



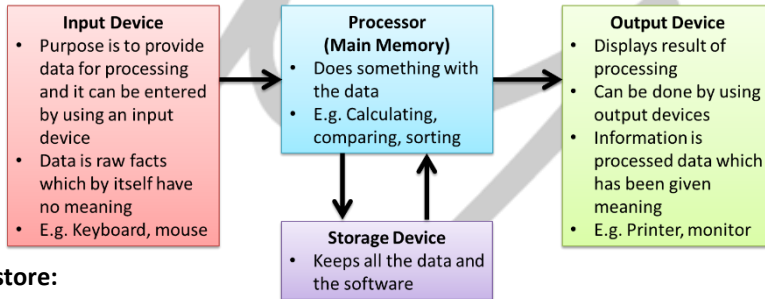
Information and Communication Technology

Study Flash Cards

HARDWARE & SOFTWARE

- **Hardware:** Tangible physical components of a computer system
- **Software:** programs that control the computer system
 - **Systems software:** programs that allow the hardware to run properly e.g. operating systems
 - **Applications software:** programs that allow the user to do specific tasks e.g. MS Word
- **Main components of a computer system:**
 - **Input devices:** keyboard, mouse
 - **Output devices:** monitor, printer
 - **Secondary storage devices:** removable hard drives, DVD R/W drive

BASIC COMPUTER MODEL



- **Backing store:**

- Stores data/information and programs not being used at current time
- Backing store device = reader or recorder e.g. Hard disk drive
- Backing store media = hardware containing data e.g. Hard disk

- **CPU:**

- Control unit – coordinates inputs and outputs
- Arithmetic logical unit – performs calculation and logical comparison
- Immediate access store – holds data and program in current use

MAIN MEMORY

- **RAM: random access memory**
 - All programs and data in current use is stored on RAM
 - RAM is usually larger than ROM
 - Volatile memory: data lost when computer turned off
- **ROM: read only memory**
 - Used to store permanent information
 - Chips cannot be altered, only read from
 - Non-volatile memory: data not lost when computer turned off
- **BIOS: basic input/output system**
 - Tells computers what to do when it first starts
 - Carries out hardware check then it loads operating system into RAM
 - BIOS stores date, time and system configuration in a non-volatile chip called CMOS (complementary metal oxide semiconductor), which is usually battery powered

OPERATING SYSTEMS

- Enables users to communicate with computer systems
- Controls operation of input, output and backing storage device
- Maintains security of system and a computer log
- **GUI: graphical user interface**
 - Uses WIMP – window, icon, menu, pointer
 - Advantages: easy to use and explore, don't have to learn commands, good help facilities
 - Disadvantages: more RAM, processing power and storage used and slow for techs
- **CLI: command line interface**
 - Type in command to tell the computer what to do – used by technicians
 - Advantages: much less RAM and processing power used, faster if commands known
 - Disadvantages: can be confusing, commands must be types correctly and a large amount of commands need to be learned

TYPES OF COMPUTERS

- **Desktop:** usually refers to a general purpose computer which is made up of separate monitor, keyboard, mouse and processor unit
- **Laptop:** A type of computer where the monitor, keyboard, pointing device and processor are all together in one single unit
- **Netbook:** A type of computer that can almost fit onto and a hand and is a smaller version of a laptop
- **PDA (personal digital assistants) :** small handheld computers that usually come with a touch screen and stylus
- **Mainframe:** large, very powerful, computer systems and are often housed in large room-sized frames

INPUTS

- **Keyboards:**

- Ergonomic
- QWERTY
- Numeric
- Concept

- **Pointers:**

- Mice
- Touchpad
- Tracker ball
- Joysticks
- Touch screens

- **Direct access:**

- Magnetic stripe readers
- Smart card readers
- Chip and PIN readers
- Scanners
- OMR
- OCR
- MICR

- **Media inputs:**

- Digital cameras
- Webcams
- Microphone

- **Sensors:**

- Temperature
- Pressure
- Light
- Sound
- Humidity/moisture
- pH
- Proximity
- Motion

- **Drawing:**

- Light pen
- Graphics tablet

OUTPUTS

- **Monitors:**

- CRT
- TFT

- **Printers:**

- Inkjet
- Laser jet
- 3D inkjet
- Dot matrix
- Graph plotters

- **Media:**

- Speakers
- Multimedia projector

NOTES

CONTROL DEVICES

- **Actuators** are **transducers** and are used to take signals from a computer and convert them into some form of motion
- As part of the control process, digital signals are sent from the computer to an actuator to operate a device
- Usually, conversion of the digital signals to analogue is required first (using a DAC)
- **Control devices:**
 - Motors
 - Buzzers
 - Lights
 - Heaters

BACKING UP

- **What is backing up of data?**

- Backing up refers to the copying of files and data to a different medium in case of a problem with the main storage device
- Backing up files and data on a regular basis is seen as good computing practice and many computer systems can be set to back up files automatically on a regular basis
- The backups are often stored in a different place to the main storage
- This is in case of fire or some other situation which could lead to irretrievable loss of key data and files

- **Why backup data?**

- Data lost due to hardware failure
- Hackers may corrupt or cause you to lose data completely
- Might need backup if files need to be used elsewhere – original files then protected
- Backups do not guard effects of viruses, virus could attach to original and backup

TYPES OF ACCESS

- **Serial access:**
 - This type of access is the slower type because you have to go through everything one by one until you reach what you want.
 - If you want to watch a show that you recorded earlier, you have to rewind / fast-forward through all other shows until you find it. (can't just skip)
 - The good thing is that when this type of access needs updating you can easily just add another tape and merge the old one with the new.
- **Direct access:**
 - Computer uses a key field to calculate where data has been stored
 - It is then able to access the data directly from the calculated position
 - Access is much faster therefore used in applications where access speed is vital
 - When updating, new data written to next available location and its position is calculated using built-in algorithm

BACKING STORAGE MEDIA

- **Magnetic:**
 - Fixed hard disk
 - Portable hard disk
 - Floppy disk drives
 - Magnetic tapes
- **Optical storage media:**
 - CD-ROM and DVD-ROM
 - CD-RW and DVD-RW
 - DVD-RAM
 - Blu-ray
- **Solid state:**
 - Memory sticks/pen drives
 - Flash memory cards

