Past Papers May/June 2015 to 2018, Oct/Nov 2015 till 2017:
Topic 1.1.2, 1.1.3, 1.1.4 Images Sound Video

(9608/11/M/J/15)

Q2 (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]

(9608/12/M/J/17)

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]

(9608/13/M/J/15)
3(a) (i) Using two's complement, show how the following denary numbers could be stored in an 8-bit register:

[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]

(9608/11/M/J/16)
4 (a) Convert the following denary integer into 8-bit binary.

[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]

5. 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.

.....

.....

.....

.....

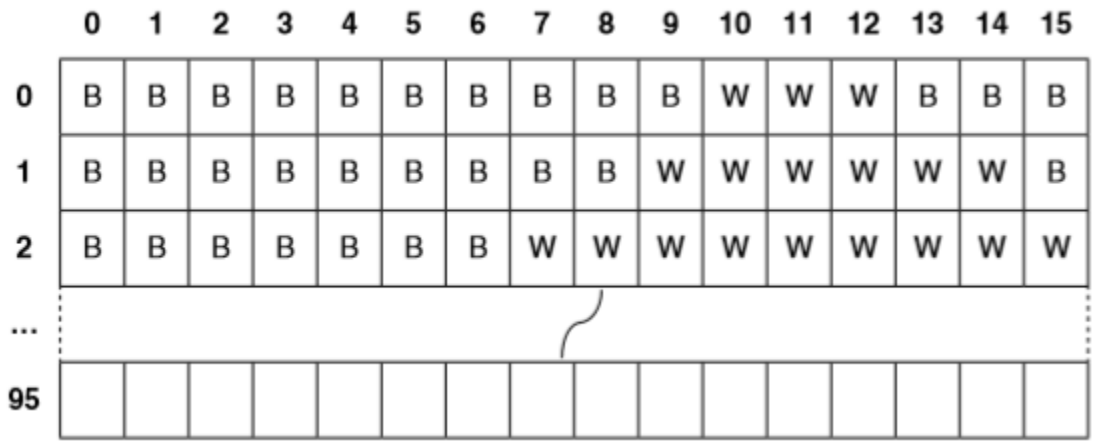
.....

.....[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



Show how RLE will compress the first three rows of this image.

Row 1: .....

Row 2: .....

Row 3: .....[2]

(9608/13/M/J/16)

6.(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.

.....[2]

(9608/11/M/J/17)

7. (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]

(9608/12/M/J/17)

8. (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]

(9608/11/M/J/18)

9. A logo is designed as a bitmap image.

(a) Describe what is meant by a bitmap image.

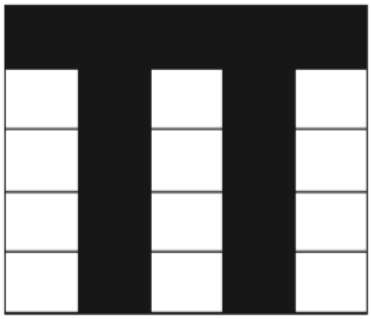
.....

.....

.....

.....[2]

(b) A black and white bitmap image is shown.



(b)(i) Explain how a computer can store this bitmap image.

.....

.....

.....

.....[2]

(b)(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]

(9608/12/M/J/18)

10. (a) The Accumulator is a register. The current contents of the Accumulator are:

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]

11. 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]

(9608/13/M/J/18)

12.
(c) H is a register. The current contents of H are:

1	1	0	0	0	0	0	1

The current contents of register H represent an unsigned binary integer. (i) Convert the value in register H into denary.

.....[1]

(ii) Convert the value in register H into hexadecimal.

.....[1]

(iii) The current contents of register H represent a two's complement binary integer. Convert the value in register H into denary.

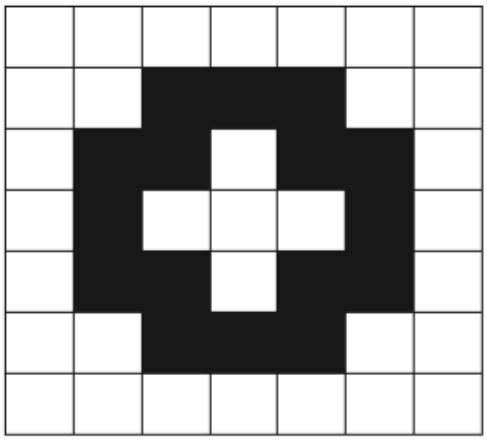
.....[1]

(iv) State why register H does not currently contain a Binary Coded Decimal (BCD).

