables in your answer.

Do **not** attempt to normalise the tables.

.....

.....

.....

.....

.....

..... [2]

- (b) Give an example from the database SOFTWARE\_MANAGEMENT for each of the following database terms.

Term	Example
Entity	
Foreign key	
Attribute	

[3]



- (c) The company also develops computer games. They extend the relational database SOFTWARE\_MANAGEMENT by adding a new table. The new table, GAME\_DEVELOPMENT, stores details about the games and the software development teams creating them.

The table shows example data in GAME\_DEVELOPMENT.

GameName	Genre	TeamNumber	DevelopmentStage	ManagerID
Bunny Hop	Platform	4	Analysis	23KP
Fried Eggs	Retro	2	Programming stage 1	9RTU
Create-a-game	Action	1	Acceptance testing	11TF

- (i) Complete the Data Definition Language (DDL) statement to create the table GAME\_DEVELOPMENT.

```
CREATE ..... (
    GameName VarChar,
    Genre VarChar,
    ..... ,
    DevelopmentStage VarChar,
    ManagerID VarChar,
    ..... (GameName)
);
```

[5]

- (ii) Another table, PRODUCT\_MANAGER, is created.

```
PRODUCT_MANAGER(ManagerID, FirstName, LastName)
```

Complete the Data Manipulation Language (DML) statement to return the game name, genre and team number of all games managed by the product manager with the first name 'James' and the last name 'Fitz'.

```
..... GameName, Genre, TeamNumber
FROM GAME_DEVELOPMENT, PRODUCT_MANAGER
WHERE PRODUCT_MANAGER.FirstName = "James"
AND PRODUCT_MANAGER.LastName = "Fitz"
AND .....
= ..... ;
```

[3]

- 7 A company allows customers to stream music from its servers over the Internet. The company's internet connection is currently provided through copper cables.

(a) Identify **two** pieces of hardware, other than the cables, that enable the servers to connect to the Internet. Describe the purpose of each device.

Device 1 .....

Purpose .....

.....

.....

Device 2 .....

Purpose .....

.....

.....

[4]

(b) The company wants to upgrade their internet connection to fibre-optic cables.

Give **one** benefit and **one** drawback to the company of upgrading to fibre-optic cables.

Benefit .....

.....

.....

Drawback .....

.....

.....

[2]

- (c) A customer enters a song title into a web page to listen to the song. The design of the web page is shown:

Company Name	
Navigation Bar	
Enter song title:	<input type="text"/>
	<input type="button" value="Search"/>

The web page will make use of both client-side and server-side scripting.

- (i) Explain how client-side scripting will be used in this web page.

.....

.....

.....

.....

.....

..... [3]

- (ii) Explain how server-side scripting will be used after the customer clicks the 'Search' button.

.....

.....

.....

..... [2]

(d) The company needs to keep the data on its servers secure from online threats.

(i) Describe how a firewall will help to protect the data on the servers from online threats.

.....

.....

.....

..... [2]

(ii) Give **one additional** security measure that the company can use to protect the data on the servers from online threats.

..... [1]

---

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## 9608/13

May/June 2020

**1 hour 30 minutes**

You must answer on the question paper.

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
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- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **16** pages. Blank pages are indicated.

- 1 Ana owns a small company with four employees. The office has a network containing several computers that run on a client-server model. There is one server that connects to the Internet using a router.

(a) Networks transmit data using various types of connection shown in the following table.

Complete the table.

Type of connection	Description
Fibre-optic	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
<p>.....</p> <p>.....</p>	A communication device in Earth's orbit that receives and transmits data
Radio waves	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
<p>.....</p> <p>.....</p>	Carries data as electrical signals and can consist of a twisted pair

[4]

(b) Explain how the client-server model enables the employees to access the same files from different computers.

.....

.....

.....

.....

.....

.....

.....

[2]

(c) Each computer in the network has a private IP address.

Give **two** reasons why the computers do **not** have public IP addresses.

1 .....

.....

2 .....

.....

[2]

2 Billy has a laser printer.

(a) Complete the following description of the basic internal operation of a laser printer.

The printer uses a ..... and a rotating .....  
to draw the contents of the page on the photosensitive drum as .....  
charge. The ..... is attracted to this charge.

[4]

(b) The laser printer has both RAM and ROM.

Describe the purpose of RAM and ROM in the **laser printer**.

RAM .....  
.....  
.....  
.....

ROM .....  
.....  
.....  
.....

[4]

(c) Billy's computer has several ports.

(i) State the purpose of a port.

.....  
..... [1]

(ii) Identify **one** type of port.

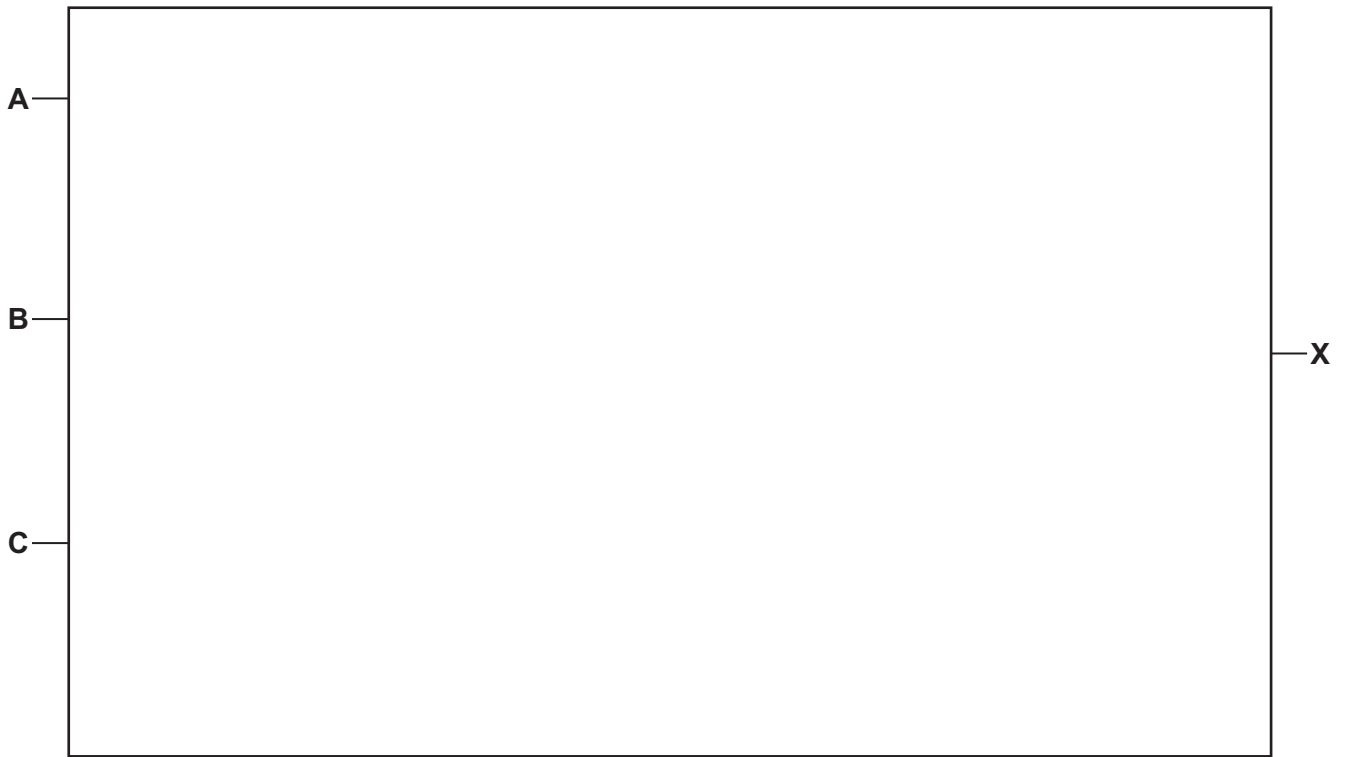
.....  
..... [1]



- 3 (a) The following is a logic expression.

$$X = \text{NOT}(A \text{ OR } B) \text{ OR } (A \text{ AND } (B \text{ XOR } C))$$

Draw the logic circuit for the given expression, using a maximum of **four** logic gates.



[4]

(b) Complete the truth table for the logic expression:

$$X = \text{NOT}(A \text{ OR } B) \text{ OR } (A \text{ AND } (B \text{ XOR } C))$$

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

(c) The following is a logic expression.

$$A \text{ AND } B \text{ XOR } C \text{ OR NOT } A$$

Identify **one** logic gate that would **not** be used in the logic circuit for this expression.  
Draw the symbol for the logic gate.

Logic gate .....

Logic gate symbol:

[2]

4 Annchi is writing a computer game with a group of friends.

(a) One of her friends has suggested using Dynamic Link Library (DLL) files to help them develop the game.

(i) Give **three** reasons why Annchi and her friends should use DLL files when developing the game.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(ii) Give **two** reasons why Annchi and her friends should **not** use DLL files when developing the game.

1 .....

.....

2 .....

.....

[2]

(b) Each member of the group is creating a different part of the game. Each person needs to test their part of the game independently before they are combined.

Identify the **most appropriate** type of translator that should be used to test each part of the game independently. Justify your choice.

Translator .....

Justification .....

.....

.....

.....

.....

[3]

(c) Annchi needs to decide which type of software licence to use for the game.

(i) Give **two** benefits to **Annchi** of using a commercial licence.

1 .....

.....

2 .....

.....

[2]

(ii) Give **one** benefit to the **customers** of the game being released using a commercial licence.

.....

..... [1]

(iii) Describe **one** benefit to the **customers** of the game being released using a shareware licence.

.....

.....

.....

..... [2]

5 Wei is developing a program.

(a) He wants to make sure the source code is secure on his laptop.

Explain how encrypting the source code can keep it secure.

.....

.....

.....

.....

.....

..... [3]

(b) Wei wants to compress the source code to transport it to another computer.

Identify the **most appropriate** compression technique he should use.

Justify your choice.

Compression technique .....

Justification .....

.....

.....

.....

.....

.....

..... [3]

6 Sheila creates a relational database for her hotel using a Database Management System (DBMS).

(a) Draw **one** line from each database term to its most appropriate description.

Database Term	Description
Primary key	A field in one table that links to a primary key in another table
Attribute	A collection of records and fields
Foreign key	The type of data that is being stored
Entity	A unique identifier for each tuple
	A data item, represented as a field within a table
	The concept or object in the system that we want to model and store information about

[4]

(b) Identify **three** tasks that Sheila can perform using the DBMS developer interface.

- 1 .....
- 2 .....
- 3 .....

[3]

- (c) Sheila creates the database `HOTEL` with the following table structure:

`ROOM(`RoomNumber`, RoomType)`

`BOOKING(`BookingID`, RoomNumber, CustomerID, StartDate)`

`CUSTOMER(`CustomerID`, FirstName, LastName, Address, Tel_Num)`

- (i) The following table shows some sample data for the table `ROOM`.

RoomNumber	RoomType
1	Standard
2	Double
3	Executive
4	Standard

Complete the Data Definition Language (DDL) statement to create the table `ROOM`.

```
..... TABLE ROOM (
    RoomNumber Integer,
    RoomType .....,
    ..... (RoomNumber)
);
```

[3]

- (ii) Room number **5** is a **Double** room.

Complete the Data Manipulation Language (DML) statement to add the details for room number 5 to the table `ROOM`.

```
INSERT ..... ROOM
VALUES (.....);
```

[2]

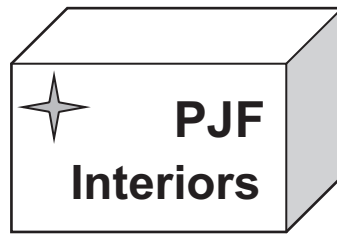
- (iii) The table `BOOKING` needs an additional field to store the number of nights (for example, 3) a customer is staying.

Write a Data Definition Language (DDL) statement to add the new field to the table `BOOKING`.

```
.....
.....
.....
.....
.....
```

[2]

- 7 Xiaoming created the following logo using bitmapped graphics software.



- (a) Describe how **one** typical feature of bitmapped graphics software was used to create the logo.

.....

.....

.....

..... [2]

- (b) The finished logo is 160 pixels wide and 160 pixels high. The image has a colour depth of 3 bytes per pixel.

Calculate an estimate of the file size for the logo. Give your answer in kilobytes. Show your working.

Working .....

.....

.....

Answer ..... KB [3]

- (c) Xiaoming needs to use his logo on his business card, on his website and on large display boards. He is told that he should have created a vector graphic logo instead of a bitmapped graphic logo.

Describe **one** benefit of creating a vector graphic logo instead of a bitmapped graphic logo.

.....

.....

.....

..... [2]



(d) The hexadecimal colour value of the background of Xiaoming's website is:

913C8E

Complete the following table by converting each hexadecimal value to denary value.

	Red	Green	Blue
Hexadecimal value	91	3C	8E
Denary value			

[2]

(e) Part of Xiaoming's website contains the JavaScript function `performTask()`.

```
function performTask(){
    var value1;
    value1 = document.getElementById("FirstBox").value;

    if (value1 == "Yes"){
        document.getElementById("paragraph1").innerHTML = "Agreed";
    } else if(value1 == "No"){
        document.getElementById("paragraph1").innerHTML = "Sorry";
    } else {
        alert("Error")
    }
}
```

Describe the purpose of the following JavaScript statements from the function `performTask()`.

(i) `alert("Error")`

.....  
 ..... [1]

(ii) `value1 = document.getElementById("FirstBox").value;`

.....  
 .....  
 .....  
 ..... [2]

(iii) `document.getElementById("paragraph1").innerHTML = "Agreed";`

.....  
 .....  
 .....  
 ..... [2]



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## 9608/11

October/November 2020

**1 hour 30 minutes**

You must answer on the question paper.

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **16** pages. Blank pages are indicated.

- 1 Draw **one or more** lines to link each language translator to the most appropriate statement(s).

**Language translator****Statements**

Compiler

Interpreter

Converts a low-level language instruction into binary

Stops as soon as it finds a syntax error

Needs the source code to be present when the user's program is run

Reports all errors found at the end of the process

Corrects syntax errors as they are detected

Converts a high-level language into a different form

Creates an executable file

[3]

- 2 A veterinary surgery cares for sick animals. The surgery has a file-based database that stores data about the pets, their owners, and appointments made with the surgery.

The surgery wants to upgrade to a relational database.

- (a) Explain the reasons why the surgery should upgrade their database.

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (b) The design for the surgery database, SURGERY, is:

PET(PetID, OwnerFirstName, OwnerLastName, PetName, PetBreed,  
PetDateOfBirth, TelephoneNumber)

APPOINTMENT(AppointmentID, Date, Time, StaffID, PetID)

- (i) Give **one** reason why the database design for SURGERY is **not** in Third Normal Form (3NF).

.....

..... [1]

- (ii) The database needs to be normalised to 3NF. A pet may have more than one owner and an owner may have more than one pet.

The appointment table does not need to change and has been repeated below.

Give the name **and** attributes of three **additional** tables in 3NF. Identify the primary key(s) in each table.

APPOINTMENT (AppointmentID, Date, Time, StaffID, PetID)

Table 1 .....

.....

.....

Table 2 .....

.....

.....

Table 3 .....

.....

.....

[4]

- (c) Part of the table APPOINTMENT is shown. The veterinary surgery uses Data Manipulation Language (DML) statements to search for appointments.

AppointmentID	Date	Time	StaffID	PetID
222010	02/02/2021	12:40	JK1	20CF
222011	02/02/2021	12:40	PP2	10DT
222012	02/02/2021	12:50	JK1	9RR
222013	02/02/2021	13:00	JK1	7MR

- (i) Identify the industry standard language that provides both DML and Data Definition Language (DDL) statements.

.....

..... [1]



- (ii) Write a DDL statement to update the table `APPOINTMENT` and define `AppointmentID` as the primary key.

.....  
 .....  
 .....  
 ..... [2]

- (iii) Complete the DML script to display the times and Pet IDs of all appointments on 02/02/2021 with staff ID of 'JK1', in descending order of time.

SELECT ..... , .....  
 FROM APPOINTMENT  
 WHERE ..... AND .....  
 ORDER BY Time ..... ;  
 [3]

- (d) New pet owners complete a paper-based form to register their pets at the surgery.

- (i) Describe **two** verification checks that can be carried out when the data from the paper-based form is entered into the database.