NOTES

COMPARING STORAGE MEDIA

Volume of data

Very large storage capacity	Fixed hard disks
	Portable hard disks
	Magnetic tapes
Large storage capacity	Memory sticks/pen drives
	Flash memory cards
	Blue-ray/HD DVD
	DVD-ROM
	DVD-R
	DVD-RW
Limited storage capacity	DVD-RAM
	CDs

Portability

Very portable	Flash memory cards
	Memory sticks/pen drives
	All the CDs and DVDs
Less portable	Portable hard disks
	While some tapes are small others are large
Not portable	Fixed hard disks

Speed of data access

Very fast	Flash memory cards
	Memory sticks and pen drives
Fast	Fixed hard disks
	Portable hard disks
	All CDs, DVDs, Blu-ray
Slow	Magnetic tape

COMPARING STORAGE MEDIA

Volume of data

Very large storage capacity	Fixed hard disks
	Portable hard disks
	Magnetic tapes
Large storage capacity	Memory sticks/pen drives
	Flash memory cards
	Blue-ray/HD DVD
	DVD-ROM
	DVD-R
	DVD-RW
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Speed of data access

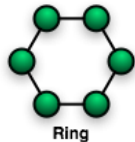
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LOCAL AREA NETWORKS

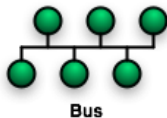
- Not over a large geographical area (e.g. in one building)
- Typical LAN will consist of a number of computers and devices
- Devices and computers will be connected to hubs or switches.
- If hubs or switches connected to a router and modem allows the LAN to connect to the internet and in doing so it then becomes part of a wide area network
- **Advantages of networking using LAN:**
 - The sharing of resources
 - Communication between users
 - Network administrator can control and monitor all aspects of the network
- **Disadvantages of networking using LAN:**
 - Easier spread of viruses throughout the whole network - increased security risks
 - Slower access to external networks, such as the internet
 - If main server breaks down, usually the networks will no longer function.

LAN NETWORK TOPOLOGIES

- Ring networks:



- Bus networks:



- Star networks:



- Tree networks:



WIRELESS LANs (WLANs)

- Do not involve any wiring or cabling - use radio or infrared signal's instead
- Provide wireless network connection overs a short distance
- Devices known as Access Points (APs) use spread spectrum technology for a larger range
- **Advantages:**
 - All computers can access the same services and resources
 - No cabling is involved and the system is more flexible
 - Adding new computers and devices is very easy
 - Cost is reduced and safety is improved
- **Disadvantages:**
 - Security is an issue
 - Problems and interference can affect the signal
 - The data transfer is slow than in the wired LAN
- **Wi-Fi:** any system which allows you to connect to a network through wireless communication

COMMON TYPES OF NETWORKS

- **Wi-Fi hotspots:**

- Wi-Fi hotspots are places where you can access Wi-Fi (free or paid)
- Hotspots are found in public places like Airports, hotels and cafés
- War driving: The act of driving and searching for unsecured Wi-Fi hotspots
- This gives a risk to the Wi-Fi system

- **Bluetooth:**

- Bluetooth is an example of wireless personal area networking (WPAN) technology
- Spread spectrum transmission (radio waves) is used to provide wireless links

- **Wide area networks:**

- Formed by a number of LANs being connected together through a router or a modem
- Some companies set up Private WANs; expensive however much enhanced security
- Common to use an Internet service provider (ISP) for connections to the internet
- Additional hardware is needed for a WAN: Routers, modems and proxy servers

NETWORK DEVICES

- **Modems:**

- It stands for modulator demodulator.
- Converts computer's digital signals (modulates it) into analogue for transmission through telephone lines and converts analogue signal from a telephone line into digital for a computer to process the data (demodulates it)
- Used to connect computer networks over long distances using existing telephone lines

- **Types of modems:**

- Dial-up modems: operate at 60 kilobits/sec (slow compared to modern standards)
- (ADSL) asymmetric digital subscriber line modems operate at 11,000 kilobits/sec.
- Asymmetric: faster at downloading than uploading
- They don't tie up the line while accessing the internet, which allows simultaneous internet access and usage of telephone.
- Cable modems: allow cable TV users to receive TV signals as well as internet access.

NETWORK DEVICES

- **Hubs:**

- Devices that can have multiple devices connected to them.
- Main task is to receive data from different ports and send it to each device
- Information will be received to the device whether its relevant, or not

- **Switches:**

- More efficient than hubs in distributing data.
- Each device has an access control media address MAC which identifies it uniquely
- MAC is a number unique to each device connected to the network (like fingerprints)
- Data sent will have a MAC address which tells the source and receiving device.

- **Bridges:**

- It connects 2 different types of networks together e.g. a bus and star network
- It can only connect networks that use the same way for handling messages
- They do this by changing the form of message to suite the different type of network

NETWORK DEVICES

- **Routers:**

- Acts like a bridge, yet can link between two or more networks
- Makes decisions on messages being passed between the networks
- Formats the messages making it suitable for the new network
- Reads information about the message and decides where the message should go and the best route for it to get there
- Used to provide a connection between a network and the internet

- **HTTP proxy servers:**

- Type of server that acts as a buffer between a WAN and a LAN.
- Retrieves web pages and passes them onto the computer that made a request.
- Stores any page retrieved on the server, which means that when a different computer requests the same page it would be available therefore speeds up the browsing process

THE INTERNET

- **The Internet:**

- The internet is a worldwide collection of networks.
- It allows for web browsing, gaming, file sharing, video and email.
- User can access by web browser.

