

Introduction

Scenario

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Exam Question

This unit	Activities	Other units/LOs	
Unit 1	Computer hardware, components and connectivity methods	Unit 1 Fundamentals of IT	
	Types of computer system		
	Communications hardware		
	Hardware troubleshooting		
	Units of measurement		
	Number systems		
	Number conversion		

The above topics are covered in this taster material. There is a lot reading including in the slides provided in this presentation and therefore no extra reading is required to tackle the questions.

RELATED ACTIVITIES

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Exam Question

Explanations of the key terms used within this unit, in the context of this unit

Key term	Explanation
Change management	Change management is a systematic approach to dealing with change, both from the perspective of an organisation and on the individual level. http://searchcio.techtarget.com/definition/change-management
Hybrid cloud	Hybrid cloud is a cloud computing environment which uses a mix of on-premises, private cloud and public cloud services with orchestration between the two platforms. By allowing workloads to move between private and public clouds as computing needs and costs change, hybrid cloud gives businesses greater flexibility and more data deployment options. http://whatis.techtarget.com/definitions/H/page/7
Hypervisor	A hypervisor is a hardware virtualisation technique that allows multiple guest operating systems (OS) to run on a single host system at the same time. The guest OS shares the hardware of the host computer, such that each OS appears to have its own processor, memory and other hardware resources. A hypervisor is also known as a Virtual Machine Manager (VMM). http://www.techopedia.com/definition/4790/hypervisor
Internet of Things	The Internet of Things (IoT) is a computing concept that describes a future where everyday physical objects will be connected to the Internet and be able to identify themselves to other devices. http://www.techopedia.com/definition/28247/internet-of-things-iot
Privacy filter	A privacy filter is a panel or filter that is placed over a display to make it difficult or impossible for someone to see the screen without being directly in front of the display. http://www.computerhope.com/jargon/p/privfilt.htm
RFID	Radio-Frequency Identification (RFID) is a system used to track objects, people, or animals using tags that respond to radio waves. RFID tags are integrated circuits that include a small antenna. They are typically small enough that they are not easily noticeable and therefore can be placed on many types of objects. http://techterms.com/definition/rfid
Social engineering	Social engineering is a non-technical method of intrusion used by hackers that relies heavily on human interaction and often involves tricking people into breaking normal security procedures. http://searchsecurity.techtarget.com/definition/social-engineering
VoIP	Voice over Internet Protocol (VoIP) is a technology that allows telephone calls to be made over computer networks like the Internet. http://compnetworking.about.com/cs/voicefaxoverip/g/bldef_voip.htm

Assignment Scenario

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Exam Question

- ▶ There are 5 sections to this Theory Unit, each of which will give you a basic understanding and practice at possible exam questions. It will involve gaining knowledge towards the answers.

- ▶ This is not a wrote learning course, you will need to understand the basics of ICT in order to adapt your knowledge towards companies and their needs. For **this bridging material**, this will involve understanding:
 - Computer Hardware,
 - Components and connectivity methods,
 - Types of Computer Systems,
 - Communication Hardware,
 - Hardware Troubleshooting,
 - Number Systems
 - Number Conversion.

- ▶ In the exam you will be given precise questions requiring precise answers based on a scenario to answers questions from, and adapt your knowledge and use the key terms and named components to give a judgemental answer.

1.1 – Computer hardware, components and connectivity methods

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Exam Question

- ▶ Outlines below are the objectives for this section of the Unit. They should be revised as part of the exam preparation.
- ▶ **Hardware** – This is the general term for the physical components that make up a computer system, for example, keyboard monitor, processor, base unit etc. This also includes Tablets, Laptops and Phones. If you can touch it or hold it then it is hardware.
- ▶ Hardware can be divided into 3 sections:
 - **Input Devices** – keyboard, mouse, touchpad, joystick, scanner
 - **Output Devices** – Monitor, printer, turtle.
 - **Secondary Storage devices** – CD, DVD, USB, External Hard Drive.