1 .....  
 .....  
 .....  
 .....  
 .....  
 2 .....  
 .....  
 .....  
 .....  
 ..... [4]

- (ii) Appointments can be booked between 09:00 and 16:50 on Monday to Friday.

Describe the ways in which the appointment date and time can be validated to make sure they are reasonable.

.....

.....

.....

..... [2]

- (e) The surgery has five computers that can all access the database. A copy of the database is stored centrally.

- (i) Complete the description of this type of network model by filling in the missing terms.

The ..... model has one ..... that stores all the data for the surgery. The other computers are ..... When a user requests data, a request is sent to the .....

[4]

- (ii) The surgery wants to keep all data secure. The surgery network is not connected to the Internet.

Identify **two** authentication techniques the surgery could use to restrict access to the data.

1 .....

2 .....

[2]

- 3 Ria manages a team of software developers. The team is creating a mobile application game for a client.

Ria wants to ensure that her team works to the ACM/IEEE Software Engineering Code of Ethics.

- (a) Explain the ways in which Ria and her team can ensure that they follow the Code of Ethics in relation to the product and their colleagues.

(i) Product

.....

.....

.....

..... [2]

(ii) Colleagues

.....

.....

.....

..... [2]

- (b) Ria's client wants to sell the game for a profit. The client cannot decide which type of software licence to use to distribute the game.

Identify **two** types of licence that Ria could recommend to her client **and** justify the use of each licence.

Licence 1 .....

Justification .....

.....

.....

Licence 2 .....

Justification .....

.....


.....

[4]

- 4 The following table shows assembly language instructions for a processor that has one general purpose register, the Accumulator (ACC).

Instruction		Explanation
Op code	Operand	
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC.
LDM	#n	Immediate addressing. Load the denary number n to ACC.
LDI	<address>	Indirect addressing. The address to be used is at the given address. Load the contents of this second address to ACC.
CMP	<address>	Compare the contents of ACC with <address>.
STO	<address>	Store contents of ACC at the given address.
ADD	<address>	Add the contents of the given address to ACC.
SUB	<address>	Subtract the contents of the given address from the contents of ACC.
OUT		Output to screen the character whose ASCII value is stored in ACC.
INC	<register>	Add 1 to the contents of the register (ACC or IX).
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True.
END		Return control to the operating system.

- (a) The current contents of the main memory are:


Address	Instruction
100	LDD 200
101	ADD 201
102	ADD 202
103	SUB 203
104	STO 204
105	END
...	
200	10
201	20
202	5
203	6
204	
205	

Tick (✓) **one** box to indicate which **one** of the following statements is **true** after program execution.

Statements	Tick (✓)
Memory location 204 contains 400	
Memory location 204 contains 41	
Memory location 204 contains 231	
Memory location 204 contains 29	

[1]

(b) The current contents of the main memory are:


Address	Instruction
100	LDM #120
101	ADD 121
102	SUB 122
103	STO 120
104	END
...	
120	10
121	2
122	4
123	6
124	8
125	10

Tick (✓) **one** box to indicate which **one** of the following statements is **true** after program execution.

Statement	Tick (✓)
Memory location 120 contains 135	
Memory location 120 contains 118	
Memory location 120 contains 0	
Memory location 120 contains 16	

[1]

(c) The current contents of the main memory are:

Address	Instruction
150	LDI 200
151	ADD 200
152	ADD 201
153	STO 205
154	END
...	
200	202
201	203
202	201
203	200
204	
205	

Tick (✓) **one** box to indicate which **one** of the following statements is **true** after program execution.

Statement	Tick (✓)
Memory location 205 contains 607	
Memory location 205 contains 601	
Memory location 205 contains 603	
Memory location 205 contains 606	

[1]

(d) Identify **two** modes of addressing that are **not** used in **parts (a), (b) or (c)**.

1 .....

2 .....

[2]

- (e) Assembly language instructions can be put into groups.

Tick (✓) **one** box on each row to indicate the appropriate instruction group for each assembly language instruction.

Assembly language instruction	Arithmetic	Data movement	Jump instruction	Input and output of data
STO 120				
JPE 200				
ADD 3				
LDD 20				
INC ACC				
OUT				

[3]

5 Oscar is watching a concert on his laptop computer.

(a) The concert is streamed to his computer at the same time as it is taking place.

(i) Identify whether Oscar is using real-time or on-demand bit streaming. Justify your choice.

Streaming method .....

Justification .....

.....

.....

.....

.....

[3]

(ii) The video of the concert repeatedly stops and restarts while Oscar is watching it on his laptop computer. His friend is watching the same video of the concert at the same time, in a different location, but he does not experience the same problem as Oscar.

Give **three** possible reasons why Oscar's video constantly stops and starts again.

1 .....

.....

2 .....

.....

3 .....

.....

[3]



- (b) The video of the concert is made up of a sound track and multiple images.

Two successive frames of one section of the video are shown. The pixel colours are represented by letters.

BL	BL	BL	RD	RD	RD
K	K	K	K	K	K
LG	LG	LG	DG	DG	DG
Y	Y	K	Y	Y	K
W	K	W	W	W	DG
P	P	P	P	P	P

**Frame 1**

BL	BL	BL	RD	RD	RD
BL	BL	BL	RD	RD	RD
LG	LG	LG	DG	DG	DG
BK	BK	BK	BK	BK	BK
W	K	W	W	W	DG
P	P	P	P	P	P

**Frame 2**

- (i) Explain the way in which progressive encoding can be used to transmit Frames 1 and 2.

.....  
 .....  
 ..... [2]

- (ii) Explain, using Frames 1 and 2 as an example, the way in which temporal redundancy can be used to compress a video.

.....  
 .....  
 .....  
 .....  
 ..... [3]

- (iii) Give another type of redundancy technique that can be used to compress a video.

..... [1]

- (iv) MP4, WMV and AVI are all examples of a type of format that combines sound and image components into a video.

Identify the type of format that combines the sound and image components into a video.

..... [1]

- 6 (a) Convert the following denary number into a 12-bit two's complement binary form.

-245

--	--	--	--	--	--	--	--	--	--	--	--

[1]

- (b) Convert the following hexadecimal number into denary.

F0

.....  
 ..... [1]

- (c) Convert the following unsigned binary integer into denary.

10101111

.....  
 ..... [1]

- (d) Convert the following Binary Coded Decimal (BCD) into denary.

100001010011

.....  
 ..... [1]

- 7 Anne is downloading a sound file from a web server. She had the choice of a sampling rate of 44.1 kHz or 98 kHz before she downloaded the sound file.

Explain the differences between the two sound files stored on the server.

.....

.....

.....

.....

.....

.....

.....

..... [4]

8 Joshua's laptop is connected to the router on his home network.

- (a) The laptop has a private IP address. The router has both public and private IP addresses.

Explain the reasons why Joshua's laptop has a private IP address only, but the router has both a private and a public IP address.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (b) Joshua visits a website by entering its Uniform Resource Locator (URL).

Describe how the URL is converted into a matching IP address.

.....

.....

.....

.....

.....

.....

.....

..... [3]

- (c) Give **one** example of a valid IPv4 address.

.....

..... [1]

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# Cambridge International AS & A Level

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## COMPUTER SCIENCE

9608/12

Paper 1 Theory Fundamentals

October/November 2020

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

### INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

### INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **16** pages. Blank pages are indicated.

1 Different types of data can be represented in a computer system.

(a) Numeric is one type of data.

(i) Convert the following denary number into Binary Coded Decimal (BCD).

105

..... [1]

(ii) Convert the following two's complement binary integer into denary.

10111111

..... [1]

(iii) Convert the following hexadecimal number into denary.

AB

..... [1]

(b) Character is another type of data.

The following tables show part of the ASCII code character set.

Character	Denary value
A	65
B	66
C	67
D	68
E	69

Character	Denary value
a	97
b	98
c	99
d	100
e	101

(i) Describe how the computer uses ASCII codes to represent characters.

.....

.....

.....

..... [2]

(ii) Convert the following string into ASCII codes.

Bed

.....

..... [1]

(iii) Give the denary ASCII code for the following character.

H

..... [1]

2 One method of compressing a file is run-length encoding (RLE).

(a) Describe, using an example, how a **text file** is compressed using RLE.

.....

.....

.....

.....

.....

..... [3]

(b) Explain why run-length encoding will sometimes increase the size of a text file.

.....

.....

.....

..... [2]

3 (a) Complete the following statements about CPU architecture by filling in the missing terms.

The Von Neumann model for a computer system uses the ..... program concept.

A program is a series of instructions that are saved in .....

The processor ..... each instruction, ..... it and then ..... it.

The processor uses several ..... to store the data and instructions from the program because they can be accessed faster than main memory.

[6]




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- (b) The following table shows assembly language instructions for a processor that has one general purpose register, the Accumulator (ACC).

Instruction		Explanation
Op code	Operand	
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC.
LDM	#n	Immediate addressing. Load the denary number n to ACC.
LDI	<address>	Indirect addressing. The address to be used is at the given address. Load the contents of this second address to ACC.
STO	<address>	Store contents of ACC at the given address.
ADD	<address>	Add the contents of the given address to ACC.
CMP	<address>	Compare the contents of ACC with the contents of <address>.
OUT		Output to screen the character whose ASCII value is stored in ACC.
INC	<register>	Add 1 to the contents of the register (ACC or IX).
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True.
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False.
END		Return control to the operating system.

- (i) The current contents of the main memory are:

**Address      Instruction**

50	LDD 80
51	ADD 80
52	STO 80
53	LDD 82
54	INC ACC
55	STO 82
56	CMP 81
57	JPN 50
58	LDD 80
59	OUT
60	END
...	
80	10
81	2
82	0

**ASCII code table (Selected codes only)**

ASCII Code	Character
38	&
39	'
40	(
41	)
42	*

Trace the program currently in memory using the following trace table. The first instruction has been completed for you.

[illegible]

[5]

- (ii) Assembly language instructions can be put into groups.

Tick (✓) **one** box in each column to identify the appropriate instruction group for each of the three assembly language instructions.

Instruction group	Assembly language instruction		
	STO 80	JPN 50	INC ACC
Input and output of data			
Data movement			
Arithmetic operations			
Unconditional and conditional jump instructions			
Compare instructions			

[3]

- 4 (a) Complete the truth table for the logic expression:

$$X = ((A \text{ NOR } B) \text{ AND } (C \text{ XOR } A)) \text{ OR } B$$

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

- (b) Describe the difference between the operation of an **AND** gate and a **NAND** gate.

.....

.....

.....

[2]

- 5 A teacher uses a relational database, `RESULTS`, to store data about her students and their test results.

(a) Describe the benefits to the **teacher** of using a relational database instead of a file-based approach.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) The teacher sets up the `RESULTS` database using a Database Management System (DBMS).

(i) Explain the ways in which the developer interface of a DBMS will help the teacher set up the database.

.....

.....

.....

..... [2]

(ii) The DBMS creates a data dictionary for the `RESULTS` database.

Identify **three** items that will be included in the data dictionary.

1 .....

2 .....

3 ..... [3]

- (c) The RESULTS database has the following structure:

STUDENT(StudentID, FirstName, LastName, Class, TargetGrade)

TEST(TestID, Topic, MaxMarks)

STUDENT\_TEST(StudentID, TestID, Mark)

- (i) Complete the following table by giving **one** example of each database term from the database RESULTS. Give both the field name and the corresponding table name.

Database term	Field name	Table name
Primary key		
Foreign key		
Attribute		

[3]

- (ii) Tick (✓) **one** box to identify whether the database RESULTS is in 1NF, 2NF or 3NF. Justify your choice.

1NF	2NF	3NF

Justification: .....

.....

.....

..... [3]

- (iii) Complete the Data Manipulation Language (DML) script to display the Student ID, mark and maximum marks for all tests with the topic of 'Programming'.

SELECT StudentID, Mark, .....

FROM STUDENT\_TEST, .....

..... Topic = "Programming"

AND ..... = .....;

[5]

- (iv) The teacher wants to implement validation to make sure that all data entered into the database `RESULTS` are reasonable.

Name **three** different methods of data validation that can be used in the `RESULTS` database. Describe how each method will limit the data that can be entered in this database.

Method 1 .....

Description .....

.....

Method 2 .....

Description .....

.....

Method 3 .....

Description .....

.....

[6]

- (d) The teacher stores the database on the desktop computer in her classroom.

- (i) Explain why it is important to keep the database secure.

.....

.....

.....

..... [2]

- (ii) Explain the ways in which the teacher can use data backup and disk mirroring to limit the amount of data lost in the event of hardware failure.

Data backup

.....

.....

.....

.....

Disk mirroring

.....

.....

.....

.....

[4]

**6** Malika has started a new job as a trainee software engineer.

- (a)** Malika's manager has asked her to work with a senior software engineer for the first week.

Explain the ways in which Malika's manager has acted ethically.

.....

.....

.....

..... [2]

- (b)** Malika researched the company and the programming languages used by the company before she started the job.

Explain the ways in which Malika has acted ethically.

.....

.....

.....

..... [2]

- (c)** Malika thinks that her colleagues do not like her, so she asks her manager for help.

Describe the actions the manager could take to support Malika in an ethical way.

.....

.....

.....

..... [2]



7 A web server has a public IPv4 address.

(a) Draw lines to link each characteristic to its appropriate IP address.

Characteristic	IP address
Can use hexadecimal notation	
Each group of digits is a number between 0 and 65535	IPv4
Consists of four groups of digits	
Uses double colons (::)	IPv6
The total length of the address is 32 bits	

[2]

(b) IP addresses can be static or dynamic.

Explain the reasons for the web server using a static instead of a dynamic IP address.

.....

.....

.....

.....

.....

..... [3]





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## 9608/13

October/November 2020

**1 hour 30 minutes**

You must answer on the question paper.

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **16** pages. Blank pages are indicated.

1 Identify the **most appropriate** utility program to use for each of the following tasks.

Task	Utility program
Rearrange the data on a disk so that files are contiguous, and all free space is collected together	
Prepare a disk for initial use	
Reduce the size of a file	
Examine a disk to find any bad sectors	

[4]

2 Four terms about videos are given with six descriptions.

Draw **one** line from each term relating to videos to its correct description.

**Term**

**Description**

Progressive encoding

The number of images that are displayed per second

Frame rate

The number of pixels per unit of measurement  
e.g. per inch

Interlaced encoding

Each frame is split into two fields: the first field contains only the odd lines, the second field contains the even lines

Image resolution

Only the pixels that have changed are transmitted

The complete frame is reproduced in each scan of the image

The number of pixels in the image

[4]

- 3 Hannah is writing a computer program using a high-level language. She uses both a compiler and an interpreter.

(a) Describe the ways in which Hannah will use an interpreter while writing the program.

.....

.....

.....

..... [2]

(b) Explain the reasons why Hannah uses a compiler when she has finished writing the program.

.....

.....

.....

..... [2]

(c) Some high-level languages are partially compiled and partially interpreted.

Give **one** benefit and **one** drawback of using a language that is partially compiled and partially interpreted.

Benefit .....

.....

Drawback .....

.....

[2]

4 A laptop on a home network connects to the Internet through a router.

(a) The laptop has an IP address.

(i) Give the reasons why the laptop has an IP address.

.....

.....

.....

..... [2]

(ii) The laptop's IP address is private.

Give the reasons why the laptop does **not** have a public IP address.

.....

.....

.....

..... [2]

(iii) The router has an IPv4 address.

Give **three** differences between the format of an IPv4 address and an IPv6 address.

1 .....

.....

2 .....

.....

3 .....

.....

[3]



- (b) A Public Switched Telephone Network (PSTN) is one example of a communication system that can be used to support the Internet.

Identify **and** describe **two other** communication systems that can be used to support the Internet.

System 1 .....

Description .....

.....

System 2 .....

Description .....

.....

[4]

(c) A web page contains PHP code.

(i) Complete the following table by writing a description of the function of each line of PHP code.

PHP code	Description
<code>echo "Hello World";</code>	
<code>\$number1 = 22;</code>	
<code>\$newValue = \$_GET["number"];</code>	
<code>print "Hello " . \$name . "&lt;br&gt;;</code>	

[4]

(ii) PHP is a server-side scripting language.

Give an example of a client-side scripting language.

.....  
 ..... [1]

(d) The laptop includes a parity bit in each byte it transmits.

Explain how parity checks protect the integrity of the data.

.....  
 .....  
 .....  
 ..... [2]

5 The fetch-execute cycle is used when a computer processor runs a program.

(a) (i) Complete the table by writing the register transfer notation for each of the descriptions.