- **Websites:**

- Web is made up of millions of websites and web pages
- Web pages are documents on a computer screen containing various multimedia and text, pictures
- A website consists of many of these pages linked together
- Web browsers use URLs to retrieve files - standard way of locating on the internet

ACCESSING THE INTERNET

Type of access	Description
Dial up internet access (dial up modem)	<ul style="list-style-type: none">• Slowest type (60kbps)• Connects via the telephone line dialing a number given by ISP• Disadvantage: telephone line gets tied up while a dial up modem is in operation
Cable internet access (cable modem)	<ul style="list-style-type: none">• Local cable television operators gives user access through cable networks
Internet access via DSL (broadband modem)	<ul style="list-style-type: none">• Fastest download speed connections (at least 11000kbps)

INTRANETS

- **Intranets:** It is an internal website that is setup internally for companies and can be accessed by employees for the purpose of standard documents or information and many items of information and data.
- **Benefits:**
 - Safer and less chance of hacking
 - Possible to prevent employees from accessing unwanted sites
 - Companies ensure that info. available is specific to their needs
 - Easier to send sensitive messages that remain within a company

NETWORK SECURITY

- **User IDs:**
 - To log on to a network, a user must type in a user ID
 - User ID assigns user privilege once user logs in
- **Passwords:**
 - Combination of letters, numbers and symbols
 - Passwords are shown as stars (***) so nobody overlooking can see it.
- **Encryption**
 - The conversion of data to code by encoding it done by using encryption software
 - Since data is encoded, it appears meaningless to a hacker
- **Authentication techniques:**
 - Something you know – password/pin
 - Something belonging to you – bank card
 - Something unique to you – your fingerprint

COMMUNICATION METHODS

- **Fax:**

- A system that scans documents electronically and converts them into a bit map image
- Then transmitted as a series of electrical signals through the telephone network
- Receiving fax machine converts the electronic image and prints it out on paper
- Also possible to generate fax signals from a computer to allow documents to be sent to a fax machine - saves printing out the document first
- Fax software in a computer converts image into a form fax machines can recognize

- **Email:**

- Method to send text and attachments from one computer to another over a network
- **Advantages:** speed of sending and receiving replies is quick, it is low cost (no stamps, paper etc.) and there is no need to leave home to send mail
- **Disadvantages:** possibility of virus threats and hacking, need for the email address to be correct and inability to send bulky objects via emails

COMMUNICATION METHODS

- **Video conferencing:**

- This is a method of communication between people at 2 or more separate locations
- It is done in real time and makes use of LAN, if internal, or WAN if through the internet.
- Uses special software like CODEC converts and compresses analogue data into digital data to send down digital lines.

- **VOIP: voice over internet protocol**

- Method used to talk to people over internet
- Converts sound (picked up by a microphone) into discrete digital packets that can be sent to a destination via internet
- The biggest advantage is that it is free and can be used all over the world
- The biggest disadvantage is that sound quality is usually bad.

TYPES OF DATA

- **Logical/Boolean data:**
 - Can only have two values TRUE or FALSE
 - Used when carrying out a search in a database or on the internet.
- **Alphanumeric and text data:**
 - Can have alphabets and numerical characters
 - Usually symbols and spaces are also allowed.
- **Numeric data:**
 - Integers - Whole numbers (no decimals)
 - Real numbers- Numbers that have a decimal part
- **Date data:**
 - Date can be written in many forms
 - Often takes the form of 3 pairs of numbers – dd/mm/yy or mm/dd/yy
 - May store 4 digits for the year – dd/mm/yyyy (takes more storage space)

DATA STRUCTURES

- **File:** full set of data
- **Record (row):** set of data associated with a single object or person
- **Field (cell):** Each item of data for a record is stored in a field
- **Key Field/Primary Field:**
 - Each primary key is unique and is used to locate a record in a file
 - First field of the set of data (table)

ID No.	Name	D.o.B.	Phone	Class	Tutor	Room
356	Jess	3 Mar 1995	7564356	5B	Mr Noggin	56
412	Hamad	12 Nov 1994	7465846	5B	Mr Noggin	56
459	Sita	9 Jan 1994	8565634	6Y	Ms Take	18
502	Hamad	3 Mar 1995	6554546	5B	Mr Noggin	56

One Record

ID No.	Name	D.o.B.	Phone	Class	Tutor	Room
356	Jess	3 Mar 1995	7564356	5B	Mr Noggin	56
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Field Names

ID No.	Name	D.o.B.	Phone	Class	Tutor	Room
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The D.o.B. Field for Student 412

TYPE OF FILES

- **Sequential:**
 - Records are stored in order of the key
 - Easier to use and find things
- **Serial:**
 - In order of how they were inputted
 - Difficult to find record you are looking for
 - Index can be created to allow records to be stored randomly. Index will be in order and indicate where the record can be found.
 - Enabling rapid look-ups which is called direct file access
- **File maintenances:**
 - **Updates:** Change one or more items of data not the whole record.
 - **Insertions:** Inserting a new record
 - **Deletions:** Delete a whole record

DATABASES

- A collection of information which is structured in some way to permit manipulation and searching of data
- **Uses:**
 - To promote data consistency
 - Data duplication is reduced – only one copy of each data item needs to be kept
 - Relatively easy to expand
 - Security of data easier to monitor and maintain
- **Flat file:**
 - Only contains a single table of data
 - All the data stored in this one place
 - Disadvantage = repeated data
 - Wastes space and a pain to update
 - Takes time to input, typing the same data over and over (and mistakes may be made)

DATABASES

- **Relational:**

- Consists of a no. of separate tables which are related and each table contains a primary key field that is also a field in at least one other table.
- Connected by links called relationships
- Foreign Key – when a key field from one table appears in a different table
- **Advantages:**
 - Faster data retrieval because of links between tables
 - Easy expansion of the database
 - Only need to change data in one table

Student Table

ID No.	Name	D.o.B.	Phone	Class
356	Jess	3 Mar 1995	7564356	5B
412	Hamad	12 Nov 1994	7465846	5B
459	Sita	9 Jan 1994	8565634	6Y
502	Hamad	3 Mar 1995	6554546	5B

In the Student table, the Class field is a **Foreign Key**

Class Table

Class	Tutor	Room
5B	Mr Noggin	56
6Y	Ms Take	18

In the Class table, the Class field is the **Key Field**

SOFTWARE COPYRIGHT

- A law that protects books, music art and other media that are written is copyright law.
 - It is an automatic right and does not need applying for
 - The person who owns the rights must be asked before it can be used again
- Software is a specific thing created and written on a computer
 - Needs to be protected as it is so easy for people to copy
 - Users create a license which determines the terms and conditions
- **Rules that must be obeyed are:** illegal to make copies, cannot be used on networks without network license, illegal to copy parts of code, illegal to rent out and Illegal to use copyrighted name
- **Software protection:** installed software requires a unique reference number, users have to accept license agreement, software may only run if CD-ROM or DVD-ROM is actually in the drive and some software will only run if a memory stick is plugged in USB ports