.....

.....[1]

13. A black and white bitmap image is shown.



(a) State the minimum number of bits needed to represent each pixel in this image.

.....[1]

(b) Run-length encoding (RLE) is used to store the image with the following colour codes.

Colour	Code
Black	1A
White	3B

Show how run-length encoding is used to store the image.

.....

.....

.....[3]

(c) An image has 30 different colours. State the minimum number of bits needed to represent each pixel in the 30-colour image.

.....[1]

(d) When the image is saved, a header is added to the file. State the purpose of the file header. Give two examples of the file header contents. Purpose

.....

.....

Example 1

.....

.....

Example 2

.....

.....[3]

(e) Graphics software is used to edit a digital photograph.

Give three features of graphics software that can be used to edit the photograph. Describe the effect each has on the photograph.

Feature 1

.....

Effect

.....

.....

.....

Feature 2

.....

Effect

.....

.....

.....

Feature 3

.....

Effect

.....

.....

..... [6]

(9608/11/O/N/15)

14. (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]

15,

(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]

Answers: **9608/11/M/J/15**

1 (i) B 8 **[1]**

(ii) 1 0 0 1 0 1 1 1 **[1]**

(iii)

114	0	1	1	1	0	0	1	0
– 93	1	0	1	0	0	0	1	1

[2]

2 (a) (i) Any one from:

- amplitude of sound wave taken at different points in time
- measurement of value of analogue signal at regular time intervals/a point in time [1]

(ii) Any one from:

- bit depth/sampling resolution sufficient for good quality sound
- higher bit depth/sampling resolution would mean bigger files ...hence less (music) content on each CD
- can represent dynamic range of about 90 dB
- 90 dB is basically the maximum dynamic range of human hearing
- compromise between quality and reasonable file size **[1]**

(iii) Any two from:

- resolution is the number of distinct values available to encode/represent each sample
- specified by the number of bits used to store/record each sample
- sometimes referred to as bit depth
- the higher the sampling resolution, the smaller the quantization error
- a higher sampling resolution results in less distortion of the sound
- usually 8 bit, 16 bit, 24 bit or 32 bit **[2]**

(iv) 1 mark for benefit and 1 mark for drawback.

benefit

- allows for larger dynamic ranges
- ..as dynamic range is approximately six times the bit depth
- more accurate representation/crisper sound quality

drawback

- bigger files/occupies more memory/storage
- longer to transmit data/download music
- greater processing power needed **[2]**

(b) Any two from:

- edit start time, stop time and duration of any sound/timeline
- extract/delete/save part of a clip

- frequency, amplitude, pitch alteration
- fade in/out of a clip
- mix/merge multiple sound sources/tracks
- combine different sources at various volume levels
- pan between tracks/channels
- use of filters
- playback to speakers, processors or recording medium
- conversion between different audio file formats etc... **[2]**

(c) Any three from: For full marks both techniques must be mentioned.

- lossless designed to lose none of the original detail/lossless allows original file to be recreated exactly
- lossless technique based on some form of replacement
- mention of type of replacement, for example RLE, FLAC etc.
- by example: e.g. 000–1111–222222–333 = 3–0, 4–1, 6–2, 3–3 etc.
- maximum compression about 50%
- lossy may result in loss of detail compared to original file/lossy does not allow original file to be re-created exactly
- lossy techniques make decision about what parts of sound/sound file are important and discards other information
- only keeps sounds human ear can process/discards sounds most people cannot hear
- ... then applies lossless technique, for further reduction
- lossy compression can reduce to about 10%
- an example of jpeg, mp3 or other correct examples of compressed formats.