Letter	Description	Register transfer notation
<b>A</b>	The Memory Address Register (MAR) stores an address. The contents of this stored address are copied to the Memory Data Register (MDR).	
<b>B</b>	The contents of the Program Counter (PC) are copied to the Memory Address Register (MAR).	
<b>C</b>	The contents of the Memory Data Register (MDR) are copied to the Current Instruction Register (CIR).	
<b>D</b>	The contents of the Program Counter (PC) are incremented.	

[4]

(ii) Write one of the letters **A**, **B**, **C** or **D** (from the table above) on each row (1 to 4), to show the correct order of the fetch-execute cycle.

1 .....

2 .....

3 .....

4 .....

[2]

(b) Buses are used to transfer data between various components of the computer system.

Tick (✓) **one or more** boxes on each row to identify the bus(es) each statement describes.

Statement	Address bus	Control bus	Data bus
Receives data from the MAR			
Carries an address or an instruction or a value			
Transmits timing signals to components			
Bidirectional			

[2]

- (c) The following table shows assembly language instructions for a processor that has one general purpose register, the Accumulator (ACC).

Instruction		Explanation
Op code	Operand	
INV		Input a denary value from the keyboard and store it in ACC.
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC.
LDM	#n	Immediate addressing. Load the denary number n to ACC.
LDI	<address>	Indirect addressing. The address to be used is at the given address. Load the contents of this second address to ACC.
ADD	<address>	Add the contents of the given address to ACC.
OUT		Output to screen the character whose ASCII value is stored in ACC.
INC	<register>	Add 1 to the contents of the register (ACC or IX).
CMP	<address>	Compare the contents of ACC with the contents of <address>.
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True.
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False.
STO	<address>	Store contents of ACC at the given address.
END		Return control to the operating system.

- (i) The assembly language instructions are grouped according to their function.

Write **one** example of an op code from the table of instructions for each of the following groups.

Arithmetic .....

Data movement .....

[2]

- (ii) The current contents of the main memory are:

Address	Instruction
500	INV
501	STO 901
502	INV
503	STO 900
504	ADD 902
505	STO 902
506	LDD 903
507	INC ACC
508	STO 903
509	CMP 901
510	JPN 502
511	END
...	⋮
900	
901	
902	0
903	0

Trace the program currently in memory using the following trace table when the values 2, 10 and 3 are input.

The first instruction has been completed for you.

[illegible]

(d) The current contents of a general-purpose register **X** are:

<b>X</b>	1	1	0	0	1	0	1	0
----------	---	---	---	---	---	---	---	---

(i) The contents of **X** represent an unsigned binary integer.

Convert the contents of **X** into denary.

..... [1]

(ii) The contents of **X** represent a two's complement binary integer.

Convert the contents of **X** into denary.

..... [1]

(iii) State why the binary number in **X** cannot represent a Binary Coded Decimal (BCD).

.....

..... [1]

6 Lara is managing a team of software developers who are writing a computer program.

(a) Benedict is one of the developers. He is struggling to keep up with his workload.

Describe the ways in which Lara can ethically support Benedict.

.....

.....

.....

..... [2]

(b) Lara has identified that when a specific sequence of actions is performed in the program, a run-time error causes the program to crash.

She has decided there is not enough time to debug the code because the client needs the system urgently, and there is a possibility that the client may never perform this sequence of actions.

Explain the reasons why Lara is not acting ethically.

.....

.....

.....

..... [2]

(c) The client wants to copyright the final program so that no one else can copy or amend it.

(i) State the purpose of copyrighting the computer program.

.....

..... [1]

(ii) Identify **two** software licences that would be appropriate for the program.

Licence 1 .....

Licence 2 ..... [2]

(iii) Identify **one** software licence that would **not** be appropriate for the program. Justify your choice.

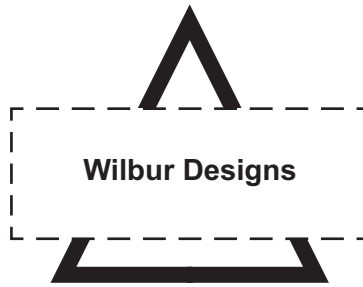
Software licence .....

Justification .....

.....

..... [2]

- 7 Wilbur uses vector graphics to create a logo for his company.



- (a) Describe how the logo is represented and encoded by the computer.

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (b) Wilbur scans a hand drawn image. The scanned image uses 8 bits to store the colour for each pixel. The image is 2048 pixels wide by 1024 pixels high.

- (i) Calculate an estimate of the file size of the scanned image. Give your answer rounded to the nearest MB.

Show your working.

.....

.....

.....

.....

Answer ..... MB

[2]



- (ii) Wilbur wants to compress the scanned image before emailing it to his colleague.

Describe **one** lossy compression technique that Wilbur can use to compress this image.

.....

.....

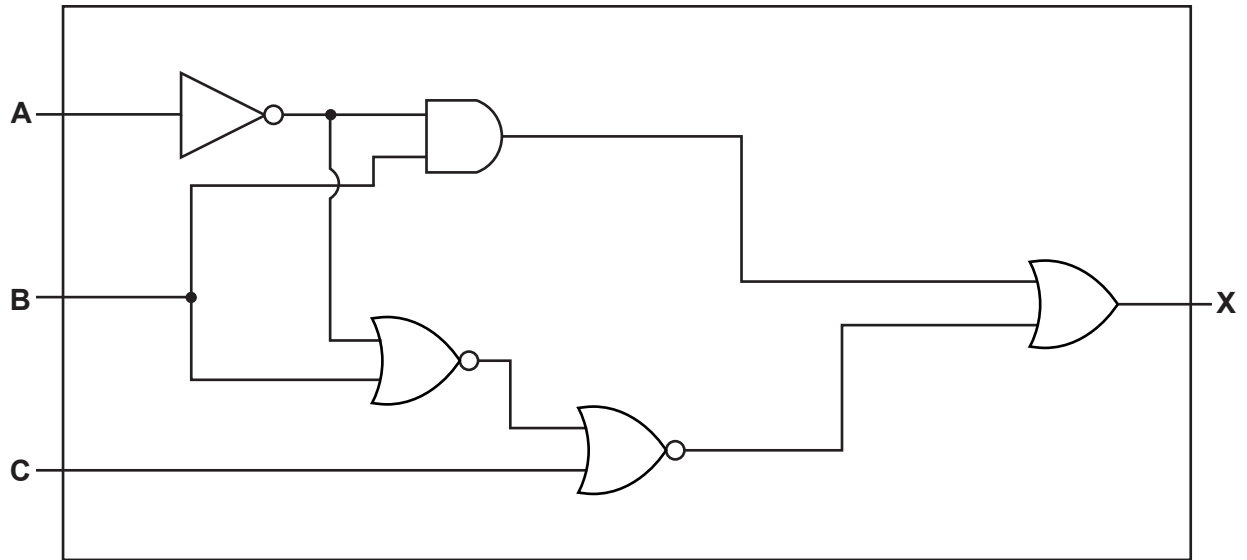
.....

.....

.....

..... [3]

8 Consider the following logic circuit.



(a) Complete the truth table for the logic circuit.

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

(b) Identify **one** logic gate **not** used in the logic circuit shown. Complete the truth table for this logic gate with the inputs **A** and **B**.

Logic gate .....

A	B	Output
0	0	
0	1	
1	0	
1	1	

[2]



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## 9608/11

May/June 2021

**1 hour 30 minutes**

You must answer on the question paper.

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **20** pages. Any blank pages are indicated.

- 1 Draw **one** line from each software licence to its correct description.

**Software licence****Description**

Shareware

A limited version of the software could be released and downloaded by anyone, but users would need to pay to unlock additional features.

Open  
Source

A licence **must** be purchased to use the software.

Commercial

Users **cannot** download the software over the Internet.

The original source code is made available for other developers who can then modify and improve the software.

[3]

- 2 Zak designs a logo for his company. He uses vector graphics software to create the logo.



- (a) One of the drawing objects in the logo is a circle.

Identify **four** properties of the circle.

- 1 .....
- 2 .....
- 3 .....
- 4 ..... [4]

- (b) Describe what is meant by a **drawing list** using the logo as an example.

- .....
- .....
- .....
- ..... [2]

- (c) Zak could have used a bitmapped image for the logo.

Describe **two** drawbacks of using a bitmapped image for the logo instead of a vector graphic.

Drawback 1 .....

.....

.....

.....

Drawback 2 .....

.....

.....

.....

[4]

- (d) Zak's company holds details about clients in a database.

Give **three** security measures that Zak can implement to make sure that only authorised employees can access the data.

1 .....

2 .....

3 .....

[3]




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- 3 The table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Op code	Operand	
LDD	<address>	Direct addressing. Load the content of the location at the given address to ACC.
LDI	<address>	Indirect addressing. The address to be used is at the given address. Load the contents of this second address to ACC.
DEC	<register>	Subtract 1 from the contents of the register (ACC or IX).
CMP	<address>	Compare the contents of ACC with the contents of <address>.
JMP	<address>	Jump to the given address.
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True.
STO	<address>	Store the contents of ACC at the given address.
END		Return control to the operating system.

The current contents of the main memory are:

Address	Instruction
100	LDD 200
101	CMP 201
102	JPE 106
103	DEC ACC
104	STO 200
105	JMP 101
106	END
...	
200	2
201	0
202	200

- (a) Trace the program currently in memory using the following trace table.

Instruction address	ACC	Memory address		
		200	201	202
		2	0	200

[3]

- (b) The instruction in memory address 100 needs to be changed. It needs to use indirect addressing to load the contents of memory address 200.

Give the new instruction to replace LDD 200.

..... [1]

(c) Each instruction in the assembly language program is encoded in 16 bits (8-bit op code followed by an 8-bit operand).

(i) The instruction `CMP 201` has the operand 201.

Convert the operand 201 into 8-bit binary.

--	--	--	--	--	--	--	--

[1]

(ii) State the **maximum** number of op codes that can be represented using eight bits.

..... [1]

(d) The status register contains condition flags.

Identify **three** condition flags that can be set in the status register.

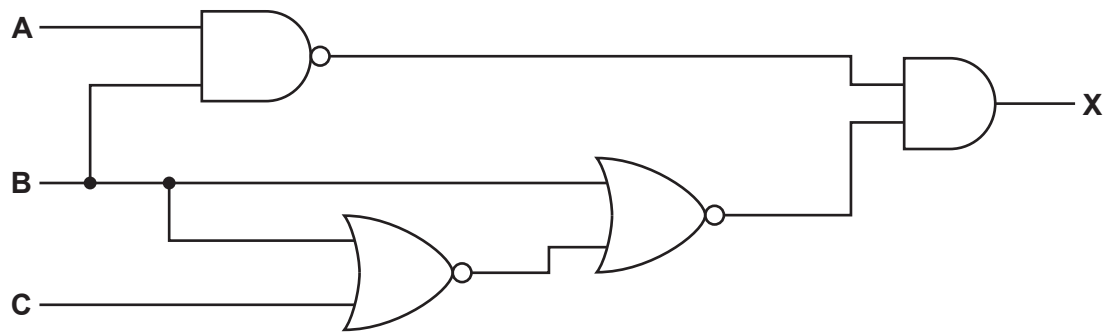
1 .....

2 .....

3 .....

[3]

4 Consider the following logic circuit:



(a) Complete the truth table for the logic circuit.

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

(b) Identify **three** logic gates **not** used in the logic circuit.

Gate 1 .....

Gate 2 .....

Gate 3 .....

[1]

- 5 A company runs activity courses. It is creating a relational database to store details of the courses it runs.

The database has five tables:

EMPLOYEE(EmployeeID, FirstName, LastName, Role, Language)

BOOKING(BookingID, CustomerID, CourseID)

CUSTOMER(CustomerID, FirstName, LastName)

COURSE(CourseID, Title, Level, Date)

COURSE\_EMPLOYEE(CourseID, EmployeeID)

- (a) Complete the entity relationship (E-R) diagram for the database.



[4]

- (b) Describe what is meant by **referential integrity**.  
Give an example from the CUSTOMER and BOOKING tables in your answer.

.....

.....

.....

..... [2]

- (c) A Data Definition Language (DDL) is used to create the structure of the database. One item that can be created is the database.

Identify **three other** items that can be created in the database using the DDL.

- 1 .....
- 2 .....
- 3.....
- [3]

- (d) Part of the `EMPLOYEE` table is shown.

EmployeeID	FirstName	LastName	Role	Language
001	Jasmine	Chen	Leader	French
002	Kenton	Archer	Leader	English
003	Michael	Roux	Cook	French
004	Conrad	Slavorski	Leader	Russian

Write a Data Manipulation Language (DML) statement to return the first name and last name of all employees, who are leaders, and speak either French or English.

.....

.....

.....

.....

.....

..... [4]

**6** A web page includes HTML, JavaScript and PHP code.

```

01  <html>
02  <body>
03
04  <p>
05  <?PHP
06      $message = "Enter the current time"
07      echo $message
08  ?>
09  </p>
10
11  24 hour clock hour<input id = "Time" value = "">
12  <button onclick = "timeOfDay()">Enter</button>
13
14  <script>
15      function timeOfDay() {
16          var hour, greeting;
17          hour = document.getElementById("Time").value;
18          if (hour < 18) {
19              greeting = "Good day";
20          } else {
21              greeting = "Good evening";
22          }
23          alert(greeting);
24      }
25  </script>
26
27  </body>
28  </html>

```

**(a)** The page is loaded and the value 16 is entered.

State the output when the enter button is clicked.

..... [1]

**(b)** Give the line number where the JavaScript function is called.

..... [1]

**(c)** Give the identifier names of **two** variables used in the JavaScript code.

1 .....

2 .....

[1]



- (d) Tick (✓) **one** box in each row to indicate whether each of the following statements is true or false.

Statement	True	False
The program contains client-side and server-side code		
The PHP code in the program will run on the client-side		
Line 19 of the code outputs the message "Good day"		
Line 18 of the code contains a conditional statement		

[2]

- (e) Examine the following list of terms:

**bandwidth**      **browser**      **compiler**      **HTML**      **interpreter**  
**JavaScript**      **PHP**      **router**      **server**      **server-side**  
**transmission**      **validation**

Complete the following sentences by filling in the missing terms from the list.  
Some terms may be used more than once. Some terms are not used.

..... can be performed both client-side and server-side.

It is performed more rapidly by the ..... because there is no delay in  
transmitting and receiving data to and from the .....

It is also performed on the server-side, because the client's ..... may  
not support ....., so the data will still need checking to avoid errors.

[5]

7 This question presents three scenarios.

Tick (✓) **one** box for each scenario to indicate whether you think the behaviour shown is ethical or unethical. Justify your choice.

- (a) Marina has a very short deadline to create a piece of software for a client. Algorithm A is quick to code and simpler to test but has an inefficient run time. Algorithm B is more complex to code and test but has a more efficient run time. She decides to implement algorithm A.

Ethical	
Unethical	

Justification .....

.....

.....

.....

..... [2]

- (b) Doug is managing a project for a client that has fallen behind schedule. He asks all members of the project team to work extra hours and to cancel any holiday plans to get the project back on schedule.

Ethical	
Unethical	

Justification .....

.....

.....

.....

..... [2]

- (c) Debbie is programming a car safety management system. She thinks that the test plan she has been given is not adequate. She decides to discuss her concerns on a public internet forum.

Ethical	
Unethical	

Justification .....

.....

.....

.....

..... [2]

8 Jay is developing a computer game that allows users to create stories.

(a) Jay uses a language translator to develop the computer game.

(i) Tick (✓) **one or more** boxes in each row to identify the language translator(s) each statement describes.

Statement	Assembler	Interpreter	Compiler
Translates and executes each line of source code one line at a time			
Translates low-level source code into machine code			
Must be present in memory to execute the code			
Translates high-level source code into low-level code			

[4]

(ii) Jay decides to use a compiler to develop the game.

Identify **two** benefits of using a compiler.

Benefit 1 .....

.....

Benefit 2 .....

.....

[2]

- (b) The game generates a story which is stored as a text file.  
Jay compresses the text file using lossless compression before sending it by email to his friend.

(i) Identify **two** reasons for compressing the text file.

1 .....

.....

2 .....

.....

[2]

(ii) Explain the reasons why Jay compresses the text file with lossless compression instead of lossy compression.

.....

.....

.....

..... [2]

- 9 (a) Identify **two** differences between a public IP address and a private IP address.

1 .....

.....

2 .....

.....

[2]

- (b) Complete the table by identifying the **most appropriate** term for each description. Each term must be different.