THINK ABOUT

- ▶ The Hardware changes that have happened in your lifetime
- ▶ The new technology due to come out
- ▶ The way gaming and PC's have improved
- ▶ How more advanced your car dashboard is.
- ▶ What life was like before computers came along
- ▶ Would you miss your technology

1.2 – Main Components

Scenario

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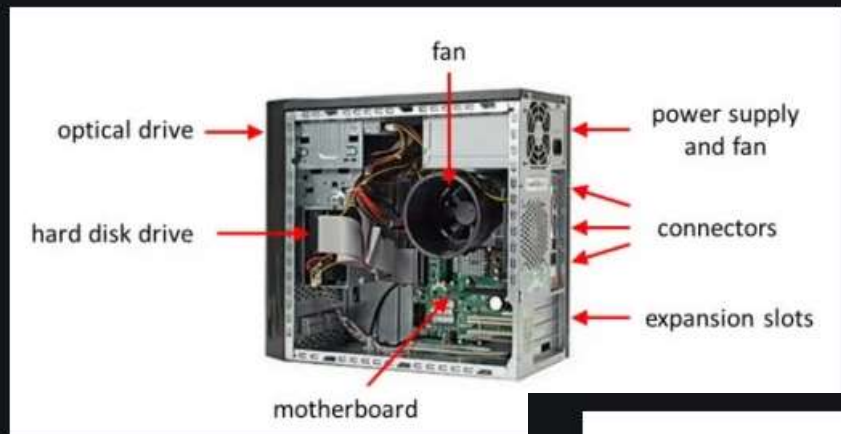
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Exam Question



THINK ABOUT

- What is in the box in front of you
- Why some computers are slower than others
- Why a tablet has a different look and feel to a laptop.
- The USB memory stick you, how does the computer know it is there.
- What will be different in terms of hardware in ten years.
- Will a tablet replace a Laptop

write down the 7 main parts

1.1 – Hardware - Overall

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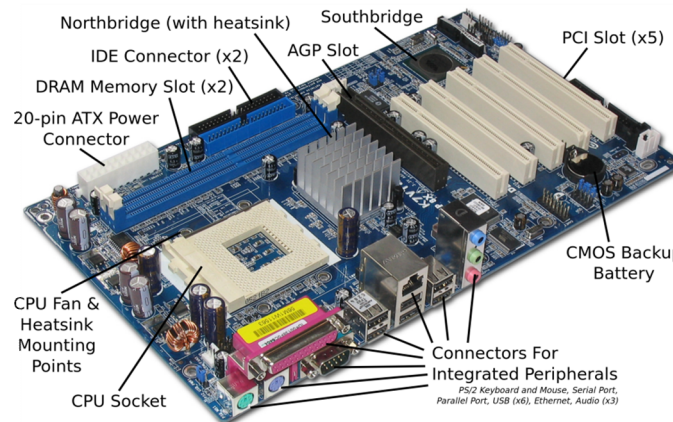
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Exam Question

- ▶ There are **8** main parts of a computer

Motherboard	CPU	Video Card	RAM
Power Supply	Hard Disk	Optical Drive	BIOS

- ▶ **Motherboard** – This is the main component inside all computers and is a base for all the other components to connect to. It is complimented by the CPU. There are lots of technical things about Motherboards you could look up such as Bridges, Models, Connectors and Speed.
- ▶ All processes link through the Motherboard which holds the memory (RAM and ROM) to move information to and from the CPU.
- ▶ Though they look complex, most motherboards are set up in a similar way.



Task 1 – Define what a North Bridge and South Bridge do on a Motherboard.