VIRUSES AND HACKING

- **Viruses:**
 - Program that replicates itself and is designed to cause harm to a computer
 - May cause computer to crash or corrupt data
- **To prevent viruses:** use an anti-virus software, do not use illegal software, only download from reputable sites and use firewalls
- **Hacking:**
 - Hackers are people who get into your computer without having rights to: prove a system is vulnerable, steal data, alter or destroy data, or for fun/challenge
- **To prevent hacking:** use strong authentication techniques, encrypt data (make it unreadable), have a backup of your data and use firewalls

IMPACT OF ICT ON EMPLOYMENT

- **Led to unemployment in many areas:** manufacturing, computer controlled warehouses and labor intensive work
- **New jobs have been created in ICT:** writing softwares, maintenance of robots and internet related jobs
- **Effects on people:**
 - People need to be retrained
 - Computers can now do tasks that required high skill level
 - Safer and cleaner working environment
 - Fewer manual tasks
- **Effect on companies:**
 - Can employ less people
 - Robots do not take holiday, get sick or need breaks
 - Greater consistency in products made

IMPACT OF ICT ON SHOPPING & BANKING

- A collection of information which is structured in some way to permit manipulation and searching of data
- **Uses:**
 - To promote data consistency
 - Data duplication is reduced – only one copy of each data item needs to be kept
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- **Flat file:**
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POLICING THE INTERNET

- Currently, the internet has no boundaries - anything and everything can be put online
- **For policing:**
 - Prevent illegal material being posted
 - People can easily find info on how to become hackers or make bombs etc.
 - Prevent children from accessing undesirable websites
 - Could reduce the amount of incorrect information
- **Against policing:**
 - Material already available in other sources i.e. books
 - Very expensive
 - Users would have to fund
 - Difficult to enforce rules
 - Against freedom of information
 - Laws already exist to deal with perpetrators

MICROPROCESSORS AT HOME

- Nowadays common household items are fitted with microprocessors and controls many functions
- **Labor saving devices:** automatic washing machines, microwave ovens, ovens, dishwashers
 - **Advantages:** leads to more leisure time - devices can be programmed to do tasks, more time to socialize and becoming very sophisticated and can make use of embedded web technology
 - **Disadvantages:** unhealthy diets, people become lazy and rely on devices and dependency on technology increases
- **Other household devices:** TV, Hi-Fis, fridge/freezers, central heating systems
 - **Advantages:** saves energy - switches off automatically and easier to program device rather than set timings, dates
 - **Disadvantages:** more wasteful society - devices thrown away if they fail, not economic to repair and leaving on standby wastes resources

INFORMATION FROM THE INTERNET

Page 39

- **Reliability of Information:**

- Information is more likely to be up to date than in books, since websites can be updated very quickly
- Much easier to get information from websites- search engines link key words together and find info. that matches the criteria
- Vast amount of information on the internet- easier to locate than using indices in books
- Information on the internet however may be incorrect, inaccurate or even biased- it does not go through any checking process
- Information overload can make it difficult for the user to find relevant info.

- **Undesirability of certain websites:**

- Risk of finding undesirable websites
- Risk of doubtful websites which are not genuine
- They could lead to problems such as undesirable web links, security risks etc.

SECURITY ISSUES

- **Phishing:**
 - Fraudulent operation involving uses of emails
 - Creator sends out legitimate looking email and user clicks on link and directed to a spoof website where he enters personal detail and could lead to identity theft
- **Pharming:**
 - Scam in which malicious code is installed onto computer hard disk and code misdirects user to fraudulent website without their knowledge
 - Phishing requires email to be sent to each and every one however pharming does not require email to be sent out to anyone
- **Spam:**
 - Electronic junk mail and is a type of advertising from a company
 - It is harmless but can clog up networks and slow them down

SECURITY ISSUES

- **Spyware:**

- Software that gathers user information through their network connections without them being aware that this is happening
- Once spyware installed, it monitors all key presses and transmits the information back
- It can also install other spyware software, read cookies and changes default home page
- Anti-spyware can be used to search out the software and correct corruption

- **Cookies:**

- Small files sent to a user computer via web browser when they visit certain websites
- They store information about the users and this data is accessed each time they visit
- E.g. Sending messages like “Welcome Sarah” and to recognize buying habits
- Without cookies, the web server would have no way of knowing whether user had visited the websites before

INTERNET DEVELOPMENTS

- **Blogs:**

- Personal internet journals where writer posts their observations on a topic
- Range from minor project to important subjects
- Comments are immune from law and bloggers can be prosecuted for offensive comments

- **Wikis:**

- Allow users to easily create and edit web pages
- Wikis support hyperlinks and has a very simple syntax
- Wikis are described as web pages with an edit button

- **Digital media sharing websites:**

- Allow users to upload video clips and other media to an internet website
- Video host will then store the video on a server – popular since most users don't have unlimited web space. For example: YouTube

INTERNET DEVELOPMENTS

- **Social networking sites:**
 - Focus on building online communities who share the same interests e.g. Facebook
 - Becoming the modern way of interacting socially
 - Allow people to communicate across the world and share their interests and views
- **Folksonomies:**
 - Closely related to tagging and mean “the management of people”
 - Tagging is a type of social bookmarking
 - A user can tag any web page with words that describe its content
 - In folksonomies the visual representation is a tag cloud – sequence of words of different sizes that represent popular tags by showing them in a larger font size e.g. Flickr

HEALTH ASPECTS

Health risk	Solution
Back and neck problems/strain	<ul style="list-style-type: none">• Use adjustable chairs- correct posture• Use foot rests to reduce posture problems• Tilted screens- ensure neck is at correct angle
Repetitive strain injury (RSI)- damage to fingers and wrists	<ul style="list-style-type: none">• Ensure correct posture (e.g. correct angle of arms to keyboard)• Take regular breaks• Use ergonomic keyboards
Eyestrain	<ul style="list-style-type: none">• Ensure there is no screen Flicker• Take regular breaks• Change to LCD screens- Flicker is less of a problem than with CRT screens
Headaches	<ul style="list-style-type: none">• Use an anti-glare screen to cut out light reflections• Take regular breaks• Have eyes tested regularly
Ozone irritation caused by laser printers in an office	<ul style="list-style-type: none">• Proper ventilation- removes ozone gas quickly• Put the house laser printers in a designated printer room• Change to other types of printers (inkjet printer)