Description	Term
Receives data packets from a network and forwards them onto a similar network	
Manages access to a centralised resource	
Joins networks that use different sets of rules to transmit data	
Monitors and controls incoming and outgoing network traffic based on set criteria	

[4]

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## 9608/12

May/June 2021

**1 hour 30 minutes**

You must answer on the question paper.

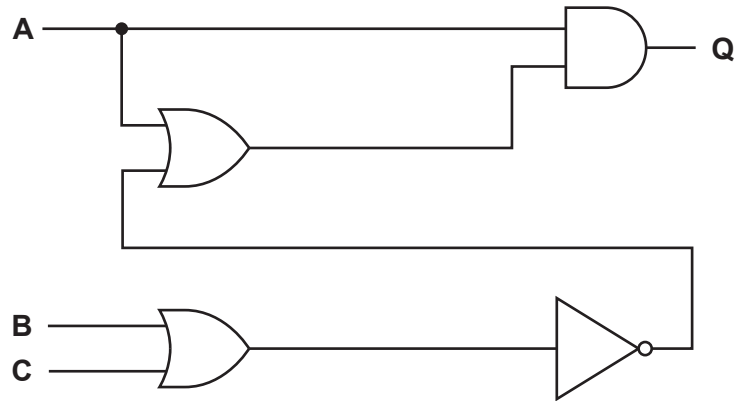
No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **20** pages. Any blank pages are indicated.

1 Consider the following logic circuit:



(a) Complete the truth table for the logic circuit.

A	B	C	Working space	Q
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

(b) Identify the **three** logic gates used in the given logic circuit.

Gate 1 .....

Gate 2 .....

Gate 3 .....

[1]

- 2 The following diagram shows four register notations and seven descriptions.

Draw **one** line from each register notation to its **most appropriate** description.


Register notation	Description
MDR	Holds the op code and operand of an instruction ready for it to be decoded
	Holds the address of the next instruction to be read
CIR	Holds flags that are set when the Arithmetic and Logic Unit (ALU) executes instructions
	Holds data read from, or to be written to, memory
MAR	Holds the current value in the Index Register
	Holds the address where data is to be written to or read from
PC	Holds the result of the last instruction executed by the ALU

[4]

- 3 The table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Op code	Operand	
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC.
LDI	<address>	Indirect addressing. The address to be used is at the given address. Load the contents of this second address to ACC.
STO	<address>	Store the contents of ACC at the given address.
ADD	<address>	Add the contents of the given address to ACC.
INC	<register>	Add 1 to the contents of the register (ACC or IX).
JMP	<address>	Jump to the given address.
CMP	<address>	Compare the contents of ACC with the contents of <address>.
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True.
END		Return control to the operating system.

The current contents of the main memory are:

Address	Instruction
50	LDI 103
51	CMP 101
52	JPE 59
53	ADD 102
54	STO 102
55	LDD 100
56	INC ACC
57	STO 100
58	JMP 51
59	ADD 102
60	STO 102
61	END
...	
100	1
101	3
102	0
103	100

**(a)** Trace the program currently in memory using the following trace table.

[illegible]

- (b) The instruction in memory address 50 needs to be changed to use direct addressing to load the contents of the memory location at address 100.

Give the new instruction to replace `LDI 103`.

..... [1]

- (c) Each instruction in the assembly language program is encoded in 16 bits (8-bit op code followed by an 8-bit operand).

- (i) The instruction `JPE 59` has the operand 59.

Convert the operand 59 into 8-bit binary.

--	--	--	--	--	--	--	--

[1]

- (ii) Convert the denary value 59 into hexadecimal.

..... [1]

- (d) The assembly language program uses direct and indirect addressing.

Identify **two other** modes of addressing used in an assembly language program.

1 .....

2 .....

[2]

- 4 K2 Mountain Guiding is a company that runs courses teaching people how to climb mountains. The company uses a file-based approach to store and retrieve data.

(a) Describe **three** drawbacks of a file-based approach compared to a relational database.

Drawback 1 .....

.....

.....

.....

Drawback 2 .....

.....

.....

.....

Drawback 3 .....

.....

.....

.....

[6]

- (b) Each course has a destination and a trip date, and is run by a guide. Customers can book a place on one or more courses.

The following table shows part of the stored file:

Customer name	Customer date of birth	Guide	Destination	Trip date
Jay Patel	10/10/1976	Artem	Elbrus	06/03/2023
Paul Schloss	10/04/1999	Kenton	K2	01/03/2022
Mina Wang	03/03/2000	Kenton	K2	01/03/2022
Paul Schloss	10/04/1999	Safia	Mont Blanc	07/07/2024
Jay Patel	10/10/1976	Safia	K2	04/04/2023

The company has decided to create a relational database to replace the current file-based approach.

Identify **three** reasons why the data in this table is not in First Normal Form (1NF).

1 .....

.....

2 .....

.....

3 .....

.....

[3]



(c) The table, `GUIDE_TABLE`, is created.

Each guide has a unique guide ID.

Part of the table `GUIDE_TABLE` is shown:

GuideID	Guide	DateOfBirth	Gender
1	Artem	07/03/1992	M
2	Kenton	08/04/1984	M
3	Safia	10/10/1999	F

Write a Data Definition Language (DDL) statement to define the table `GUIDE_TABLE`.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

**5** A web page includes HTML and JavaScript code.

```

01 <html>
02 <body>
03
04 Calculate area of a triangle:
05 <form name = "Triangle">
06   <p>Base <input type = "number" name = "B" value = ""></p>
07   <p>Height <input type = "number" name = "H" value = ""></p>
08   <button onclick = "area()">Calculate</button>
09 </form>
10
11 <script>
12 function area() {
13   var base = document.forms["Triangle"]["B"].value;
14   var height = document.forms["Triangle"]["H"].value;
15   if (base == "" || height == "") {
16     alert("Both values must be entered");
17     return false;
18   }
19   else {
20     area = 0.5 * height * base;
21     alert("The area is: " + area);
22   }
23 }
24 </script>
25 </body>
26 </html>

```

**(a)** Give the **three** identifiers used in the JavaScript code.

- 1 .....
- 2 .....
- 3 ..... [2]

**(b)** State the purpose of the code on line 08.

- .....
- ..... [1]

- (c) The page is loaded and the values 2 and 8 are entered.

State the output when the calculate button is clicked.

.....  
..... [1]

- (d) State the meaning of the `||` operator in line 15 of the code.

..... [1]

- (e) Data validation has been used in line 15 of the JavaScript code.

- (i) Identify the type of data validation used in line 15.

..... [1]

- (ii) Identify **two** other data validation checks that could be used.

1 .....  
2 .....  
[2]

**Question 5 continues on the next page.**

Cambridge International Holidays allows customers to make holiday bookings on its website.

(f) Bochen visits the Cambridge International Holidays website to book a holiday.

The sequence (1 to 8) below describes the steps that take place when he submits a booking.

Four of the statements **A**, **B**, **C**, **D**, **E** and **F** are used to complete the sequence.

<b>A</b>	Any errors found at the server side are flagged, and step 1 is repeated.
<b>B</b>	HTML code is used on the client's web browser to validate the form data.
<b>C</b>	PHP code is executed to generate a confirmation (HTML) web page that is returned to the client's web browser.
<b>D</b>	The form data is transmitted to Cambridge International Holidays' web server.
<b>E</b>	JavaScript code is executed to generate a confirmation (HTML) web page that is returned to the client's web browser.
<b>F</b>	JavaScript code is executed on the client's web browser to validate the form data.

Write **one** of the letters (**A**, **B**, **C**, **D**, **E** or **F**) in the appropriate row to complete the sequence.

- 1 Bochen completes the online booking and clicks 'Submit'.
- 2 .....
- 3 Any errors found are flagged, and step 1 is repeated.
- 4 .....
- 5 PHP code is executed to perform extra data validation checks on the form data.
- 6 .....
- 7 The booking details are added to the database.
- 8 .....

[4]

6 This question presents three scenarios.

Tick (✓) **one** box for each scenario to indicate whether you think the named person's behaviour is ethical or unethical. Justify your choice.

- (a) Latifah has changed jobs and has started to work for a new company. The company uses an Integrated Development Environment (IDE) to develop code. Latifah decides not to use the IDE that the company has because she is familiar with a different IDE.

Ethical	
Unethical	

Justification

.....

.....

.....

.....

..... [2]

- (b) Samid is in charge of a project to write a banking application. He is employing staff to work on the application. His daughter is a computer security expert. She is looking for a new job. Samid decides to employ his daughter.

Ethical	
Unethical	

Justification

.....

.....

.....

.....

..... [2]

- (c) Jason works for a social media company. He is concerned that users of the company's social media website have not been told how their personal data is being used.

Jason tells his manager his concerns. His manager tells him not to worry because there have been no complaints from the users. Jason takes no further action.

Ethical	
Unethical	

Justification

.....

.....

.....

.....

..... [2]

- 7 Sam is a photographer. She has an image library of over 10 000 images. She stores the images on a high capacity magnetic hard disk.

(a) Explain why Sam would use the following utility software.

(i) Backup

.....

.....

..... [2]

(ii) Defragmenter

.....

.....

..... [2]

(iii) Disk repair

.....

.....

..... [2]

(b) The images are stored as bitmap files.

Identify **four** items that will be stored in the header of a bitmap file.

1 .....

2 .....

3 .....

4 ..... [4]

- (c) The bitmap images are compressed for use on a website.

Tick (✓) **one** box to select the **most appropriate** type of compression for the images used on the website and justify your answer.

Lossy	
Lossless	

Justification

.....

.....

.....

.....

.....

..... [3]



- 8 (a) Complete the following table by identifying the **most appropriate** term for each description. Each term must be different.

Description	Term
Ensures data is accurate and up to date	
Prevents accidental or malicious data loss	
Prevents unauthorised access to data	

[3]

- (b) Describe what is meant by a **digital signature**.

.....

.....

.....

..... [2]

9 Networks can be either wired using cables or wireless using radio waves.

(a) Describe **one** benefit of using a wireless network compared to using a wired network.

.....

.....

.....

..... [2]

(b) Describe **two** drawbacks of using a wireless network compared to using a wired network.

Drawback 1 .....

.....

.....

.....

Drawback 2 .....

.....

.....

..... [4]

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# Cambridge International AS & A Level

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## COMPUTER SCIENCE

9608/13

Paper 1 Theory Fundamentals

May/June 2021

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

### INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

### INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **16** pages. Any blank pages are indicated.

1 An adventure sports company has a website.

- (a) Customers can book courses using an online booking form. The booking form contains a number of fields.

The following table gives a description of the validation for each field.

Write the validation type for each validation description in the table.

Field	Validation description	Validation type
Name	A name must be entered	
Date of Birth	Entered as dd/mm/yyyy	
Telephone Number	A limit of 15 characters can be entered	
Experience Level	Only values between 1 and 5 can be entered	

[4]

- (b) (i) Validation is one way to protect the integrity of input data.

Identify **one other** method to protect the integrity of input data.

..... [1]

- (ii) The data input will be transferred to a central server.

Identify **two** measures to protect the integrity of the data during transfer.

1 .....

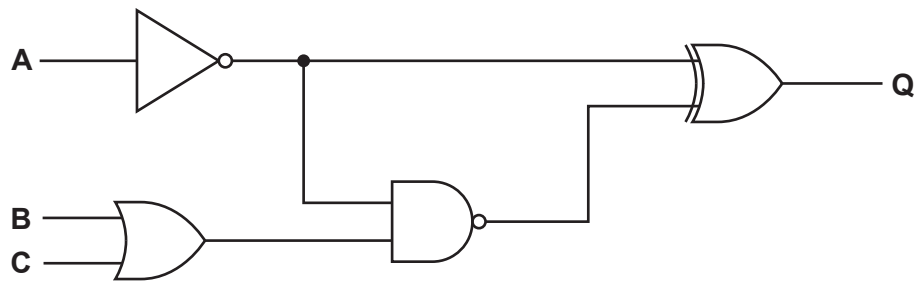
.....

2 .....

.....

[2]

2 Consider the following logic circuit:



(a) Complete the truth table for the logic circuit.

A	B	C	Working space	Q
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

(b) Identify **four** logic gates used in the logic circuit above.

- 1 .....
- 2 .....
- 3 .....
- 4 .....

[1]

- 3 The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Op code	Operand	
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the index register. Copy the contents of this calculated address to ACC.
LDR	#n	Immediate addressing. Load the number n to IX.
DEC	<register>	Subtract 1 from the contents of the register (ACC or IX).
JMP	<address>	Jump to the given address.
CMP	<address>	Compare the contents of ACC with the contents of <address>.
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True.
OUT		Output to the screen the character whose ASCII value is stored in ACC.
END		Return control to the operating system.

The current contents of the main memory and selected values from the ASCII character set are:

**Address Instruction**

75	LDR #2
76	LDX 180
77	CMP #0
78	JPE 82
79	OUT
80	DEC IX
81	JMP 76
82	END
...	↷
180	0
181	41
182	71
183	40
184	70
185	43
186	69

**ASCII code table (selected codes only)**

ASCII code	Character
36	\$
40	(
41	)
43	+
69	E
70	F
71	G



**(a)** Complete a trace table for the execution of the program.

[illegible]

[5]

(b) Identify **two** modes of addressing that are **not** used in the assembly language program given.

1 .....

2 ..... [2]

(c) Each instruction in the assembly language program is encoded in 16 bits (8-bit op code followed by an 8-bit operand).

(i) The instruction `LDX 234` has the operand 234.

Convert the operand 234 into 8-bit binary.

--	--	--	--	--	--	--	--

[1]

(ii) Convert the denary value 234 into hexadecimal.

..... [1]

(iii) The contents of memory address 190 represent a two's complement binary integer.

**Address**

190

1	1	0	1	1	0	0	1
---	---	---	---	---	---	---	---

Convert the value in memory address 190 into denary.

..... [1]

(d) The fetch-execute (FE) cycle is shown in register transfer notation.

Complete the FE cycle using register transfer notation.

.....  $\leftarrow$  [PC]

PC  $\leftarrow$  ..... + 1

MDR  $\leftarrow$  [ [MAR] ]

.....  $\leftarrow$  [MDR]

[3]

4 An operating system (OS) is installed on a computer.

(a) The OS performs a number of different tasks such as device management and error detection and recovery.

(i) State **three** device management tasks the OS performs.

- 1 .....
- 2 .....
- 3 ..... [3]

(ii) State **three** error detection and recovery management tasks the OS performs.

- 1 .....
- 2 .....
- 3 ..... [3]

(iii) State **two** tasks, other than device management and error detection and recovery management that are carried out by an OS.

- 1 .....
- 2 ..... [2]

(b) Utility programs are installed on a new computer.

(i) The following table lists six programs.

Tick (✓) **one** box in each row to identify whether the program is a utility program or not a utility program.

Program	Utility	Not utility
Language translator		
Backup		
Integrated Development Environment (IDE)		
Graphics		
Defragmenter		
Spreadsheet		

[2]

(ii) Identify **two other** utility programs.

1 .....

2 .....

[2]

5 A web page `staff.html` contains the following HTML and PHP code.

```

01 <html>
02 <body>
03 <p><b>Current Staff</b></p>
04
05 <?php
06     echo "<h1>Staff list</h1>";
07     echo "<p>";
08
09     $first_name="Jason";
10     $last_name="Chan";
11
12     $result = $first_name." ".$last_name;
13     echo $result;
14 ?>
15
16 </body>
17 </html>

```

(a) Give the identifier of **two** variables used in the PHP code.

- 1 .....
- 2 ..... [2]

(b) The PHP code produces multiple outputs.

Give **all** the line numbers where the PHP code produces an output.

..... [1]

(c) Describe the purpose of line 12 of the code.

.....

.....

.....

..... [2]

- 6 (a) A customer completes a booking form on a web page and clicks a submit button to submit the form.

The following sequence (1 to 6) describes the steps that take place when the form is submitted.

- 1 .....
- 2 The form data is transmitted to the web server
- 3 .....
- 4 .....
- 5 The HTML code is returned to the browser
- 6 .....

Write **one** of the letters A to D in each row (1, 3, 4 and 6) to complete the sequence.

A	The browser displays the web page
B	Server-side code is processed
C	Client-side code is processed
D	The web server produces the HTML code

[3]

- (b) The web page 9608.html is accessed from the URL:

`https://www.cambridgeinternational.org/9608.html`

An employee of the company states, "A Domain Name and an IP address are exactly the same thing".