No double credit to opposite answers, e.g. lossless maintains detail, but lossy loses detail just one mark. **[3]**

(12/MJ/2017)

3(a)	*Definition*: **Max two** from: ▯ The number of distinct values available to encode/represent each sample 1 ▯ Specified by the number of bits used to encode the data for one sample 1 ▯ Sometimes referred to as bit depth 1 *Explanation:* **Max two** from: ▯ A larger sampling resolution will mean there are more values available to store each sample 1 ▯ A larger sampling resolution will improve the accuracy of the digitised sound // A larger sampling resolution will decrease the distortion of the sound 1 ▯ Increased sampling resolution means a smaller quantization error 1
3(b)(i)	**One** from: ▯ The number of pixels per unit measurement 1 ▯ The number of pixels in an image 1 ▯ The number of pixels wide by the number of pixels high 1 ▯ Number of pixels per row by the number of rows 1
3(b)(ii)	4

3(b)(iii)	*Working*: **Max two** from: • Number of pixels is 8192 · 256 • One pixel will be stored as one byte • Number of kilobytes = (8192 · 256) / 1024 *Answer*: **One** mark: Number of kilobytes = 2048 KB	 1 1 1 1
3(b)(iv)	**Two** from: • Confirmation that the file is a BMP • File size • Location/offset of image data within the file • Dimensions of the image (in pixels) // image resolution • Colour depth (bits per pixel, 1, 4, 8, 16, 24 or 32) • Type of compression used, if any	 1 1 1 1 1 1

(9608/13/M/J/15)

3.

(a) (i)

124	**0**	**1**	**1**	**1**	**1**	**1**	**0**	**0**
–77	**1**	**0**	**1**	**1**	**0**	**0**	**1**	**1**

[2]

(ii) **124: 7 C**

–77: B 3 **[2]**

(b) **(i) 0 0 1 1 0 1 0 1 1 0 0 1** **[1]**

(ii)

- **when denary numbers need to be electronically coded**
- **e.g. to operate displays on a calculator where each digit is represented**
- **decimal fractions can be accurately represented** **[2]**

(9608/11/M/J/16)

4. (a) **00110111** **[1]**

(b) **83** **[1]**

(c) **10011010** **[2]**

Marks allocated as follows:
1 mark for the most significant bit 1 mark for the remaining 7 bits

(d) **78** **[1]**

5 (a) Three from: **[3]**

- The height/amplitude of the (sound) wave is determined.
- At set (time) intervals // by example of sensible time period.
- To get an approximation of the sound wave
- And encoded as a sequence of binary numbers // and converted to a digital signal.
- Increasing the sampling rate will improve the accuracy of the recording.

(b) (i) No mark awarded for identifying method. Three marks for justification. **[3]**

Lossy – Three points from:

- The human ear will not notice that the decompressed stream will not be identical to the original (file) / that parts of the original data have been discarded / removed / deleted.
- File size reduction is greater than using lossless.
- Email has limits on file sizes (on attachments) / a smaller file will take less time to transmit.
- The file may not need to be of high precision / accuracy.
- The producer has requested an mp3 file.

Lossless – Three points from:

- The file needs to be high precision / accuracy.
- None of the original data is lost / the decompressed file will be identical to the original.
- The producer has requested a flac file.

(ii) Three points from: **[3]**

- Lossless method of compression.
- Reduces (the physical size of) a string of adjacent, identical characters/pixels / bytes etc.
- The repeating string (a run) is encoded into two values.
- One value represents the number of (identical) characters in the run (the run count).
- The other value is the code of the character / colour code of pixel etc. in the run (the run value).
- The run value and run count combination may be preceded by a control character. • Any valid example given.

(iii) Two marks for three correct rows, one mark for two correct rows. **[2]**

Row 1: 153 10 255 3 153 3
Row 2: 153 9 255 6 153 1
Row 3: 153 7 255 9

Alternative correct answer:

Row 1: 153 9 255 2 153 2
Row 2: 153 8 255 5 153 0
Row 3: 153 6 255 8

(9608/13/M/J/16)

6. (a) 77 [1]

(b) 1000 0010 [1]

(c) −53 [2]

One mark for '53' and one mark for '−'

(d) C6 [2]

One mark for the answer, one mark for the method

Working e.g. 198 / 16 = 12, 198 − (12*16) = 6

(9608/11/M/J/17)

Answer

7. (a) Sampling rate The number of samples taken per unit time // the number of times the amplitude is measured per unit time [1]

Increasing the sampling rate will increase the accuracy / precision of the digitised sound // Increasing the sampling rate will result in smaller quantisation errors. [1]
[2]

7.(b)
(i) Pixel Smallest picture element which can be drawn [1]