SAFETY ASPECTS

Safety hazard	Ways of eliminating or minimizing hazard
Electrocution	<ul style="list-style-type: none">• Use a residual circuit breaker (RCB)• Check insulation on wires regularly• Do not allow drinks near computers• Check equipment regularly
Trailing wires (trip hazard)	<ul style="list-style-type: none">• Cable ducts- make wires safe• Cover wires/tuck them away• Use wireless connections
Heavy equipment falling	<ul style="list-style-type: none">• Strong desk/tables to support heavy hardware• Use large desks and tables so that hardware doesn't fall off edge
Fire risk	<ul style="list-style-type: none">• Have a CO2 fire extinguisher nearby• Don't cover equipment vents- can cause equipment to overheat• Make sure hardware is fully maintained• Do not overload sockets with too many items

COMMUNICATION APPLICATIONS

- **Multimedia presentations:** it is a mixture of media to present information. This is produced using software packages and is used with a projector so large audience can view
 - **Advantages:** uses sound and animation/video effects, have interactive/hyperlinks built into presentations and are more likely to hold audience's attention
 - **Disadvantages:** there is need for special equipment – expensive and it may require internet access
- **Paper-based presentations:** is always possible to produce presentations in hardcopy format
 - **Advantages:** disabled people do not have to go to the venue to see the presentation, possible to print it out in Braille for the benefit of blind people and the recipients have a permanent copy, which they can refer to at any time they want
 - **Disadvantages:** The presentation needs to be distributed in some way. There are no special effects (sound/video/animation) and there are printing costs (paper/ink/etc.)

COMMUNICATION APPLICATIONS

- **Flyers and posters:** A word processor or desktop publisher is used to create it. Needs to hold minimum amount of information and be accessible very quickly – needs to make an immediate impact when people look at them. Some posters require larger printers than A4
- **Websites:** Collection of webpages, text, graphics, video and sound. Hosted on a web server on the internet - usually hire space from web hosting company. Need to write code or use a web authoring application. Hyperlinks to other pages can be added. Interactive websites require programming knowledge. Can use a camera, scanner, microphone to input data
 - **Advantages:** Ability to add sound/video/animation, links to other websites/hyperlinks, the use of hot spots, buttons to navigate/move around the website and hit counters to see who has visited the websites
 - **Disadvantages:** Can be hacked and modified or viruses introduced, there is need for a computer and internet connection, lack of portability compared with paper based system and need to maintain website once it is set up

COMMUNICATION APPLICATIONS

- **Music production:** Music samplers and mixers allow original tracks that were recorded in a studio to be modified. Electronic instruments can play back through electronic effects machines. Synthesizers combine simple wave forms to produce complex music creations. Electronic organs can mimic any other instrument. Music scores can be generated from music itself using software. Software can automatically correct music notes in a score. There is no need to understand music notation to write a music score. Music notes are automatically printed out in the correct format
- **Cartoon animations:** Animations can be produced using computer hardware and software. With 3D animations objects are designed on a computer and a 3D skeleton is produced. Parts of the skeleton are moved by the animator using key frames. The difference in appearance of the skeleton in these key frames is automatically calculated by the software and is known as tweening or morphing. The final stage is to make a realistic image by a technique known as rendering

SATELLITE & MOBILE NETWORK COMMUNICATIONS

- **Mobile phone networks:**
 - Communicate by using towers inside many cells networked together to cover large areas.
 - Towers allow transmission of data throughout mobile phone networks.
 - Each tower transmits within its own cell.
 - Can now be used by computers - plug-in device allows computer to connect to mobile network which then allows access to internet
- **Embedded web technology:**
 - New development that uses internet in real time to control or interact with a device in the home or a device which is part of an industrial application
 - Device must contain an embedded microprocessor for system to work
 - Device can be controlled by authorized user from a computer anywhere on a network or from a web enabled mobile phone

SATELLITE & MOBILE NETWORK COMMUNICATIONS

- **Global positioning satellite (GPS) systems:**
 - Used to determine the exact location of a number of modes of transport
 - Satellites surrounding the Earth transmit signals to the surface
 - Computers installed in the mode of transport receive and interpret these signals
 - The computer on board the mode of transport calculates its exact position based on the information from at least three satellites
- **Advantages:**
 - The driver does not have to consult paper maps while driving, removes errors as it can warn drivers and can estimated time of arrival
 - Possible to program in the fastest route
- **Disadvantages:**
 - If maps aren't up to date or wrong start/end entered - incorrect instructions
 - Loss of satellite signals can cause problems

DATA HANDLING APPLICATIONS

- **Surveys:**

- **Data collection:** Data capture forms can be used for many applications. Decide what needs to be collected and then what questions should be used to collect it. Paper or electronically
- **Rules for creating forms:**
 - Make them look official
 - Spaces should be thought about giving enough space for answers
 - Restrict the amount of possible answers, do not use open questions
 - If open questions are used limit the amount of space available for answers
 - Asking for 'Name' needs to be carefully thought about
 - If sensitive information – keep anonymous
 - If not – decide which name u would like
 - Give instructions about how to answer questions

DATA HANDLING APPLICATIONS

- **Surveys:**
 - **How will the data be collected:**
 - Advantages of paper surveys scanned using OMR or OCR: faster to get results, fewer errors, it is easier to do statistical analysis and less expensive to carry out as it requires fewer people
 - Advantages of online questionnaires no data preparation needed and results can be sent directly to database for analysis
- **School reports:**
 - Database applications such as SIMS store large amounts of data which can be used to create annual and termly school reports
 - Things able to be gathered from here are:
 - Data individual to student – tests/exam results
 - Teacher comments – adds comments on to report

DATA HANDLING APPLICATIONS

- **Tuck shop records:**
 - Uses spreadsheets to keep a record of prices and takings
 - Advantage: Easier to vary parameters to show how to optimize profits or to see why loss is being made
 - System can be programmed to automatically warn of any problems
- **Club and society records:**
 - Need to keep a record on members usually in a database
 - Usually payment details, contact details and interests
 - It makes it easy to match people with interests and send information about what they are interested in.
 - This can be done by using mail merging
 - Easy to check memberships and send out reminders
 - It is important to follow the data protection act.