State whether this statement is true or false **and** justify your choice.

.....

.....

.....

.....

.....

.....

..... [3]

- 7 Patrick is writing a new software application. He is using a compiler to develop the software application.

(a) Describe the drawbacks of using a compiler instead of an interpreter.

.....

.....

.....

.....

.....

..... [3]

(b) Patrick has completed the application. He needs to choose whether to distribute the software application using an open source licence or a commercial licence.

Describe **open source** and **commercial** software licensing.

Open source .....

.....

.....

.....

Commercial .....

.....

.....

..... [4]

(c) Patrick works for a company that has a code of conduct for its employees.

Explain the reasons why the company needs a professional code of conduct.

.....

.....

.....

.....

.....

..... [3]

**8** A charity has a relational database, CHARITY\_PROJECT.

The database has three tables to store information about the charity's employees, the projects and the project teams.

EMPLOYEE(EmployeeID, FirstName, LastName, Salary, DOB)

PROJECT(ProjectID, Name, Location, ProjectStartDate)

PROJECT\_TEAM(EmployeeID, ProjectID, JoinedProjectDate)

- (a) Complete the entity relationship (E-R) diagram to show the relationships between these tables.



[2]

- (b) Explain how primary and foreign keys are used to link the tables in CHARITY\_PROJECT.

.....

.....

.....

.....

.....

.....

.....

..... [4]



- (c) The database needs to store the gender of each employee (either **M** for Male or **F** for Female).

Write a Data Definition Language (DDL) statement to add the attribute `Gender` to the `EMPLOYEE` table.

.....

.....

.....

.....

.....

..... [2]

- (d) Part of the `EMPLOYEE` table is shown:

<b>EmployeeID</b>	<b>FirstName</b>	<b>LastName</b>	<b>Salary</b>	<b>DOB</b>	<b>Gender</b>
001	Jasmine	Chen	25 000	25/12/2000	F
002	Kenton	Archer	20 000	01/04/1993	M
003	Michael	Roux	10 000	10/03/1990	M
004	Conrad	Slavorski	15 000	30/03/1989	M

Each employee is paid a salary in dollars (\$).

Write a Data Manipulation Language (DML) statement to return the first name, last name and salary of all employees that are paid more than \$17 500.

.....

.....

.....

.....

.....

..... [3]

9 A website streams music and videos.

(a) Two descriptions about how sound is encoded and represented on a computer are given.

Give the correct term for each description.

(i) “The number of samples taken per unit time”

Term ..... [1]

(ii) “The number of bits used to encode each sample”

Term ..... [1]

(b) Videos on the website are compressed. Compression algorithms can use spatial redundancy or temporal redundancy.

Describe **spatial redundancy** and **temporal redundancy**.

Spatial .....

.....

.....

.....

Temporal .....

.....

.....

.....

[4]



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**9618/01**

**For examination from 2021**

**1 hour 30 minutes**

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

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**[Turn over**

- 1 (a) State **one** difference between a **kibibyte** and a **kilobyte**.

.....  
 ..... [1]

- (b) Give the number of bytes in a **mebibyte**.

..... [1]

- (c) (i) Complete the following binary addition. Show your working.

$$\begin{array}{r} 1\ 0\ 0\ 1\ 1\ 0\ 1\ 0 \\ +\ 1\ 1\ 1\ 1\ 0\ 1\ 1\ 1 \\ \hline \end{array}$$

[2]

- (ii) Describe the error that occurred when you added the binary numbers in **part (c)(i)**.

.....  
 .....  
 .....  
 ..... [2]

- (d) Complete the binary subtraction. Show your working.

$$\begin{array}{r} 0\ 1\ 1\ 0\ 0\ 1\ 1\ 1 \\ -\ 0\ 0\ 1\ 1\ 0\ 0\ 1\ 0 \\ \hline \end{array}$$

[2]

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- 2 Yvette runs a company that books walking holidays for groups of people. She has a website that customers use to book the holidays.

- (a) The website has a URL and an IPv6 address.

Describe, using an example, the format of an IPv6 address.

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (b) An IP address can be static or dynamic. Describe static and dynamic IP addresses.

Static .....

.....

.....

.....

Dynamic .....

.....

.....

..... [4]

- (c) Yvette's company has a LAN (Local Area Network) that has hybrid topology.

- (i) Describe the characteristics of a LAN.

.....

.....

.....

..... [2]



- (ii) The LAN has a range of different topologies. One subnetwork connects four computers and one server set up as a star topology.

Describe how packets are transmitted between two of the computers in this subnetwork.

.....

.....

.....

.....

.....

..... [3]

- (d) The LAN has both wired and wireless connections.

- (i) Ethernet cables connect the computers to the server.

Identify **three** other hardware components that might be used to set up the LAN.

1 .....

.....

2 .....

.....

3 .....

..... [3]

- (ii) Describe how Carrier Sense Multiple Access/Collision Detection (CSMA/CD) manages collisions during data transmission.

.....

.....

.....

.....

.....

..... [3]

3 Mehrdad has a holiday company database that includes:

- data about holidays, such as the location, date, duration (in days)
- data about the customers and the holidays they have booked.

(a) Mehrdad has **normalised** the database, which has three tables.

(i) Draw an entity-relationship (E-R) diagram for the **normalised** tables.

[3]

(ii) Complete the table to identify the primary key and foreign key(s) for each of the tables you identified in **part (a)(i)**. If the table has no foreign key(s), write 'None'.

Table name	Primary key	Foreign key

[3]

(iii) Explain why the holiday database is in Third Normal Form (3NF).

.....

.....

.....

..... [2]

- (b) The holiday company has several members of staff. The database has **two** additional tables to store data about the staff.

STAFF(StaffID, FirstName, SecondName, DateOfBirth, Role, Salary)

SCHEDULE(ScheduleID, StaffID, WorkDate, Morning, Afternoon)

The following table shows some sample data from the table SCHEDULE.

ScheduleID	StaffID	WorkDate	Morning	Afternoon
210520-1	BC	21/05/2020	TRUE	TRUE
210520-2	JB	21/05/2020	TRUE	FALSE
220520-1	BC	22/05/2020	FALSE	TRUE
220520-2	LK	22/05/2020	TRUE	FALSE

- (i) Write an SQL script to display the first name and second name of all staff members working on 22/05/2020.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (ii) Write an SQL script to count the number of people working on the morning of 26/05/2020.

.....

.....

.....

.....

.....

.....

..... [3]

4 A cake factory uses machines to make cakes.

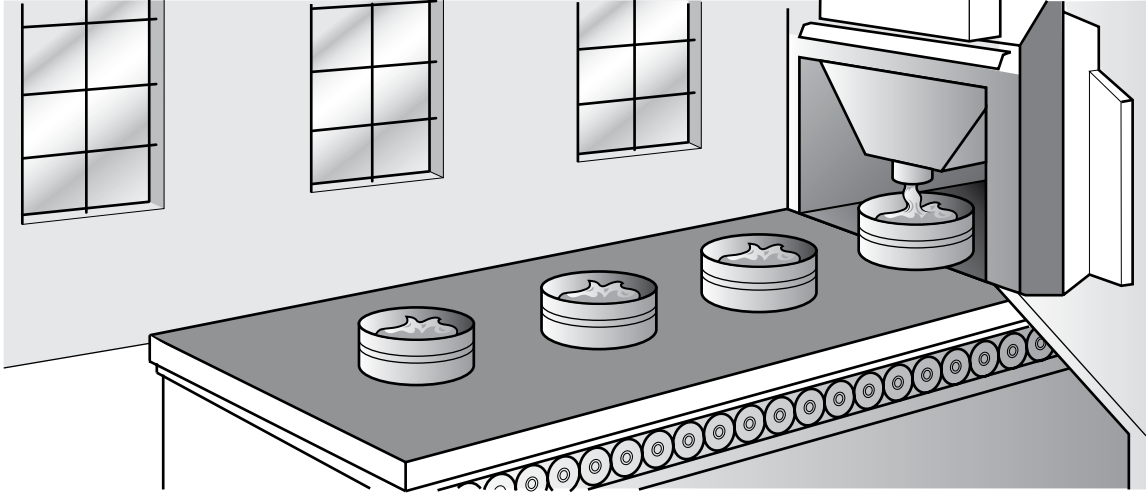
(a) Complete the following descriptions of types of system. Write the correct missing term in the spaces.

The factory uses a ..... system to record data such as the number of cakes being produced each hour.

When the data collected from sensors are analysed and used as

..... it is a ..... system. One example of this system, used in the factory, is to maintain a constant temperature in the ovens. It uses a ..... to measure the values. [4]

- (b) Cake mixture is mixed in a large pot. A conveyor belt moves the cake tins beneath the pot. The conveyor belt stops and a set quantity of the cake mixture fills the cake tin. The conveyor belt then moves and another cake tin is positioned beneath the pot.



Explain how the control system will ensure the correct amount of mixture is placed in the cake tins.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

(c) The cake factory has servers that store its confidential recipes and control the factory machines.

(i) Describe the implications of a hacker gaining access to the cake factory's servers.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(ii) Explain how the company could protect its data against hackers.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (d) The machines have a counter to record the number of cake tins filled. Each time a cake tin is filled, the counter is increased by 1. The value is stored in an 8-bit register and the current value is shown.

0	0	0	0	1	0	0	1
---	---	---	---	---	---	---	---

- (i) Show the value of the binary number after another five cake tins have been filled.

--	--	--	--	--	--	--	--

[1]

- (ii) The following table shows some assembly language instructions for a processor which has one general purpose register, the Accumulator (ACC).

Instruction		Explanation
Opcode	Operand	
AND	#n	Bitwise AND operation of the contents of ACC with the operand
AND	<address>	Bitwise AND operation of the contents of ACC with the contents of <address>
XOR	#n	Bitwise XOR operation of the contents of ACC with the operand
XOR	<address>	Bitwise XOR operation of the contents of ACC with the contents of <address>
OR	#n	Bitwise OR operation of the contents of ACC with the operand
OR	<address>	Bitwise OR operation of the contents of ACC with the contents of <address>
LSL	#n	Bits in ACC are shifted logically n places to the left. Zeros are introduced on the right hand end
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left hand end

At the end of each day, the register is reset to 0.

Write the assembly language statement to reset the register to 0.

.....  
 ..... [2]

- (iii) A **two-place logical shift** to the **left** is performed on the binary number shown in **part (d)**.

Show the result of this logical shift.

--	--	--	--	--	--	--	--

[1]

- (iv) State the mathematical result of a **one-place logical shift** to the **right** on a binary number.

.....

..... [1]

- (e) The factory servers run software that makes use of Artificial Intelligence (AI).

Explain how the use of AI can help improve the safety and efficiency of the factory.

.....

.....

.....

.....

.....

.....

.....

..... [3]



- 5 (a) Draw a logic circuit diagram for the logic expression:

$$X = \text{NOT } (A \text{ OR } B \text{ OR } C) \text{ OR } (B \text{ AND } C \text{ AND } D)$$



[4]

- (b) Complete the truth table for the logic expression:

$$X = (A \text{ XOR } B) \text{ OR } \text{NOT } (A \text{ OR } B \text{ OR } C)$$

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

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## 9618/11

May/June 2021

**1 hour 30 minutes**

You must answer on the question paper.

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **16** pages.

1 Anya scans an image into her computer for a school project.

(a) The scanned image is a bitmapped image.

(i) Complete the following table to describe the two terms about graphics.

Term	Description
Pixel	<p>.....</p> <p>.....</p> <p>.....</p>
File header	<p>.....</p> <p>.....</p> <p>.....</p>

[2]

(ii) The image is scanned with an image resolution of  $1024 \times 512$  pixels, and a colour depth of 8 bits per pixel.

Calculate an estimate for the file size, giving your answer in mebibytes. Show your working.

Working .....

.....

.....

.....

Answer ..... mebibytes

[3]

(b) The image is compressed using lossless compression.

Identify **one** method of lossless compression that can be used to compress the image **and** describe how the method will reduce the file size.

Lossless compression method .....

Description .....

.....

.....

.....

.....

[3]

- (c) One of the colours used in the image has the hexadecimal colour code:

#FC238A

FC is the amount of red, 23 is the amount of green and 8A is the amount of blue in the colour.

- (i) Convert the hexadecimal code FC into denary.

..... [1]

- (ii) The amount of green in binary is 00100011. This has the denary number 15 added to it to create a second colour.

Add the denary number 15 to the binary number 00100011 and give your answer in binary.

Perform the addition in binary. Show your working.

Working .....

.....  
 .....  
 .....  
 .....  
 .....

Answer (in binary) .....

[3]

- (iii) Hexadecimal 23 in two's complement representation is 00100011. The denary number 10 needs to be subtracted from this value.

Subtract the denary number 10 from the two's complement representation 00100011.

Give your answer in binary. Show your working.

Working .....

.....  
 .....  
 .....  
 .....  
 .....

Answer (in binary) .....

[3]

- (d) Anya made sure that the image was not subject to any copyright before scanning it.

Describe what is meant by **copyright**.

.....

.....

.....

..... [2]

2 Bingwen's computer comes with an Operating System and utility software.

(a) Draw **one** line from each utility software to its correct description.

Utility software	Description
	Scans software for errors and repairs the problems
Disk formatter	Moves parts of files so that each file is contiguous in memory
Defragmentation	Creates a copy of data that is no longer required
Back-up	Sets up a disk so it is ready to store files
Disk repair	Scans for errors in a disk and corrects them
	Creates a copy of data in case the original is lost

[4]

(b) Identify **four** key management tasks that the Operating System will perform.

- 1 .....
- 2 .....
- 3 .....
- 4 .....

[4]

- 3 A processor has one general purpose register, the Accumulator (ACC), and several special purpose registers.

(a) Complete the following description of the role of the registers in the fetch-execute cycle by writing the missing registers.

The ..... holds the address of the next instruction to be loaded. This address is sent to the .....

The ..... holds the data fetched from this address.

This data is sent to the ..... and the Control Unit decodes the instruction's opcode.

The ..... is incremented.


[5]



- (b) The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Opcode	Operand	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
LDI	<address>	Indirect addressing: The address to be used is at the given address. Load the contents of this second address to ACC
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the Index Register. Copy the contents of this calculated address to ACC
LDR	#n	Immediate addressing. Load the number n to IX
MOV	<register>	Move the contents of the accumulator to the given register (IX)
STO	<address>	Store contents of ACC at the given address
ADD	<address>	Add the contents of the given address to the ACC
INC	<register>	Add 1 to the contents of the register (ACC or IX)
CMP	<address>	Compare the contents of ACC with the contents of <address>
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False
JMP	<address>	Jump to the given address
OUT		Output to the screen the character whose ASCII value is stored in ACC
END		Return control to the operating system
LSL	#n	Bits in ACC are shifted logically n places to the left. Zeros are introduced on the right hand end
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left hand end
<address> can be an absolute address or a symbolic address # denotes a denary number, e.g. #123		

The current contents of the main memory and selected values from the ASCII character set are shown.

Address	Instruction
200	LDD 365
201	CMP 366
202	JPE 209
203	INC ACC
204	STO 365
205	MOV IX
206	LDX 365
207	OUT
208	JMP 200
209	END
...	
365	1
366	3
367	65
368	66
IX	0

ASCII code table (selected codes only)	
ASCII code	Character
65	A
66	B
67	C
68	D

Complete the trace table for the program currently in main memory.

[illegible]

[6]

- (c) (i) The Accumulator currently contains the binary number:

0	0	1	1	0	1	0	1
---	---	---	---	---	---	---	---

Write the contents of the Accumulator after the processor has executed the following instruction:

LSL #2

--	--	--	--	--	--	--	--

[1]

- (ii) The Accumulator currently contains the binary number:

0	0	1	1	0	1	0	1
---	---	---	---	---	---	---	---

Identify the mathematical operation that the following instruction will perform on the contents of the accumulator.

LSR #3

.....  
 ..... [1]

4 Melinda and her friends set up a peer-to-peer network between their computers to share data.

(a) Describe the key features of a peer-to-peer network.

.....

.....

.....

..... [2]

(b) Describe **two** drawbacks to Melinda and her friends of using a peer-to-peer network.

1 .....

.....

.....

.....

2 .....

.....

.....

..... [4]

(c) Melinda connects her laptop to the internet through her router.

(i) Tick (✓) **one** box in each row to identify whether the task is performed by the router or not.