THINK ABOUT

- ▶ What is in the box (computer tower)?
- ▶ Why some computers are slower than others
- ▶ Why a tablet has a different look and feel to a laptop.
- ▶ The USB memory stick you, how does the computer know it is there.
- ▶ What will be different in terms of hardware in ten years.
- ▶ Will a tablet replace a Laptop

1.1 – Main Components - CPU

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Exam Question

- ▶ **CPU** – This is the brain of the computer whereas the motherboard is the heart. This does all the thinking (Processing) and takes information from the inputs (Keyboards, mouse, scanner etc.), processes the information (thinks about the commands given and reproduces them into binary instructional codes) and then outputs the processing to the output devices (screen, printer, GPU)
- ▶ The rule is: The faster the CPU, the faster the machine can process instructions. This is why it is the most expensive component within the computer and the most important.
- ▶ There are different kinds, Intel with its Core and Xeon range, Celeron and AMD are the 3 main manufacturers.
- ▶ All computers, mainframes, tablets and phones have one of these at the heart of the machine.

Task 2 – In 2 minutes, find out and write down what CPU the machine in front of you at home is using right now and tell me whether you think it is a good version or not and explain why.



1.1 – Main Components – Power Supply

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Exam Question

- ▶ **Power Supply** – There are several types of power supply, depending on the computer. Most bases have the large volt supply that comes with the connector cables for the majority of computer components. It has a fan because of the heat generated and a plug socket.
- ▶ For Laptops they will have their own unique supply, a small box with a lead and connector but not additional wires as the hardware is internal. It is rare for a laptop to have the supply integrated.
- ▶ They are necessary for obvious reasons, without a supply a base will not turn on, without a supply, the battery on the laptop will run out, how much depending on the age of the battery and usage.
- ▶ **In the exam you will not be asked about types but about safety, how to protect them, how to conceal the wires or how to protect the user from shock.**



1.1 – Main Components - RAM

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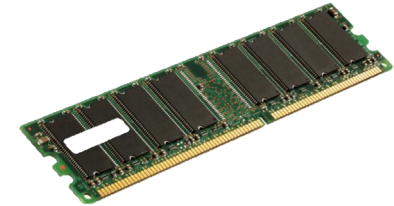
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Exam Question

- ▶ **RAM (Random Access Memory)** – There have been a few developments in Ram over the decades and most of this is down to size and speed. Ram size is measured in 128 or 256mb chunks and can be DDR1, DDR2 or DDR3 (3 being more expensive but faster), and the rule is the more memory a machine has, the faster it can store and process information.
- ▶ They have a clock speed, the faster the clock speed, the faster the processing time. And this improves games, the more processing power that is taken from the CPU, the faster the CPU can deal with the instruction code of the game.
- ▶ Unlike some hardware ram can be upgraded, simply remove the smaller one with a larger one but machines are limited to how many sockets there are for RAM.
- ▶ Ram controls the CPU output and input, information is stored onto the Ram for processing and back from the CPU to Ram for dealing with and anything that helps the CPU is good. For Laptops the Ram is physically smaller but works in the same way.
- ▶ People often mistake RAM with storage but RAM has no moving parts and does not overheat or break easily.



Task 3 – Define what Volatile and Non-Volatile Memory means.

1.1 – Main Components – Video (Graphics) Card

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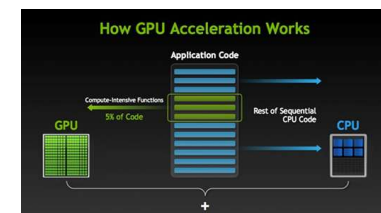
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Exam Question

- ▶ **Video Graphics cards** handle all of the visual data within a computer, interpret it and display it via a VDU. Components on a Graphics card include:
- ▶ **GPU** – Graphical Processing Unit is a dedicated microprocessor making calculations in order to display both 2D and 3D graphics.
- ▶ **Motherboard interface** – This is the method of connection and transfer of information between the motherboard. These include PCI, AGP and PCI express.
- ▶ **Video BIOS** - basic program that governs the video card's operations and provides the instructions that allow the computer and software to interface with the card.
- ▶ **Video memory** – if the card is integrated onto the mother board it may use the computers RAM, otherwise it will have a dedicated amount of memory for use for storing other data as well as the screen image such as object co-ordinates.
- ▶ **Random Access Memory** Digital-to-Analogue Converter – This converts the digital signals produced by the computer processor into an analog signal which can be understood by the computer display
- ▶ **Output connectors** – this is how the graphics card connectors to the VDU. This can include DVI, HDMI and component.
- ▶ **Cooling device** – Video cards may use a lot of electricity, which is converted into heat. If the heat isn't dissipated, the video card could overheat and be damaged. Cooling devices are incorporated to transfer the heat elsewhere. Three common methods are heat sink, fan or water block.