DATA PROTECTION ACT

- **Rules:**

- Data must be fairly and lawfully processed
- Data can only be processed for the stated purpose
- Data must be adequate, relevant and not excessive
- Data must be accurate and kept secure
- Data must not be kept longer than necessary
- Data must not be transferred to another country unless they have adequate protection

- **Guidelines:**

- Don't leave personal information lying around
- Lock all filing cabinets when leaving an office
- Do not leave computer without locking or logging off
- Protect passwords and change passwords regularly
- Do not fax or email anything of sensitive nature.

DATA HANDLING APPLICATIONS

- **Record keeping:**
 - Record keeping is keeping files and information in a simple database and stored in electronic format
 - It is used to make it easy to contact the customers and make it far more easy to search
 - Advantages:
 - Less room would be used up in the shop since no paper records
 - Quicker and easier to find details
 - Less expensive. Not necessary to employ somebody to file and search
 - Fewer errors due to no manual checking of paper files
 - Disadvantages:
 - Buy a computer and software
 - Would take time to transfer paper files to database.

MODELLING APPLICATIONS

- A simulation is the creation of a model of a real system in order to study behavior of system
- The model is computer generated and is based on mathematical representations
- Try and find out what mechanisms control how a system behaves and consequently predict behavior of system in the future and also see if it's possible to influence future behavior
- **Advantages:** save money, help find a solution quickly, and considerably safer
- **Why simulations are used:**
 - Less expensive than having to build the real thing and it's safer to run a simulation
 - With simulations various scenarios can be tried out in advance
 - Limitations of Simulations:
 - Only as good as data used and mathematical algorithms representing real life situation therefore have limited use in complex applications
 - Can be very expensive to set up and often require specialist software
 - Frequently require very fast processors

TYPES OF PROCESSING

- **Batch processing:**

- Number of tasks are collected together over a set period of time
- Job then loaded into a computer system and processed all at once
- Once the batch processing starts, no user interaction is needed
- This type of processing can be done where there are no time constraints
- A big advantage of batch processing is that job can be processed when the computer system is less busy (e.g. at night) so use of resources is optimized
- Used in billing systems, payroll systems and processing of bank checks

- **Real-time (transaction) processing:**

- Real time processing is an example of online processing.
- It is used in things like booking seats in a flight or at a theatre.
- Type of processing is required so when a query is sent the response to it should be immediate to prevent any problems

TYPES OF PROCESSING

- **Real-time process control:**
 - Although it's an example of online processing, it is very different to real-time (transaction) processing
 - System usually involves sensors and feedback loops
 - In real-time process control, physical quantities are continually monitored and input is processed sufficiently quickly to influence the input source

NOTES

TURTLE GRAPHICS

- Based on computer language called LOGO and is now usually known as turtle graphics
- It is the control of the movement of a 'turtle' on a computer screen by a number of key instructions which can be typed in
- The use of 'repeat' instructions makes a piece of code more efficient

Command	Meaning
FORWARD x	Move x cm forward
BACKWARD x	Move x cm backward
LEFT d	Turn left through d degrees
RIGHT d	Turn right through d degrees
REPEAT n	Repeat next set of instructions n times
ENDREPEAT	Finish the repeat loop
PENUP	Lift the pen up
PENDOWN	Lower the pen

APPLICATIONS USING SENSORS

Page 60

- In both cases, sensors are used to send data to a computer where the data is processed – it is what happens next where the differences occur:
 - In monitoring, computer simply reviews data from sensors (by comparing it to data stored in memory) and updates its files and/or gives a warning signal if values are outside given parameters. No changes to process are made during monitoring.
 - In control applications, the computer again reviews data from the sensors (by comparing it to data stored in memory). But if values are outside given parameters it takes action to try and get values within acceptable ranges. It does this by sending signals to devices controlling process.
- ADC and DAC are needed to process data and send signals to output devices from computer after processing

APPLICATIONS USING SENSORS

- **Advantages of using computers and sensors for monitoring:**
 - The computer will not forget to take readings and will cover
 - The computer's response time is much faster
 - Monitoring is automatic so doctors, nurses, scientists, etc. can all get on with other tasks
 - Computer give 24 hours cover every day (i.e. 24/7)
 - The readings will tend to be more accurate
 - Readings can be taken more frequently if they are done by a computer and sensors
 - It could also be safer if whatever is being monitored may have potential hazards
- **Advantages of using sensors and computer systems to control processes:**
 - The response time if some parameter is out of range is much faster
 - Safer as some processes are potentially dangerous if they go wrong—computer can control process in a more accurate way, ensuring that conditions are always correct
 - If a process is dangerous, it is better to control it from a distance

ROBOTICS

- Robots used in many areas of manufacturing, from heavy work to delicate operations
- Control of robots is either through embedded microprocessors or linked to a computer
- Programming of robot to do a task is generally done in two ways:
 - Robot is programmed with sequence of instructions which allow it to carry out a series of tasks
 - Alternatively, a human operator manually carries out a series of tasks and how each task is done is relayed back to the robot (embedded processor) or controlling computer. The sequence of instructions is remembered so that the robot can automatically carry out each task identically each time
- Robots often equipped with sensors so they can gather important information about their surroundings and also prevent them from doing 'stupid things' Robots are very good at repetitive tasks
- However, if there are many different tasks then it is often better to still use human operators

ROBOTICS

- **Advantages:**

- Robots can work in environments harmful to human operators
- They can work non-stop (24/7)
- Less expensive on long term however they are expensive to buy initially
- Productivity is higher, since they do not need holidays, are not ill etc.
- There is greater consistency – every car coming off a production line is identical
- They can do boring, repetitive tasks, leaving humans free to do more skilled work