Task	Performed by router	Not performed by router
Receives packets from devices		
Finds the IP address of a Uniform Resource Locator (URL)		
Directs each packet to all devices attached to it		
Stores the IP and/or MAC address of all devices attached to it		

[2]

- (ii) Melinda mainly uses the internet to watch films and play computer games.

Tick (✓) **one** box to identify whether Melinda should connect to the router using a wired or wireless network **and** justify your choice.

Wired	
Wireless	

Justification .....

.....

.....

.....

.....

..... [3]

- (d) Melinda sends emails from her webmail account (email account accessed through a website).

Explain whether Melinda is using the internet, or the World Wide Web (WWW), or both.

.....

.....

.....

.....

.....

..... [3]

5 Kiara has a washing machine and a refrigerator.

(a) She has an embedded system in her washing machine.

Describe what is meant by an **embedded system**, using the washing machine as an example.

.....

.....

.....

..... [2]

(b) The washing machine's embedded system makes use of both Random Access Memory (RAM) and Read Only Memory (ROM).

State the purpose of RAM and ROM within the washing machine's embedded system.

RAM .....

.....

ROM .....

..... [2]

(c) The temperature in her refrigerator must be kept between 4 and 6 degrees Celsius.

The microprocessor in the refrigerator turns on the cooling if the temperature is too high, and turns off the cooling if the temperature is too low.

Explain why the system in the refrigerator is a control and not a monitoring system.

.....

.....

.....

.....

.....

..... [2]

**6** Each of the following algorithms performs data validation.

State the type of validation check that each of the algorithms performs.

**(a)**

```
INPUT x

IF x < 0 OR x > 10 THEN

    OUTPUT "Invalid"

ENDIF
```

..... [1]

**(b)**

```
INPUT x

IF x = "" THEN

    OUTPUT "Invalid"

ENDIF
```

..... [1]

**(c)**

```
INPUT x

IF NOT(x = "Red" OR x = "Yellow" OR x = "Blue") THEN

    OUTPUT "Invalid"

ENDIF
```

..... [1]



7 Bobby and Kim are discussing databases.

(a) Bobby tells Kim that a file-based approach is usually better than a relational database.

Explain why Bobby is incorrect.

.....

.....

.....

.....

.....

..... [3]

(b) Bobby has a shop that sells products to customers. His database will store data about his customers, their payment details, orders and the products he sells. Customers will have login details to access their accounts. The database will update customers' payment and login details without keeping any historical records.

(i) Give **one** example of each of the following relationships from Bobby's database.

one-to-one

.....

.....

one-to-many

.....

.....

many-to-many

.....

.....

[3]

(ii) Tick (✓) **one** box to identify the relationship that cannot be directly implemented in a normalised relational database.

Relationship	Tick (✓)
one-to-one	
one-to-many	
many-to-many	

[1]

- (iii) Bobby wants to name his database `SHOPORDERS`.

Write a Data Definition Language (DDL) statement to define a new database with the name `SHOPORDERS`.

.....  
 ..... [1]

- (c) A database has a data dictionary.

Give **three** items that are stored in a data dictionary.

1 .....  
 2 .....  
 3 ..... [3]

- 8 Tick (✓) **one** box in each row to identify the logic gate that each statement describes.

Statement	AND	NAND	NOR	XOR	OR
The output is 1 only when both inputs are 1					
The output is 1 only when both inputs are different					
The output is 1 only when both inputs are 0					

[3]

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## 9618/12

May/June 2021

**1 hour 30 minutes**

You must answer on the question paper.

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **16** pages. Any blank pages are indicated.

- 1 Raj owns houses that other people rent from him. He has a database that stores details about the people who rent houses, and the houses they rent. The database, HOUSE\_RENTALS, has the following structure:

CUSTOMER(CustomerID, FirstName, LastName, DateOfBirth, Email)

HOUSE(HouseID, HouseNumber, Road, Town, Bedrooms, Bathrooms)

RENTAL(RentalID, CustomerID, HouseID, MonthlyCost, DepositPaid)

- (a) Give the definition of the following database terms, using an example from the database HOUSE\_RENTALS for each definition.

Term	Definition and example
Field	<p>.....</p> <p>.....</p> <p>.....</p>
Entity	<p>.....</p> <p>.....</p> <p>.....</p>
Foreign key	<p>.....</p> <p>.....</p> <p>.....</p>

[6]

- (b) Tick (✓) **one** box to identify whether the database HOUSE\_RENTALS is in Third Normal Form (3NF) or not in 3NF.

Justify your choice using one or more examples from the database HOUSE\_RENTALS.

In 3NF	
Not in 3NF	

Justification .....

.....

.....

..... [2]

(c) Example data from the table `RENTAL` are given:

RentalID	CustomerID	HouseID	MonthlyCost	DepositPaid
1	22	15B5L	1000.00	Yes
2	13	3F	687.00	No
3	1	12AB	550.00	Yes
4	3	37	444.50	Yes

- (i) Complete the following Data Definition Language (DDL) statement to define the table `RENTAL`.

```
CREATE ..... (
    RentalID INTEGER NOT NULL,
    CustomerID INTEGER NOT NULL,
    HouseID ..... (5) NOT NULL,
    MonthlyCost ..... NOT NULL,
    DepositPaid BOOLEAN NOT NULL,
    ..... (RentalID)
);
```

[4]

- (ii) Write a Data Manipulation Language (DML) script to return the first name and last name of all customers who have **not** paid their deposit.

```
.....
.....
.....
.....
.....
.....
```

[4]

2 Aisha manages a team of software developers.

- (a) Explain the reasons why it is important that Aisha acts ethically in relation to her team members.

.....

.....

.....

..... [2]

- (b) The team are developing a computer game where the user plays a board game (such as chess) against the computer.

Describe how the computer would use Artificial Intelligence (AI) to play the board game.

.....

.....

.....

.....

.....

..... [3]

- (c) The final game will be released under a licence.

Tick (✓) **one or more** boxes in each row to identify the licence(s) each statement describes.

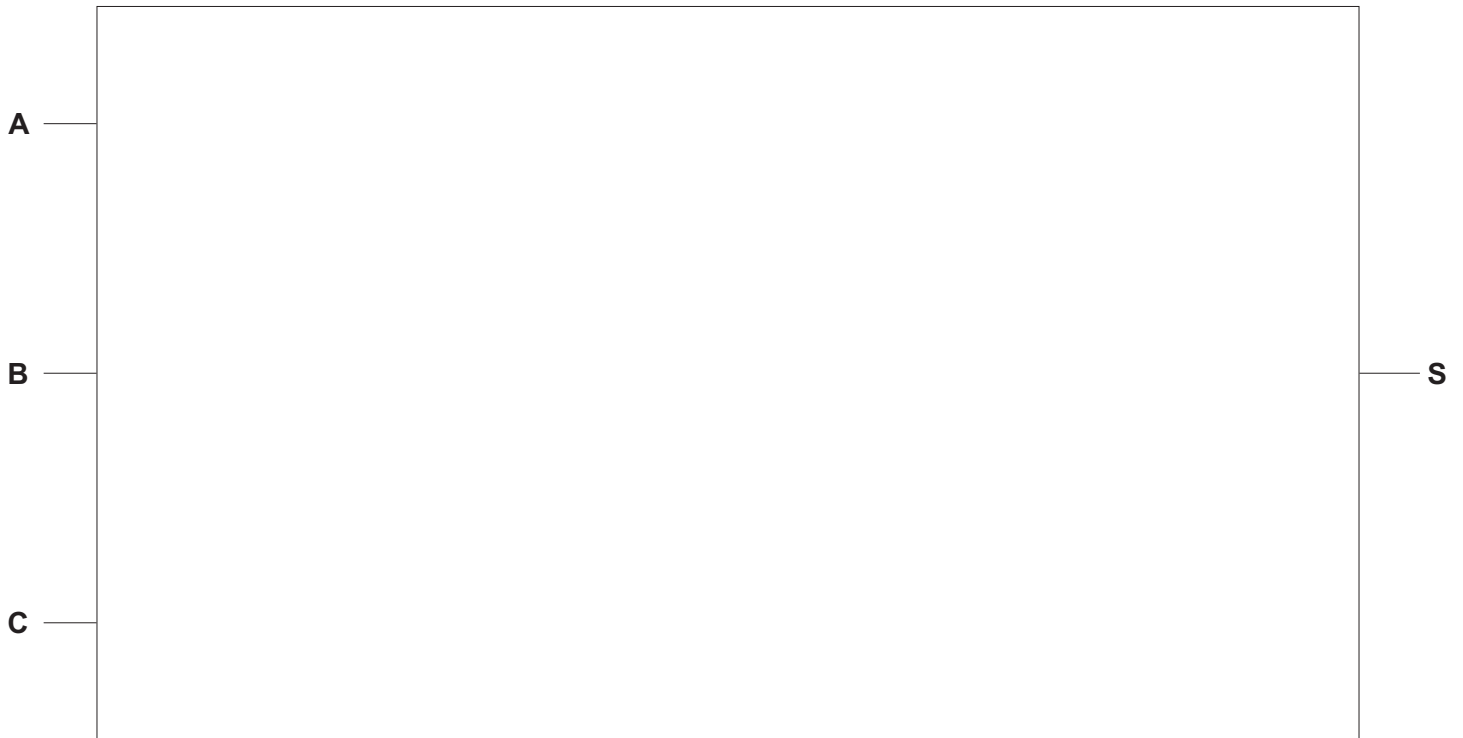
Statement	Free Software Foundation	Open Source Initiative	Shareware	Commercial Software
The user can edit the source code				
The user <b>must</b> always pay before being able to use the software				
The user can redistribute the software				
The user always gets a trial period				

[4]

3 A logic expression is given:

$$S = (A \text{ AND } B \text{ AND } C) \text{ OR } (B \text{ XOR } C)$$

(a) Draw the logic circuit for the given expression.



[4]

(b) Complete the truth table for the logic expression:

$$S = (A \text{ AND } B \text{ AND } C) \text{ OR } (B \text{ XOR } C)$$

A	B	C	Working space	S
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		


[2]

- 4 The table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Opcode	Operand	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
STO	<address>	Store contents of ACC at the given address
ADD	<address>	Add the contents of the given address to the ACC
INC	<register>	Add 1 to the contents of the register (ACC or IX)
DEC	<register>	Subtract 1 from the contents of the register (ACC or IX)
CMP	<address>	Compare the contents of ACC with the contents of <address>
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False
JMP	<address>	Jump to the given address
IN		Key in a character and store its ASCII value in ACC
OUT		Output to the screen the character whose ASCII value is stored in ACC
END		Return control to the operating system
# denotes a denary number, e.g. #123		

The current contents of the main memory and selected values from the ASCII character set are:

**Address Instruction**

70	IN
71	CMP 100
72	JPE 80
73	CMP 101
74	JPE 76
75	JMP 80
76	LDD 102
77	INC ACC
78	STO 102
79	JMP 70
80	LDD 102
81	DEC ACC
82	STO 102
83	JMP 70
...	
100	68
101	65
102	100

**ASCII code table (selected codes only)**

ASCII code	Character
65	A
66	B
67	C
68	D



- (a) Complete the trace table for the program currently in main memory when the following characters are input:

A D

Do not trace the program any further when the third input is required.

[illegible]

[4]

(b) Some bit manipulation instructions are shown in the table:

Instruction		Explanation
Opcode	Operand	
AND	#n	Bitwise AND operation of the contents of ACC with the operand
AND	<address>	Bitwise AND operation of the contents of ACC with the contents of <address>
XOR	#n	Bitwise XOR operation of the contents of ACC with the operand
XOR	<address>	Bitwise XOR operation of the contents of ACC with the contents of <address>
OR	#n	Bitwise OR operation of the contents of ACC with the operand
OR	<address>	Bitwise OR operation of the contents of ACC with the contents of <address>
<address> can be an absolute address or a symbolic address # denotes a denary number, e.g. #123		

The contents of the memory address 300 are shown:

Bit Number	7	6	5	4	3	2	1	0
300	0	1	1	0	0	1	1	0

- (i) The contents of memory address 300 represent an unsigned binary integer.

Write the denary value of the unsigned binary integer in memory address 300.

..... [1]

- (ii) An assembly language program needs to test if bit number 2 in memory address 300 is a 1.

Complete the assembly language instruction to perform this test.

..... #4

[1]

- (iii) An assembly language program needs to set bit numbers 4, 5, 6 and 7 to 0, but keep bits 0 to 3 with their existing values.

Write the assembly language instruction to perform this action.

.....

..... [2]

5 Seth uses a computer for work.

- (a) Complete the following descriptions of internal components of a computer by writing the missing terms.

The ..... transmits the signals to coordinate events based on the electronic pulses of the .....

The ..... carries data to the components, while the ..... carries the address where data needs to be written to or read from.

The ..... performs mathematical operations and logical comparisons.

[5]

- (b) Describe the ways in which the following factors can affect the performance of his laptop computer.

Number of cores

.....

.....

.....

.....

Clock speed

.....

.....

.....

.....

[4]

(c) Seth accesses both software and data using cloud computing.

(i) Give **two** benefits of storing data using cloud computing.

1 .....

.....

2 .....

.....

[2]

(ii) Give **two** drawbacks of Seth using cloud computing.

1 .....

.....

2 .....

.....

[2]

(d) Draw **one** line from each term to its **most appropriate** description.

Term	Description
	It is only visible to devices within the Local Area Network (LAN)
Public IP address	It increments by 1 each time the device connects to the internet
Private IP address	A new one is reallocated each time a device connects to the internet
Dynamic IP address	It can only be allocated to a router
Static IP address	It is visible to any device on the internet
	It does not change each time a device connects to the internet

[4]

**6** A computer uses the ASCII character set.

- (a)** State the number of characters that can be represented by the ASCII character set and the extended ASCII character set.

ASCII .....

Extended ASCII .....

[2]

- (b)** Explain how a word such as 'HOUSE' is represented by the ASCII character set.

.....  
 .....  
 .....  
 ..... [2]

- (c)** Unicode is a different character set.

The Unicode value for the character '1' is denary value 49.

- (i)** Write the hexadecimal value for the Unicode character '1'.

..... [1]

- (ii)** Write the denary value for the Unicode character '5'.

..... [1]

7 Jennifer is writing a computer program for her A Level homework.

(a) Jennifer uses a program library to help her write her computer program.

Describe how a program library can be used while writing a computer program.

.....

.....

.....

..... [2]

(b) Jennifer uses an Integrated Development Environment (IDE) to write her computer program.

(i) The IDE allows Jennifer to use both an interpreter and a compiler while creating her computer program.

Describe the ways in which Jennifer can use **both** a compiler **and** an interpreter while developing the program.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(ii) Identify **two** debugging tools that a typical IDE can provide.

1 .....

.....

2 .....

.....

[2]

- 8 A company has several security measures in place to prevent unauthorised access to the data on its computers.

(a) Describe the difference between the security and privacy of data.

.....

.....

.....

..... [2]

(b) Each employee has a username and password to allow them to log onto a computer. An employee's access rights to the data on the computers is set to either read-only, or read and write.

Identify **one** other software-based measure that could be used to restrict the access to the data on the computers.

.....

..... [1]

(c) The company is also concerned about threats posed by networks and the internet.

Identify **two** threats to the data that are posed by networks and the internet.

Threat 1 .....

.....

Threat 2 .....

.....

[2]





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9618/13

May/June 2021

**1 hour 30 minutes**

You must answer on the question paper.

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
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- Calculators must **not** be used in this paper.

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **16** pages.

1 Anya scans an image into her computer for a school project.

(a) The scanned image is a bitmapped image.

(i) Complete the following table to describe the two terms about graphics.

Term	Description
Pixel	<p>.....</p> <p>.....</p> <p>.....</p>
File header	<p>.....</p> <p>.....</p> <p>.....</p>

[2]

(ii) The image is scanned with an image resolution of  $1024 \times 512$  pixels, and a colour depth of 8 bits per pixel.

Calculate an estimate for the file size, giving your answer in mebibytes. Show your working.

Working .....

.....

.....

.....

Answer ..... mebibytes

[3]

(b) The image is compressed using lossless compression.

Identify **one** method of lossless compression that can be used to compress the image **and** describe how the method will reduce the file size.

Lossless compression method .....

Description .....

.....

.....

.....

.....

[3]

- (c) One of the colours used in the image has the hexadecimal colour code:

#FC238A

FC is the amount of red, 23 is the amount of green and 8A is the amount of blue in the colour.

- (i) Convert the hexadecimal code FC into denary.

..... [1]

- (ii) The amount of green in binary is 00100011. This has the denary number 15 added to it to create a second colour.