Task 4 – A game creation company, architect and finance officer in different companies have a budget of £400. Research and explain what Video Card would be best for their purposes.

1.1 – Main Components – Optical Drive and Media

Scenario

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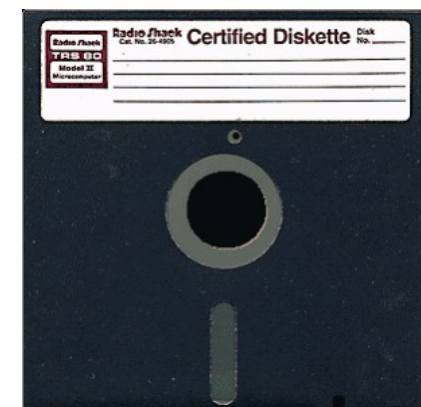
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Exam Question

- ▶ **Optical Drive** - First there was CD, 700MB, then DVD, 4400MB, now Blu-Ray. These are still not enough to back up a network drive but they are very useful as timed backups. All systems except Thin Client come with these as standard, they run off the IDE cable to the motherboard and act like a separate hard drive, taking a drive letter. Only certain Drives are RW, rewritable, but disks are so cheap that most people do not bother. This is a big step from the 3.5" and the 5.25" drives that were prevalent until 1999.
- ▶ **Optical media** – These are more common now for network storage, capable of saving 120gb on one drive for a complete backup, takes an hour on a standard network to copy down to, can be carried away, and then reused, deleted like a memory stick and resaved.
- ▶ Network managers tend to use these as a medium because of their reliability, set it running, leave it, take it away when done. Sizes of these vary again with price. They are not as easily accessible for home use like memory sticks or USB because they take time to archive and search.

Task 5 – A Media Student, Network Manager and Hosting Web Service need backup storage, define which method would be best for each.



1.1 – Main Components – Hard Disks

Scenario

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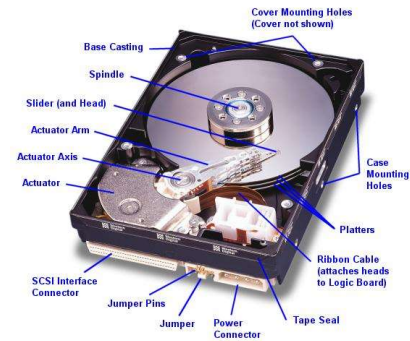
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Exam Question

- ▶ **Hard Disk** - There are two sizes of hard drive for a PC, 2.5” for a laptop and 3.5” for a full machine. This has been the de facto standard since PC’s first came out. The original PC hard drive on home computers were a massive 20mb. But with operating systems starting at MS Dos 3, all you needed was 2mb for operating system storage. Word processors were 4mb, spreadsheets another 1mb leaving a massive 13mb for games and file storage. Doom, the most popular PC game ever, installed onto 5mb and could only run off the hard drive. So you played Doom or you played something else. These all used an IDE standard, the same connectors on the PC for linking up the Hard Drive to the motherboard.
- ▶ Speed differentiation came into play, hard drive speeds of 5300 rpm, increased to 7200 rpm, and hard drives grew in size exponentially. 80mb became 120, then 200, 320, 500 and then a massive 10gb by 2000. Now the standard hard drive with a new PC is 250gb but 1.5 terabyte ones are available for home use at affordable prices. The faster the hard drive, the quicker the loading speed. For games this meant installing huge numbers of games on one machine at a time.
- ▶ The new standard is SATA which is faster than IDE and easier to install allowing the use the daisy chain multiple drives onto a PC.