Screen resolution The number of pixels which can be viewed horizontally and vertically on the screen // or by example - A typical screen resolution is 1680 pixels · 1080 pixels. [1]
[2]

(ii) 8 **[1]**

(iii) Working: Max two from:
- Number of pixels is 2048 * 512 [1]
- One pixel will be stored as one byte [1]
- Number of kilobytes = (2048 * 512) / 1024 [1]
- Answer: One mark: Number of kilobytes = 1024 KB [1]

(iv) One from:

- Confirmation that the file is a BMP [1]
- File size [1]
- Location/offset of image data within the file [1]

- Dimensions of the image in pixels // image resolution [1]
- Colour depth (bits per pixel) [1]
- Type of compression used, if any [1]

[1]

(9608/12/M/J/17)

8.

3(a)	*Definition*: **Max two** from: ▯ The number of distinct values available to encode/represent each sample 1 ▯ Specified by the number of bits used to encode the data for one sample 1 ▯ Sometimes referred to as bit depth 1 *Explanation*: **Max two** from: ▯ A larger sampling resolution will mean there are more values available to store each sample 1 ▯ A larger sampling resolution will improve the accuracy of the digitised sound // A larger sampling resolution will decrease the distortion of the sound 1 ▯ Increased sampling resolution means a smaller quantization error 1	**Max 3**
(b)(i)	**One** from: ▯ The number of pixels per unit measurement 1 ▯ The number of pixels in an image 1 ▯ The number of pixels wide by the number of pixels high 1 ▯ Number of pixels per row by the number of rows 1	**1**
b)(ii)	4	**1**
b)(iii)	*Working*: **Max two** from: ▯ Number of pixels is 8192 · 256 1 ▯ One pixel will be stored as one byte 1 ▯ Number of kilobytes = (8192 · 256) / 1024 1 *Answer*: **One** mark: Number of kilobytes = 2048 KB 1	**3**
b)(iv)	**Two** from: ▯ Confirmation that the file is a BMP 1 ▯ File size 1 ▯ Location/offset of image data within the file 1 ▯ Dimensions of the image (in pixels) // image resolution 1 ▯ Colour depth (bits per pixel, 1, 4, 8, 16, 24 or 32) 1 ▯ Type of compression used, if any 1	**Max 2**

(9608/11/M/J/18)

9.

2(a)	**1 mark** per bullet, **max 2** ▯ Made up of pixels ▯ Each pixel has one colour ▯ Colour of each pixel stored as a binary number	**2**
(b)(i)	**1 mark** per bullet, **max 2** ▯ Each pixel requires only one bit (as there are only two colours) ▯ Black represented by 1 and white by 0 (or vice versa) ▯ Bits are stored for each pixel in sequence ▯ 11111 01010 01010 01010 01010	**2**
b)(ii)	**1 mark** for the explanation ▯ Stores the colour and the number of times it occurs **1 mark** for example from ▯ An example from the bitmap given e.g. B5, W1, B1 and so on	**2**
2(c)	**1 mark** per bullet ▯ Number of pixels 500*1000 (= 500 000) ▯ 35 colours require 6 bits per pixel ▯ Number of bytes (500 000 * 6) / 8 = 3 000 000 / 8 (= 375 000) ▯ = **375 Kb**	**4**

(9608/12/M/J/18)
10.

(a)(i)	219	**1**
(a)(ii)	DB	**1**
(a)(iii)	−37	**1**
(b)(i)	**1 mark** from: ▯ The symbols that the computer recognises/uses ▯ A list of characters recognised by the computer hardware and software	**1**

(b)(ii)	**1 mark** per bullet to **max 2** ▯ UNICODE has greater range of characters than ASCII ▯ UNICODE represents most written languages in the world while ASCII does not ASCII used for English only ▯ ASCII uses 7 or 8 bits or one byte whereas UNICODE uses up to 4 bytes per character ▯ UNICODE is standardised while ASCII is not	**2**
(b)(iii)	**1 mark** for correct working, **1 mark** for correct answer Working: Code for Z = Code for A + 25_{10} Code for Z = 41_{16} +25_{10} Code for Z = 41_{16} + 19_{16} Code for Z = $5A_{16}$ Answer: $5A_{16}$	**2**

11.