Add the denary number 15 to the binary number 00100011 and give your answer in binary.

Perform the addition in binary. Show your working.

Working .....

.....  
 .....  
 .....  
 .....  
 .....

Answer (in binary) .....

[3]

- (iii) Hexadecimal 23 in two's complement representation is 00100011. The denary number 10 needs to be subtracted from this value.

Subtract the denary number 10 from the two's complement representation 00100011.

Give your answer in binary. Show your working.

Working .....

.....  
 .....  
 .....  
 .....  
 .....

Answer (in binary) .....

[3]

- (d) Anya made sure that the image was not subject to any copyright before scanning it.

Describe what is meant by **copyright**.

.....

.....

.....

..... [2]

2 Bingwen's computer comes with an Operating System and utility software.

(a) Draw **one** line from each utility software to its correct description.

Utility software	Description
	Scans software for errors and repairs the problems
Disk formatter	Moves parts of files so that each file is contiguous in memory
Defragmentation	Creates a copy of data that is no longer required
Back-up	Sets up a disk so it is ready to store files
Disk repair	Scans for errors in a disk and corrects them
	Creates a copy of data in case the original is lost

[4]

(b) Identify **four** key management tasks that the Operating System will perform.

- 1 .....
- 2 .....
- 3 .....
- 4 .....

[4]

- 3 A processor has one general purpose register, the Accumulator (ACC), and several special purpose registers.

(a) Complete the following description of the role of the registers in the fetch-execute cycle by writing the missing registers.

The ..... holds the address of the next instruction to be loaded. This address is sent to the .....

The ..... holds the data fetched from this address.

This data is sent to the ..... and the Control Unit decodes the instruction's opcode.

The ..... is incremented.


[5]



- (b) The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Opcode	Operand	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
LDI	<address>	Indirect addressing: The address to be used is at the given address. Load the contents of this second address to ACC
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the Index Register. Copy the contents of this calculated address to ACC
LDR	#n	Immediate addressing. Load the number n to IX
MOV	<register>	Move the contents of the accumulator to the given register (IX)
STO	<address>	Store contents of ACC at the given address
ADD	<address>	Add the contents of the given address to the ACC
INC	<register>	Add 1 to the contents of the register (ACC or IX)
CMP	<address>	Compare the contents of ACC with the contents of <address>
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False
JMP	<address>	Jump to the given address
OUT		Output to the screen the character whose ASCII value is stored in ACC
END		Return control to the operating system
LSL	#n	Bits in ACC are shifted logically n places to the left. Zeros are introduced on the right hand end
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left hand end
<address> can be an absolute address or a symbolic address # denotes a denary number, e.g. #123		

The current contents of the main memory and selected values from the ASCII character set are shown.

Address	Instruction
200	LDD 365
201	CMP 366
202	JPE 209
203	INC ACC
204	STO 365
205	MOV IX
206	LDX 365
207	OUT
208	JMP 200
209	END
...	
365	1
366	3
367	65
368	66
IX	0

ASCII code table (selected codes only)	
ASCII code	Character
65	A
66	B
67	C
68	D

Complete the trace table for the program currently in main memory.

[illegible]

[6]

- (c) (i) The Accumulator currently contains the binary number:

0	0	1	1	0	1	0	1
---	---	---	---	---	---	---	---

Write the contents of the Accumulator after the processor has executed the following instruction:

LSL #2

--	--	--	--	--	--	--	--

[1]

- (ii) The Accumulator currently contains the binary number:

0	0	1	1	0	1	0	1
---	---	---	---	---	---	---	---

Identify the mathematical operation that the following instruction will perform on the contents of the accumulator.

LSR #3

.....  
 ..... [1]

4 Melinda and her friends set up a peer-to-peer network between their computers to share data.

(a) Describe the key features of a peer-to-peer network.

.....

.....

.....

..... [2]

(b) Describe **two** drawbacks to Melinda and her friends of using a peer-to-peer network.

1 .....

.....

.....

.....

2 .....

.....

.....

..... [4]

(c) Melinda connects her laptop to the internet through her router.

(i) Tick (✓) **one** box in each row to identify whether the task is performed by the router or not.

Task	Performed by router	Not performed by router
Receives packets from devices		
Finds the IP address of a Uniform Resource Locator (URL)		
Directs each packet to all devices attached to it		
Stores the IP and/or MAC address of all devices attached to it		

[2]

- (ii) Melinda mainly uses the internet to watch films and play computer games.

Tick (✓) **one** box to identify whether Melinda should connect to the router using a wired or wireless network **and** justify your choice.

Wired	
Wireless	

Justification .....

.....

.....

.....

.....

..... [3]

- (d) Melinda sends emails from her webmail account (email account accessed through a website).

Explain whether Melinda is using the internet, or the World Wide Web (WWW), or both.

.....

.....

.....

.....

.....

..... [3]

5 Kiara has a washing machine and a refrigerator.

(a) She has an embedded system in her washing machine.

Describe what is meant by an **embedded system**, using the washing machine as an example.

.....

.....

.....

..... [2]

(b) The washing machine's embedded system makes use of both Random Access Memory (RAM) and Read Only Memory (ROM).

State the purpose of RAM and ROM within the washing machine's embedded system.

RAM .....

.....

ROM .....

..... [2]

(c) The temperature in her refrigerator must be kept between 4 and 6 degrees Celsius.

The microprocessor in the refrigerator turns on the cooling if the temperature is too high, and turns off the cooling if the temperature is too low.

Explain why the system in the refrigerator is a control and not a monitoring system.

.....

.....

.....

.....

.....

..... [2]

**6** Each of the following algorithms performs data validation.

State the type of validation check that each of the algorithms performs.

**(a)**

```
INPUT x

IF x < 0 OR x > 10 THEN

    OUTPUT "Invalid"

ENDIF
```

..... [1]

**(b)**

```
INPUT x

IF x = "" THEN

    OUTPUT "Invalid"

ENDIF
```

..... [1]

**(c)**

```
INPUT x

IF NOT(x = "Red" OR x = "Yellow" OR x = "Blue") THEN

    OUTPUT "Invalid"

ENDIF
```

..... [1]



7 Bobby and Kim are discussing databases.

(a) Bobby tells Kim that a file-based approach is usually better than a relational database.

Explain why Bobby is incorrect.

.....

.....

.....

.....

.....

..... [3]

(b) Bobby has a shop that sells products to customers. His database will store data about his customers, their payment details, orders and the products he sells. Customers will have login details to access their accounts. The database will update customers' payment and login details without keeping any historical records.

(i) Give **one** example of each of the following relationships from Bobby's database.

one-to-one

.....

.....

one-to-many

.....

.....

many-to-many

.....

.....

[3]

(ii) Tick (✓) **one** box to identify the relationship that cannot be directly implemented in a normalised relational database.

Relationship	Tick (✓)
one-to-one	
one-to-many	
many-to-many	

[1]

- (iii) Bobby wants to name his database `SHOPORDERS`.

Write a Data Definition Language (DDL) statement to define a new database with the name `SHOPORDERS`.

.....  
 ..... [1]

- (c) A database has a data dictionary.

Give **three** items that are stored in a data dictionary.

1 .....  
 2 .....  
 3 ..... [3]

- 8 Tick (✓) **one** box in each row to identify the logic gate that each statement describes.

Statement	AND	NAND	NOR	XOR	OR
The output is 1 only when both inputs are 1					
The output is 1 only when both inputs are different					
The output is 1 only when both inputs are 0					

[3]

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## 9618/11

October/November 2021

**1 hour 30 minutes**

You must answer on the question paper.

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
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- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **16** pages. Any blank pages are indicated.

- 1 (a) Draw **one** line from each binary value to its equivalent (same) value on the right.

Binary value	
8 bits	1 kibibyte
8000 bits	1 gigabyte
1000 kilobytes	1 byte
1024 mebibytes	1 kilobyte
8192 bits	1 gibibyte
	1 megabyte
	1 mebibyte

[5]

- (b) (i) Perform the following binary addition. Show your working.

$$\begin{array}{r}
 10101010 \\
 + 00110111 \\
 \hline
 \end{array}$$

[2]

- (ii) State how an overflow can occur when adding two binary integers.

.....  
 ..... [1]

- (c) Convert the hexadecimal value F0 into denary.

.....  
 ..... [1]

2 Xanthe wants to maintain the integrity and security of data stored on her computer.

(a) Explain the difference between data security and data integrity.

.....

.....

.....

..... [2]

(b) Xanthe uses both data validation and data verification when entering data on her computer.

(i) Describe how data validation helps to protect the integrity of the data. Give an example in your answer.

Description .....

.....

.....

Example ..... [2]

(ii) Describe how data verification helps to protect the integrity of the data. Give an example in your answer.

Description .....

.....

.....

Example ..... [2]

(c) Two malware threats are spyware and viruses.

Give **two** similarities and **one** difference between spyware and a virus.

Similarity 1 .....

.....

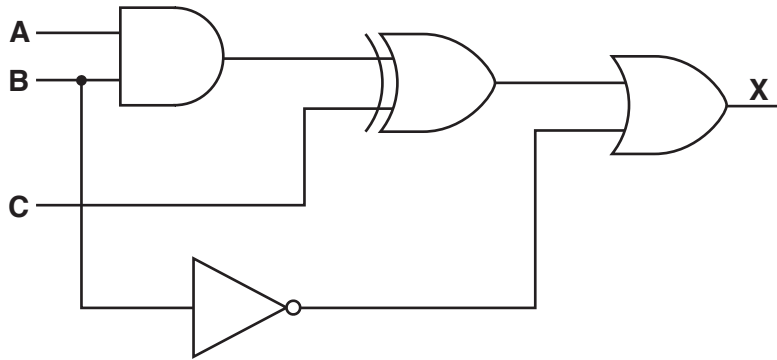
Similarity 2 .....

.....

Difference .....

..... [3]

3 A logic circuit is shown:



(a) Write the logic expression for the logic circuit.

.....  
 ..... [3]

(b) Complete the truth table for the given logic circuit.

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[2]

- (c) Identify **one** logic gate **not** used in the given logic circuit. Draw the symbol for the logic gate **and** complete its truth table.

Logic gate: .....

Symbol:

Truth table:

A	B	Output
0	0	
0	1	
1	0	
1	1	

[3]

4 Francis is starting his first job as a software developer for a multinational company.

(a) Francis has been advised to join a professional ethical body.

Describe the benefits to Francis of joining a professional ethical body.

.....

.....

.....

.....

.....

..... [3]

(b) Francis is shown the software he will be working on. He is unfamiliar with the Integrated Development Environment (IDE) he is required to use.

(i) Describe the ways in which Francis can act ethically in this situation.

.....

.....

.....

..... [2]

(ii) A typical IDE provides debugging tools to support the testing of a program.

Identify **three** other tools or features found in a typical IDE to support the writing of the program.

1 .....

2 .....

3 ..... [3]

(c) Francis is part of a team writing a program. He finds an error in part of the program that has already been tested. He decides not to tell anyone because he is worried about the consequences.

Explain the reasons why Francis acted unethically in this situation.

.....

.....

.....

..... [2]



(d) Francis's team use language translators.

Complete the descriptions of language translators by writing the missing words.

..... are usually used when a high-level language program is complete. They translate all the code at the same time and then run the program.

They produce ..... files that can be run without the source code.

..... translate one line of a high-level language program at a time, and then run that line of code. They are most useful while developing the programs because errors can be corrected and then the program continues from that line.

Assemblers are used to translate assembly code into .....

[4]

- 5 Javier owns many shops that sell cars. He employs several managers who are each in charge of one or more shops. He uses the relational database `CARS` to store the data about his business.

Part of the database is shown:

`SHOP(ShopID, ManagerID, Address, Town, TelephoneNumber)`

`MANAGER(ManagerID, FirstName, LastName, DateOfBirth, Wage)`

`CAR(RegistrationNumber, Make, Model, NumberOfMiles, ShopID)`

- (a) Tick (✓) **one** box in each row to identify whether each field is a primary key or a foreign key.

Table	Field name	Primary key	Foreign key
MANAGER	ManagerID		
SHOP	ManagerID		
CAR	RegistrationNumber		
CAR	ShopID		

[2]

- (b) Describe the ways in which access rights can be used to protect the data in Javier's database from unauthorised access.

.....

.....

.....

.....

.....

..... [3]

(c) Javier uses Data Definition Language (DDL) and Data Manipulation Language (DML) statements in his database.

- (i) Complete the following DML statements to return the number of cars for sale in each shop.

SELECT COUNT (.....)

FROM .....

..... ShopID

[3]

- (ii) Complete the DML statement to include the following car in the table CAR.

Field	Data
RegistrationNumber	123AA
Make	Tiger
Model	Lioness
NumberOfMiles	10500
ShopID	12BSTREET

..... CAR

..... ("123AA", "Tiger", "Lioness", 10500, "12BSTREET")

[2]



6 (a) There are **two** errors in the following register transfer notation for the fetch-execute cycle.

1 MAR  $\leftarrow$  [PC]

2 PC  $\leftarrow$  [PC] - 1

3 MDR  $\leftarrow$  [MAR]

4 CIR  $\leftarrow$  [MDR]

Complete the following table by:

- identifying the line number of each error
- describing the error
- writing the correct statement.

Line number	Description of the error	Correct statement

[4]

- (b) The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Opcode	Operand	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
STO	<address>	Store the contents of ACC at the given address
INC	<register>	Add 1 to the contents of the register (ACC or IX)
CMP	<address>	Compare the contents of ACC with the contents of <address>
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False
JMP	<address>	Jump to the given address
IN		Key in a character and store its ASCII value in ACC
OUT		Output to the screen the character whose ASCII value is stored in ACC
END		Return control to the operating system
XOR	#n	Bitwise XOR operation of the contents of ACC with the operand
XOR	<address>	Bitwise XOR operation of the contents of ACC with the contents of <address>
AND	#n	Bitwise AND operation of the contents of ACC with the operand
AND	<address>	Bitwise AND operation of the contents of ACC with the contents of <address>
OR	#n	Bitwise OR operation of the contents of ACC with the operand
OR	<address>	Bitwise OR operation of the contents of ACC with the contents of <address>
LSL	#n	Bits in ACC are shifted logically n places to the left. Zeros are introduced on the right hand end
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left hand end
<address> can be an absolute or symbolic address # denotes a denary number, e.g. #123 B denotes a binary number, e.g. B01001101		

The current contents of main memory are shown:

Address	Data
100	00001111
101	11110000
102	01010101
103	11111111
104	00000000

Each row of the following table shows the current contents of ACC in binary and the instruction that will be performed on those contents.

Complete the table by writing the new contents of the ACC after the execution of each instruction.

Current contents of the ACC	Instruction	New contents of the ACC
11111111	OR 101	
00000000	XOR #15	
10101010	LSR #2	
01010101	AND 104	

[4]

7 Bobby is recording a sound file for his school project.

(a) He repeats the recording of the sound several times, with a different sample rate each time.

(i) Describe the reasons why the sound is closer to the original when a higher sample rate is used.

.....

.....

.....

..... [2]

(ii) Describe the reasons why the sound file size increases when a higher sample rate is used.

.....

.....

.....

..... [2]

(b) Bobby wants to email the sound file to his school email address. He compresses the file before sending the email.

(i) Explain the reasons why Bobby compresses the sound file.

.....

.....

.....

..... [2]

(ii) Bobby uses lossless compression.

Describe how lossless compression can compress the sound file.

.....

.....

.....

..... [2]



8 A school is setting up a network within one of its buildings.

- (a) State whether the network will be a LAN (local area network) or a WAN (wide area network). Justify your choice.

.....

.....

.....

.....

.....

..... [3]

- (b) One classroom in the building has 30 computers. The computers need to be connected to the network. Each computer has a network interface card (NIC).

Identify **two** possible devices that can be used to physically connect the 30 computers to the rest of the network.

1 .....

2 ..... [2]

- (c) The school has several laptops. Each laptop has a Wireless Network Interface Card (WNIC).

Describe the functions of a Wireless Network Interface Card.

.....

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.....

..... [4]

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NUMBER

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CANDIDATE  
NUMBER

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## 9618/12

October/November 2021

**1 hour 30 minutes**

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

- The total mark for this paper is 75.
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DC (RW/SG) 206391/2  
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**[Turn over**

- 1 When designing computer systems, it is important to consider the security, integrity and privacy of the data.

Draw **one** line from each measure to indicate whether it keeps data secure or protects the integrity of data.