- **Disadvantages:**

- Robots find it difficult to do 'unusual' tasks
- They replace skilled labor, leading to unemployment
- Since robots do many of the tasks once done by humans, there is a risk of de-skilling
- Because robots are independent of the skills base, factories can be moved anywhere in the world, again causing unemployment

BATCH PROCESSING APPLICATIONS

- **Payroll:**

- At the end of each pay period (weekly or monthly) company needs to pay its employee. Payroll systems used to calculate wages and print out pay slips
- The inputs are: employee details from file, number of hours worked, overtime working, holidays, etc.
- The processing done is calculation of: gross pay, any deductions, net pay etc.
- The outputs are: printed pay slips, updating of the employee file, transfer to Bankers Automated Clearing Service (BACS) is wages paid into a bank account, etc.
- Run as a batch system, where all timesheets, etc. are gathered together before payroll and calculations are done in one go (often overnight) since there is no need for any further input, nor is it urgent to get the output

BATCH PROCESSING APPLICATIONS

- **Billing systems:**

- Because companies send out their bill/invoices on a pre-determined date, all information is gathered together and then processed in one go (batch).
- Consider an electricity billing system:
- Inputs are: customer details (address), charge per KW (unit) of power, previous readings, new readings taken from the electricity meter, bank account details, etc.
- Processing done is calculation of: number of units of electricity used (i.e. new reading minus old reading), customer's cost (i.e. units used times charge per unit), monthly payments made (if using direct debit), outstanding amount owed or carried over to next bill, etc.
- Outputs are: bill showing all details, updating of customer file, production of request for payment if not done through direct debit, etc.

AUTOMATIC STOCK CONTROL

- Automatic stock control systems rely on the use of barcodes
- Allow quick identification of product details once barcode has been scanned by a barcode reader
- Supermarkets, in particular, use electronic point of sale (EPOS) terminals, which incorporate a barcode reader that scans barcode, retrieve price of article and relay information back to computer system allowing it to update its files
- Barcodes are made up of alternating dark and light lines of varying thickness
- A number underneath barcode usually consists of four parts: country code, manufacturer's code, product code, and a check digit
- Check digit is a form of validation which is used to make sure no errors occurred during reading of barcode
- Every time barcode is read, calculation is performed to ensure it has been scanned correctly

WAYS IN WHICH ICT IS USED

- **Online booking system:**
 - Online banking systems rely on the ability to update files immediately, thus preventing double booking, which could happen if the system response time was slow
 - Booking systems are used for transport (flights, trains and buses), cinemas and theatres
- **Banking applications:**
 - **Automated teller machines (ATMs):**
 - Automated teller machines (ATMs) are places where customers can get cash (or carry out certain other banking activities) using their credit or debit card
 - **Disadvantages:**
 - They are often in places where theft can take place unnoticed
 - 'Fake' ATMs can be set up to gather information about card and retain card
 - Some banks charge customers for the use of ATMs
 - Someone else could see the PIN being entered and use it to commit fraud

WAYS IN WHICH ICT IS USED

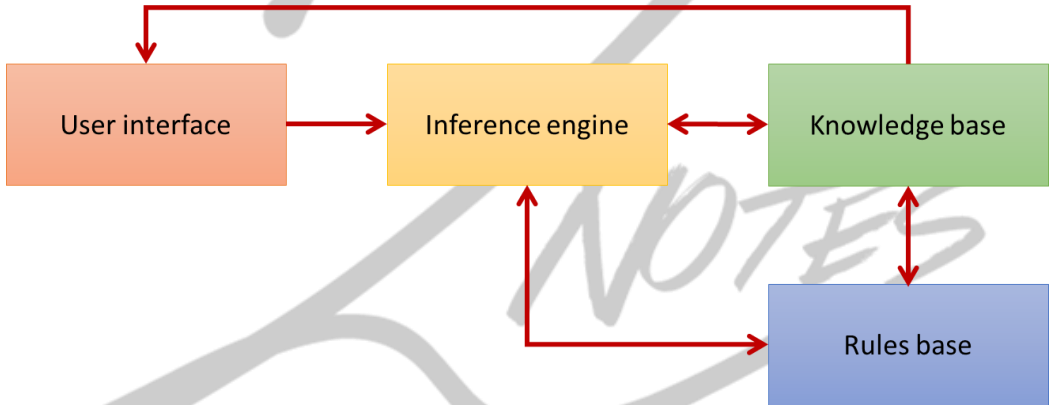
- **Banking applications:**
 - **Chip and PIN:**
 - Many credit cards are equipped with a chip as well as a magnetic stripe – this contains key information such as the PIN
 - This system is designed to enhance security since it is better than relying only on a signature
 - When paying for items using a chip and PIN card, a form of electronic funds transfer (EFT) takes place

LIBRARY SYSTEMS

- Many library systems are computer controlled
- They usually involve the use of barcodes on the books being borrowed and on the borrower's library card
- The following describes a computerized library system based on barcodes
- There are two files:
 - Book file, containing fields for example: barcode, book title, name of author etc.
 - Borrower's file, containing fields for example: borrower's number, borrower's name etc.
- When a borrower takes out a book, the book's code is scanned. The book details are then found on the book file
- The borrower's library card barcode is then scanned for the borrower's unique number. The book file is linked to the borrower's file and both files are updated to indicate which book has been borrowed and when it is due back

EXPERT SYSTEMS

- These systems have been developed to mimic the expertise and knowledge of an expert in a particular field



SETTING UP EXPERT SYSTEMS

- Experts in the field are interviewed to find out what is needed in the expert system
- Data is then collected from these experts
- A knowledge base is designed and then created
- The rules base is designed and created
- The inference engine is designed and created
- The input screen and output format are also designed and created – this is known as the user interface
- The expert system is tested against known conditions and scenarios
- It is also checked to see if it meets the original specification
- Experts are interviewed about how effective it is before the expert system goes out on general release

EXPERT SYSTEMS

- **Advantages:**
 - Expert systems provide consistent answers
 - They never 'forget' to answer a question when determining the logic
 - Using expert systems reduces the time taken to solve a problem
 - A less skilled worker force is needed, which gives the potential of saving money, but also allows areas of the world access to expertise which they could not normally afford
- **Disadvantages:**
 - They tend to lack common sense in some of the decision-making processes
 - Errors in the knowledge base can lead to incorrect decisions being made
 - It can be expensive to set up in the first place
 - Considerable training is necessary to ensure the system is used correctly by the operators