(a)	**1 mark** per bullet to **max 3** ▯ Amplitude (of the sound wave) measured ▯ At set / regular time intervals / per time unit / time period ▯ Value of the sample is recorded as a binary number	**3**
(b)	**1 mark** per bullet to **max 2** ▯ (Increasing the sampling resolution means) more bits per sample // larger range of values ▯ Larger file size ▯ More accurate representation of sound	**2**
(c)	**1 mark** per bullet to **max 3** ▯ Fewer samples (per unit time) ▯ File size will decrease ▯ Larger gaps / spaces between samples // Greater quantization errors ▯ Sound accuracy will reduce // not as close to original sound	**3**
(d)	**1 mark** for naming feature/tool, **1 mark** for description. **Max 2** features e.g. ▯ Fading ▯ Change the volume of a section of the sound for it get louder/quieter ▯ Removing sound / elements ▯ Delete sections of the sound wave, for example, background noise ▯ Copy ▯ Repeat elements of the sound wave	**4**

(9608/13/M/J/18)

12.

3(a)	**1 mark** per bullet to **max 2** for each group ▯ **ALU** performs arithmetic operations ▯ And logical operations / comparisons ▯ **Control Unit** sends / receives signals ▯ Synchronises operations ▯ to control operations // execution of instructions ▯ Accept by example e.g. Input output // flow of data	**4**
3(b)	**1 mark** per bullet to **max 2** for each group ▯ **Status Register** is interpreted as independent bits / flags ▯ Each flag is set depending on an event ▯ An example: addition overflow / result of operation is zero etc. ▯ **Program Counter** stores the address ▯ of the next instruction to be fetched	**4**
(c)(i)	193	**1**
c)(ii)	C1	**1**
c)(iii)	− 63	**1**
c)(iv)	The first 4 bits / first nibble (would give 12 which) is > 9 / 2 digits (which is not valid for BCD)	**1**

13.

(a)	1	**1**
(b)	**1 mark** for correct method (colour code and number of pixels) **1 mark** for first 7 groups correct **1 mark** for remainder correct ▯ 3B9 1A3 3B3 1A2 3B1 1A2 3B2 ▯ 1A1 3B3 1A1 3B2 1A2 3B1 1A2 3B3 1A3 3B9	**3**
(c)	5	**1**

(d)	**1 mark** for purpose • Stores data about the file contents/image/metadata **Max 2 marks** for examples of contents • Confirmation that the file is a BMP // confirmation of file type • File size • Location / offset of image data within the file • Dimensions of the image (in pixels) // image resolution • Colour depth (bits per pixel, 1, 4, 8, 16, 24 or 32) • Type of compression used (if any)	**3**
(e)	**1 mark** for naming tool, **1 mark** for describing effect **on the photograph** e.g. • Resize • Increase / decrease the size of the image • Crop • Remove part of the image • Blur • Reduce the focus • Red eye reduction • Reduces red (light reflected from human eyes)	**6**

(9608/11/O/N/15)

14. (a) any two from:

- sequence of digital signals / bits
- over a communication path / Internet
- transfer of data at high speed
- requires fast broadband connection
- requires some form of buffering
- bits arrive in the same order as sent **[2]**

(b) (i) any two from:

- no need to wait for a whole file to be downloaded
- no need to store large files on user's computer
- allows on demand playback
- no specialist software is required for playback in browser **[2]**

(ii) any two from:

- video stops / hangs if very slow Internet / broadband speed low
- video stops / hangs if inadequate buffering capacity
- loss of Internet means can't access films / files
- may require specific software to run the files / films
- viruses can be downloaded from the websites **[2]**