**Measure**

Firewall

Double entry

Presence check

Access rights

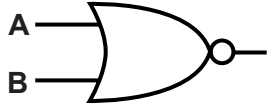
Password

Data Security

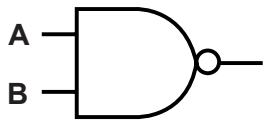
Data Integrity

[2]

- 2 (a) Complete the truth table for each of the following two logic gates.



A	B	Output
0	0	
0	1	
1	0	
1	1	



A	B	Output
0	0	
0	1	
1	0	
1	1	

[2]

- (b) Draw a logic circuit for the following logic expression.

$$X = \text{NOT}(\text{NOT}(A \text{ AND } B) \text{ AND } C)$$



[2]

3 Andy likes to play computer games.

- (a) Andy uses several input devices to play the games. These include a keyboard and a microphone.

Describe the principal operation of a microphone.

.....

.....

.....

.....

.....

..... [3]

- (b) Andy plays some of the computer games over the internet. He has several devices that connect wirelessly to the router in his house.

- (i) Identify the topology of Andy's home network. Justify your choice.

Topology .....

Justification .....

..... [2]

- (ii) The router has a wireless access point (WAP) to allow the devices to connect wirelessly.

Identify **three** functions of the router in Andy's network.

1 .....

.....

2 .....

.....

3 .....

..... [3]

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- 4 A register stores the following binary number:

1	1	0	0	1	1	0	1
---	---	---	---	---	---	---	---

- (a) The binary value in the register represents an unsigned binary integer.

Convert the unsigned binary integer into denary.

..... [1]

- (b) The binary value in the register represents a two's complement binary integer.

Convert the two's complement binary integer into denary.

..... [1]

- (c) The binary value in the register represents a hexadecimal number.

Convert the binary number into hexadecimal.

..... [1]

- (d) State why the value in the register cannot be interpreted as a Binary Coded Decimal (BCD).

.....  
 ..... [1]

- (e) The binary contents of **two** registers are:

<b>Register 1</b>	0	0	1	1	1	1	0	1
<b>Register 2</b>	0	0	1	0	1	1	0	1

- (i) Add the contents of **Register 1** and **Register 2**. Show your working.

Answer ..... [2]



- (ii) Subtract the contents of **Register 2** from the contents of **Register 1**. Show your working.

Answer .....

[2]

- 5 Riya has created the following logo as a vector graphic.



- (a) Complete the table by writing a description of each vector graphic term **and** give an example for this logo.

Term	Description	Example from logo
Property		
Drawing list		

[4]

- (b) Riya takes a photograph using a digital camera. The photograph is stored as a bitmap image.

- (i) Describe **two** differences between a vector graphic and a bitmap image.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

- (ii) Riya needs to email the photograph. She compresses the photograph before sending it using an email.

Describe **two** lossy methods that Riya can use to compress the image.

Method 1 .....

.....

.....

.....

Method 2 .....

.....

.....

.....

[4]

- 6 A shop sells plants to customers. The shop manager has a relational database to keep track of the sales.

The database, PLANTSALLES, has the following structure:

PLANT(PlantName, QuantityInStock, Cost)

CUSTOMER(CustomerID, FirstName, LastName, Address, Email)

PURCHASE(PurchaseID, CustomerID)

PURCHASE\_ITEM(PurchaseID, PlantName, Quantity)

(a) The database is normalised.

(i) The table lists the following three stages of normalisation:

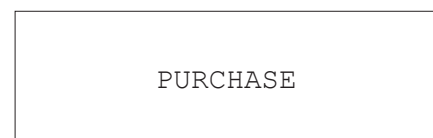
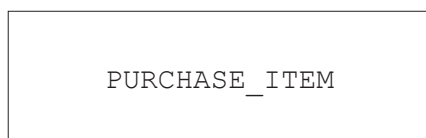
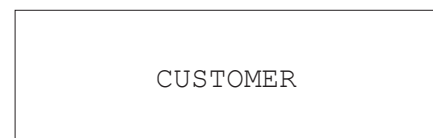
- The first stage is from a database that is not normalised (0NF) to First Normal Form (1NF).
- The second stage is from 1NF to Second Normal Form (2NF).
- The third stage is from 2NF to Third Normal Form (3NF).

Tick (✓) **one** box in each row to identify the appropriate stage for each task.

Task	Normalisation stage		
	0NF to 1NF	1NF to 2NF	2NF to 3NF
Remove any partial key dependencies			
Remove any repeating groups of attributes			
Remove any non-key dependencies			

[2]

(ii) Draw an entity-relationship (E-R) diagram for the database PLANTSALLES.



[3]

- (b) The shop manager uses a Database Management System (DBMS).

Describe the purpose **and** contents of the data dictionary in the DBMS.

.....

.....

.....

.....

.....

..... [3]

- (c) The shop manager uses both Data Definition Language (DDL) and Data Manipulation Language (DML) statements to create and search the database.

- (i) Complete the DML statements to return the total number of items purchased with the purchase ID of 3011A.

SELECT SUM (.....)

FROM .....

WHERE ..... = .....;

[4]

- (ii) Write DDL statements to include a field in the table `PURCHASE` to store the date of the order.

.....

.....

.....

..... [3]

7 A computer has system software.

(a) The Operating System handles interrupts.

Tick (✓) **one** box in each row to identify whether each event is an example of a hardware interrupt or a software interrupt.

Event	Hardware interrupt	Software interrupt
Buffer full		
Printer is out of paper		
User has pressed a key on the keyboard		
Division by zero		
Power failure		
Stack overflow		

[3]

(b) Describe the file management tasks that an Operating System performs.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(c) Identify **two** utility programs that can be used to improve the performance of a computer **and** state how they improve the performance.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

8 The Von Neumann model for a computer system uses registers.

(a) Describe the role of the following special purpose registers in the fetch-execute (F-E) cycle.

(i) Memory Address Register (MAR) .....

.....

.....

.....

Memory Data Register (MDR) .....

.....

.....

.....

[4]

(ii) Another special purpose register is the Index Register.

Identify **one other** special purpose register used in the Von Neumann model for a computer system.

.....

..... [1]

- (b) The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Opcode	Operand	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
STO	<address>	Store the contents of ACC at the given address
INC	<register>	Add 1 to the contents of the register (ACC or IX)
CMP	<address>	Compare the contents of ACC with the contents of <address>
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False
JMP	<address>	Jump to the given address
IN		Key in a character and store its ASCII value in ACC
OUT		Output to the screen the character whose ASCII value is stored in ACC
END		Return control to the operating system
XOR	#n	Bitwise XOR operation of the contents of ACC with the operand
XOR	<address>	Bitwise XOR operation of the contents of ACC with the contents of <address>
OR	#n	Bitwise OR operation of the contents of ACC with the operand
OR	<address>	Bitwise OR operation of the contents of ACC with the contents of <address>
AND	#n	Bitwise AND operation of the contents of ACC with the operand
AND	<address>	Bitwise AND operation of the contents of ACC with the contents of <address>
LSL	#n	Bits in ACC are shifted logically n places to the left. Zeros are introduced on the right hand end
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left hand end
<address> can be an absolute or symbolic address # denotes a denary number, e.g. #123		

The current contents of main memory are shown:

Address	Data
100	01010101
101	11110000
102	00001111
103	00000000
104	11111111



- (i) In the following table, each row shows the current contents of the ACC in binary and the instruction that will be performed on those contents.

Complete the table by writing the new contents of the ACC after the execution of each instruction.

Current contents of the ACC	Instruction	New contents of the ACC
01010101	XOR 101	
11110000	AND 104	
00001111	LSL #4	
11111111	OR 102	

[4]

- (ii) The following table contains five assembly language instruction groups.

Write an appropriate assembly language instruction for each instruction group, using the given instruction set. The first one has been completed for you.

Instruction Group	Instruction
Data movement	LDM #2
Input and output of data	
Arithmetic operations	
Unconditional and conditional instructions	
Compare instructions	

[4]

- (iii) The opcode `LDM` uses immediate addressing. The opcode `LDD` uses direct addressing.

Identify **and** describe **one additional** mode of addressing.

Mode of addressing .....

Description .....

.....

.....

[2]

---

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9618/13

October/November 2021

**1 hour 30 minutes**

You must answer on the question paper.

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
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8000 bits	1 gigabyte
1000 kilobytes	1 byte
1024 mebibytes	1 kilobyte
8192 bits	1 gibibyte
	1 megabyte
	1 mebibyte

[5]

- (b) (i) Perform the following binary addition. Show your working.

$$\begin{array}{r}
 10101010 \\
 + 00110111 \\
 \hline
 \end{array}$$

[2]

- (ii) State how an overflow can occur when adding two binary integers.

.....  
 ..... [1]

- (c) Convert the hexadecimal value F0 into denary.

.....  
 ..... [1]

2 Xanthe wants to maintain the integrity and security of data stored on her computer.

(a) Explain the difference between data security and data integrity.

.....

.....

.....

..... [2]

(b) Xanthe uses both data validation and data verification when entering data on her computer.

(i) Describe how data validation helps to protect the integrity of the data. Give an example in your answer.

Description .....

.....

.....

Example .....

[2]

(ii) Describe how data verification helps to protect the integrity of the data. Give an example in your answer.

Description .....

.....

.....

Example .....

[2]

(c) Two malware threats are spyware and viruses.

Give **two** similarities and **one** difference between spyware and a virus.

Similarity 1 .....

.....

Similarity 2 .....

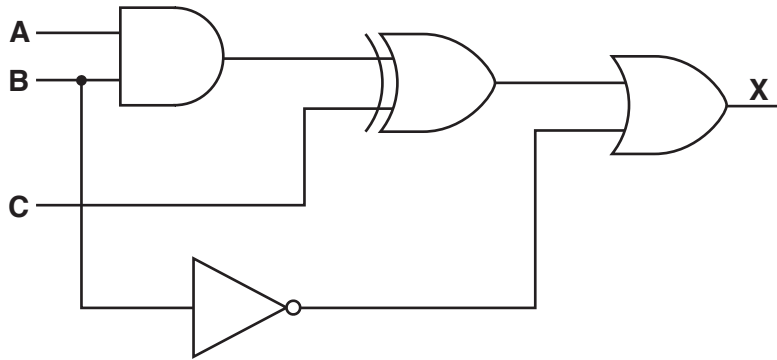
.....

Difference .....

.....

[3]

3 A logic circuit is shown:



(a) Write the logic expression for the logic circuit.

.....  
 ..... [3]

(b) Complete the truth table for the given logic circuit.

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[2]

- (c) Identify **one** logic gate **not** used in the given logic circuit. Draw the symbol for the logic gate **and** complete its truth table.

Logic gate: .....

Symbol:

Truth table:

A	B	Output
0	0	
0	1	
1	0	
1	1	

[3]

4 Francis is starting his first job as a software developer for a multinational company.

(a) Francis has been advised to join a professional ethical body.

Describe the benefits to Francis of joining a professional ethical body.

.....

.....

.....

.....

.....

..... [3]

(b) Francis is shown the software he will be working on. He is unfamiliar with the Integrated Development Environment (IDE) he is required to use.

(i) Describe the ways in which Francis can act ethically in this situation.

.....

.....

.....

..... [2]

(ii) A typical IDE provides debugging tools to support the testing of a program.

Identify **three** other tools or features found in a typical IDE to support the writing of the program.

1 .....

2 .....

3 ..... [3]

(c) Francis is part of a team writing a program. He finds an error in part of the program that has already been tested. He decides not to tell anyone because he is worried about the consequences.

Explain the reasons why Francis acted unethically in this situation.

.....

.....

.....

..... [2]



(d) Francis's team use language translators.

Complete the descriptions of language translators by writing the missing words.

..... are usually used when a high-level language program is complete. They translate all the code at the same time and then run the program.

They produce ..... files that can be run without the source code.

..... translate one line of a high-level language program at a time, and then run that line of code. They are most useful while developing the programs because errors can be corrected and then the program continues from that line.

Assemblers are used to translate assembly code into .....

[4]

- 5 Javier owns many shops that sell cars. He employs several managers who are each in charge of one or more shops. He uses the relational database `CARS` to store the data about his business.

Part of the database is shown:

`SHOP(ShopID, ManagerID, Address, Town, TelephoneNumber)`

`MANAGER(ManagerID, FirstName, LastName, DateOfBirth, Wage)`

`CAR(RegistrationNumber, Make, Model, NumberOfMiles, ShopID)`

- (a) Tick (✓) **one** box in each row to identify whether each field is a primary key or a foreign key.

Table	Field name	Primary key	Foreign key
MANAGER	ManagerID		
SHOP	ManagerID		
CAR	RegistrationNumber		
CAR	ShopID		

[2]

- (b) Describe the ways in which access rights can be used to protect the data in Javier's database from unauthorised access.

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.....

..... [3]

(c) Javier uses Data Definition Language (DDL) and Data Manipulation Language (DML) statements in his database.

(i) Complete the following DML statements to return the number of cars for sale in each shop.

SELECT COUNT (.....)

FROM .....

..... ShopID

[3]

(ii) Complete the DML statement to include the following car in the table CAR.

Field	Data
RegistrationNumber	123AA
Make	Tiger
Model	Lioness
NumberOfMiles	10500
ShopID	12BSTREET

..... CAR

..... ("123AA", "Tiger", "Lioness", 10500, "12BSTREET")

[2]



6 (a) There are **two** errors in the following register transfer notation for the fetch-execute cycle.

1 MAR  $\leftarrow$  [PC]

2 PC  $\leftarrow$  [PC] - 1

3 MDR  $\leftarrow$  [MAR]

4 CIR  $\leftarrow$  [MDR]

Complete the following table by:

- identifying the line number of each error
- describing the error
- writing the correct statement.

Line number	Description of the error	Correct statement

[4]

- (b) The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Opcode	Operand	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
STO	<address>	Store the contents of ACC at the given address
INC	<register>	Add 1 to the contents of the register (ACC or IX)
CMP	<address>	Compare the contents of ACC with the contents of <address>
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False
JMP	<address>	Jump to the given address
IN		Key in a character and store its ASCII value in ACC
OUT		Output to the screen the character whose ASCII value is stored in ACC
END		Return control to the operating system
XOR	#n	Bitwise XOR operation of the contents of ACC with the operand
XOR	<address>	Bitwise XOR operation of the contents of ACC with the contents of <address>
AND	#n	Bitwise AND operation of the contents of ACC with the operand
AND	<address>	Bitwise AND operation of the contents of ACC with the contents of <address>
OR	#n	Bitwise OR operation of the contents of ACC with the operand
OR	<address>	Bitwise OR operation of the contents of ACC with the contents of <address>
LSL	#n	Bits in ACC are shifted logically n places to the left. Zeros are introduced on the right hand end
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left hand end
<address> can be an absolute or symbolic address # denotes a denary number, e.g. #123 B denotes a binary number, e.g. B01001101		

The current contents of main memory are shown:

Address	Data
100	00001111
101	11110000
102	01010101
103	11111111
104	00000000

Each row of the following table shows the current contents of ACC in binary and the instruction that will be performed on those contents.

Complete the table by writing the new contents of the ACC after the execution of each instruction.

Current contents of the ACC	Instruction	New contents of the ACC
11111111	OR 101	
00000000	XOR #15	
10101010	LSR #2	
01010101	AND 104	

[4]

7 Bobby is recording a sound file for his school project.

(a) He repeats the recording of the sound several times, with a different sample rate each time.

(i) Describe the reasons why the sound is closer to the original when a higher sample rate is used.

.....

.....

..... [2]

(ii) Describe the reasons why the sound file size increases when a higher sample rate is used.

.....

.....

..... [2]

(b) Bobby wants to email the sound file to his school email address. He compresses the file before sending the email.

(i) Explain the reasons why Bobby compresses the sound file.

.....

.....

..... [2]

(ii) Bobby uses lossless compression.

Describe how lossless compression can compress the sound file.

.....

.....

..... [2]



8 A school is setting up a network within one of its buildings.

- (a) State whether the network will be a LAN (local area network) or a WAN (wide area network). Justify your choice.

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..... [3]

- (b) One classroom in the building has 30 computers. The computers need to be connected to the network. Each computer has a network interface card (NIC).

Identify **two** possible devices that can be used to physically connect the 30 computers to the rest of the network.

1 .....

2 ..... [2]

- (c) The school has several laptops. Each laptop has a Wireless Network Interface Card (WNIC).

Describe the functions of a Wireless Network Interface Card.

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..... [4]

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