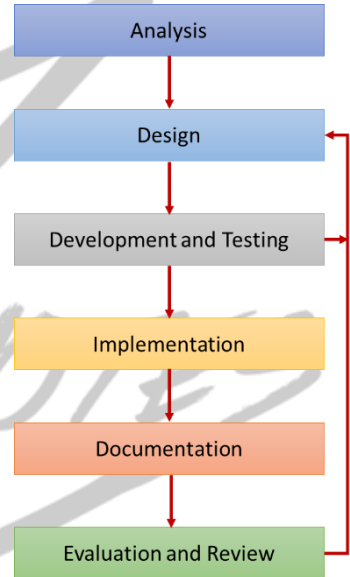
EXPERT SYSTEMS - DEFINITIONS

Page 73

- Knowledge base
 - This is a database designed to allow the complex storage and retrieval requirements of a computerized knowledge-based management system (in support of an expert system)
- Inference engine
 - This is software that attempts to derive answers from the knowledge base using a form of reasoning
 - It's how expert systems appear to use human-like reasoning when accessing information from the knowledge base in an effort to find a conclusion to a given problem
 - The inference engine is a type of reasoning engine
- Rules base
 - This is made up of a series of 'inference rules' These inference rules are used by the inference engine to draw conclusions
 - They closely follow human-like reasoning

SYSTEM ANALYSIS AND DESIGN

- A systems analysis team is often brought in to review an existing system and suggest a number of improvements
- The existing method used may be either a manual paper-based system or a computer-based operation that is no longer regarded as adequate for the task



ANALYSIS STAGE

- Basic steps in analysis stage can be summarized as:
 - Fact finding/collecting data from the current system
 - Description of the current system – establishing the inputs, outputs and processing being done
 - Identification of the problems with the current system
 - Agreeing the objectives with the customer
 - Identifying and agreeing the customer's requirements
 - Interpreting the customer's requirements
 - Producing a cost-benefit analysis
 - Producing a data flow diagram
- There are four common methods used in fact finding
- The methods are: observation, questionnaires, interviews and looking at existing paperwork

DESIGN STAGE

- Once the analysis has taken place and the systems analyst has some idea of the scale of the problem and what needs to be done, the next stage is to design the key parts of the recommended system
- **Verification:**
 - A way of preventing errors when data is copied from one medium to another
 - Two common ways of verification checks:
 - Double entry
 - Visual check
- **Validation:**
 - Process where data is checked to see if it satisfies certain criteria when input into a computer, for example to see if the data falls within accepted boundaries
 - Range check, length check, character/type check, format/picture check, limit check, presence check, consistency check, check digit

DEVELOPMENT STAGE

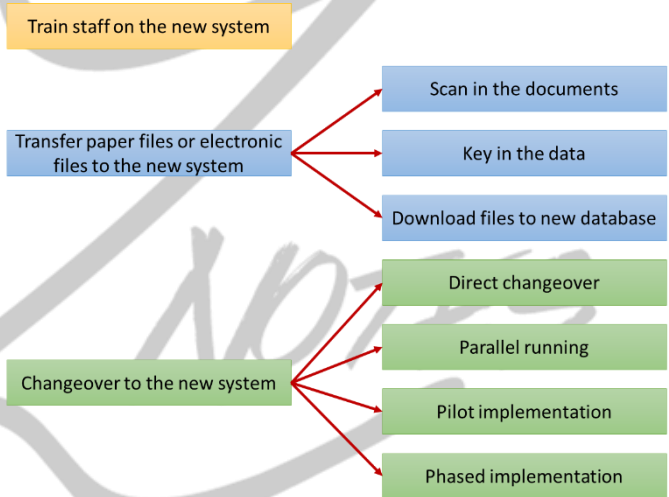
- If system contains files then file structure needs to be finalized at this stage
- Once file structure has been determined, it is then created and fully tested to make sure it is robust when the system actually goes live
- Validation and verification checks are run to make sure data populating file/s and database/s is of right type and conforms to certain rules
- Routines have to be fully tested to ensure they trap unwanted data
- They also have to make sure any data transferred from paper-based system to electronic system has been done accurately
- How hardware and specialist hardware are used to interact with system needs to be identified
- This will be followed by thorough testing to ensure user screens are user friendly and that correct output is associated with inputs to system.

TESTING STRATEGIES

- Testing of each module needs to be done to ensure each one functions correctly on its own.
- Once development of each module is completed, the whole system needs to be tested
- Even though each individual module may work satisfactorily, when they are all put together there may be data clashes, incompatibility and memory issues, etc.
- May lead to a need to improve input and output methods, file and database structures, validation and verification methods and then the system will need be fully tested again
- It's a time-consuming process but system has to be as perfect as possible before it goes live.
- Testing will use many different types of data, which will fall into one of three categories: normal, extreme or abnormal.
 - Normal: data which is acceptable/valid and has an expected (known) outcome,
 - Extreme: data at the limits of acceptability/validity,
 - Abnormal: data outside limits of acceptability/validity and should be rejected or cause an error message.

IMPLEMENTATION

- Once the system is fully tested, the next stage is to fully implement it.
- There are four common methods used for changing over from the old system to the new system.
- Each one has advantages and disadvantages which need to be weighed up before the most appropriate method is chosen for a particular application.



DOCUMENTATION

- Once the new system is fully developed, a considerable amount of documentation needs to be produced
 - For the end user
 - For people who may need to modify or develop the system further at some later stage
- **User documentation:** designed to help users to learn how to use the software or system
- **Technical documentation:** designed to help programmers and analysts who need to make improvements to the system or repair/maintain the system

EVALUATION

- Once a system is up and running it is necessary to do some evaluation and carry out any maintenance, if necessary.
- Some results from the evaluation may require changes to either hardware or software.
- Hardware may need to be updated because:
 - of feedback from end users
 - new hardware comes on the market, making change necessary
 - there are changes within the company which require new devices to be added or updated
- Software may need to be updated because:
 - of feedback from end users
 - changes to the company structure or how the company works may need modifications to the software
 - changes in legislation may need modifications to the software