(c) 2 marks for on-demand and 2 marks for real-time

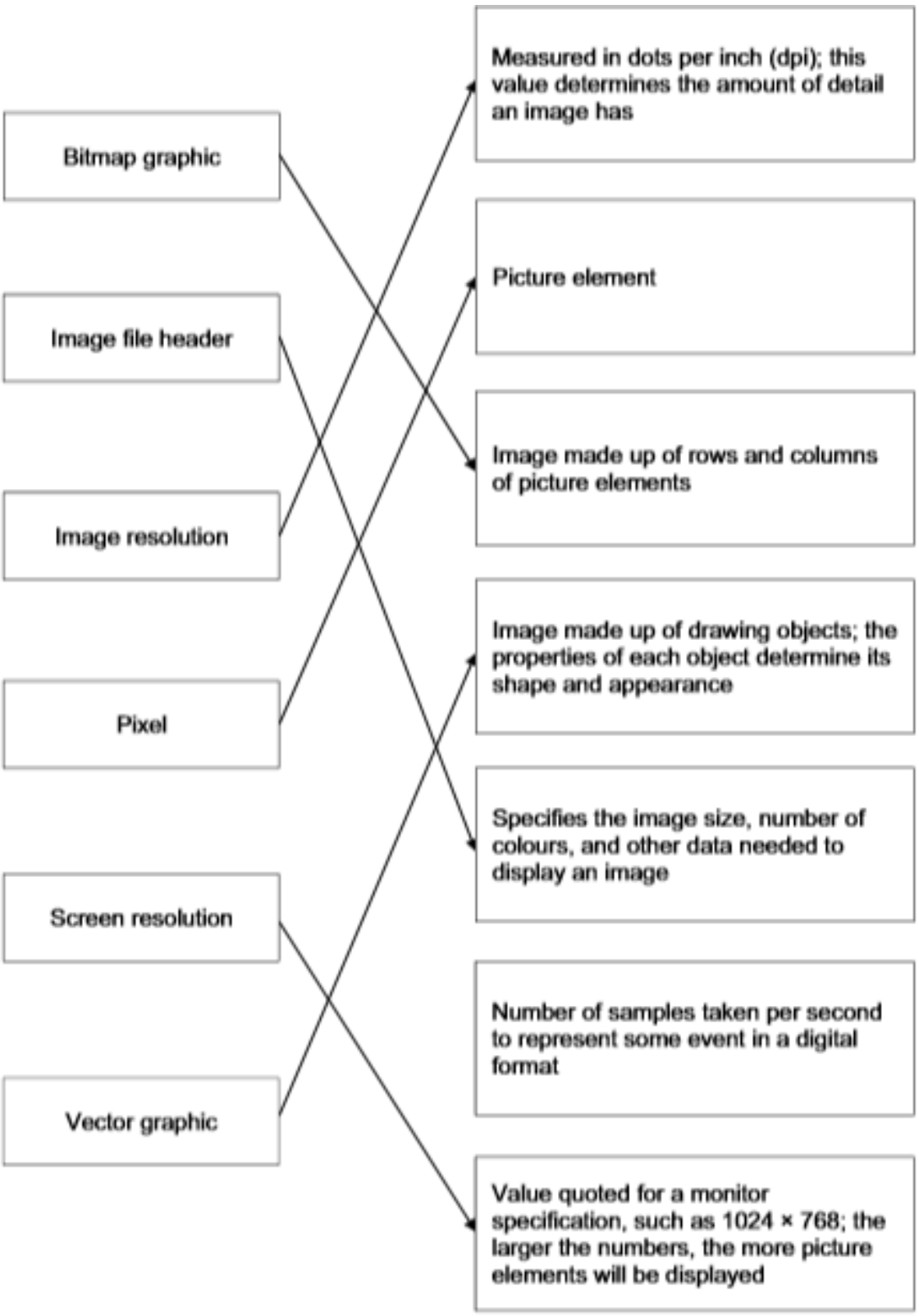
on-demand

- digital video tape, analogue video tape, or digital files are converted to bit streaming
- format for broadcasting on the net; this is known as encoding, these encoded streaming video files are then uploaded to a dedicated server
- a link for the encoded video is placed on a web site
- a user clicks on the link to download the encoded streaming video; the streamed video is then broadcast to the user as and when they require it
- can be paused / can go back and re-watch / fast-forward, etc.

real-time

- an event is captured live with a video camera
- the video camera is connected to a computer
- the video signal is converted to streaming media files (encoded) on the computer
- the encoded feed is then uploaded from the computer to a dedicated streaming server via cable, DSL, or a high-speed internet connection
- the server then sends the live images it to all users requesting it as real-time video streaming
- cannot be paused etc. **[4]**

15. (a)


Bitmap graphic
Image file header
Image resolution
Pixel
Screen resolution
Vector graphic
Measured in dots per inch (dpi); this value determines the amount of detail an image has
Picture element
Image made up of rows and columns of picture elements
Image made up of drawing objects; the properties of each object determine its shape and appearance
Specifies the image size, number of colours, and other data needed to display an image
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