Task 6 – Research and define the following terms: Tick Down, Fat 32, IRQ, SSD, Buffer, Defragmentation, and CRC



1.1 – Main Components - BIOS

Scenario

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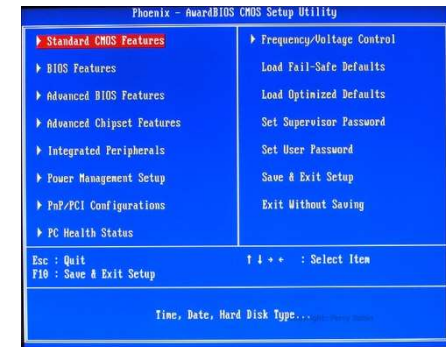
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Exam Question

- ▶ **BIOS** – Built in operating system is a small battery linked to the core of the motherboard that tells a computer what it is, what CPU, what hard drives, what kind of motherboard, where the connectors are, what time of day it is and what standard devices are connected on the inside like Hard Drives and CD's. All computers have one but they seem the least of things.
- ▶ The two most common types are Phoenix and Ami, they contain a battery life of at least 3 years and contain several pages of important information, specifically hard drive configurations and IRQ allocation. Operating systems can override the BIOS but this takes extra time and can lead to IRQ conflicts.

Task 7 - How many of those parts do you find in a Laptop and how many of those parts do you find in a Tablet?



1.2 – Types of Computers – PC's

Scenario

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Exam Question

- ▶ There are many different types of computer in existence, we will focus on the most common ones.
- ▶ **PC** – A PC/**Desktop** usually refers to a general purpose computer which is made up of separate monitor, keyboard and mouse and processing unit (Base) The term PC comes refers to a system which is IBM compatible, rather than Apple and sometimes gets confused with a Laptop.
- ▶ **Advantages** – Spare parts and connections tend to be standard reducing the price.
 - Desktops have to be a better specification (e.g. faster processor) for a given price (often due to size and construction restraints of a laptop)
 - The large case allows for heat dissipation.
- ▶ **Disadvantages** – They are not portable since they are made up of separate components.
 - All the components need to be hooked up with wiring, which can be quite complex and clutters up the desk space.
 - Because they are not portable, it is necessary to copy files when you want to do work elsewhere.

💡 THINK ABOUT

- 💡 Better and bigger screens
- 💡 Can have multiple internal hard drives.
- 💡 Only need to change one thing to make it faster.
- 💡 Playing games
- 💡 Desk space (footprint).
- 💡 Noise levels
- 💡 Clutter, cables, leads, inputs and outputs.
- 💡 Not environmentally friendly when disposing of.

1.2 – Types of Computers - Laptops

Scenario

Glossary

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Exam Question

- ▶ **Laptops (or Notebooks)** – This refers to a range of computers where the monitor, keyboard, pointing device and processor are all together in one unit, making them more portable.
- ▶ These have become the most common type of Computer in the home but not at work. Most companies prefer their staff not to be away from their desks. Over the decades of use, they have grown more powerful and in some ways smaller with better battery life.
- ▶ **Advantages** – Portable since all the devices are combined.
 - Low Weight (to aid portability)
 - Low power consumption (therefor longer battery life)
 - A processor that does not generate too much heat (cooling is vital)
 - Good for sampling and sensing.
- ▶ **Disadvantages** – Since they are portable, they are easy to steal.
 - Limited battery life so the user has to carry a power supply.
 - Keyboards and pointing devices can be difficult to use.
 - Heat dissipation is more difficult due to the structure of the laptop.
 - Graphics on the screen will not be as good as a standalone. (e.g. Motion blur)
 - Restricted on the amount of devices that can be added at one time.

THINK ABOUT

- 💡 Which one you would prefer and why.
- 💡 The limitations in game playing or TV watching.
- 💡 How many you have broken by accident.
- 💡 Spills and how expensive it will be to repair compared to a PC.
- 💡 Desk space (footprint).
- 💡 Noise levels
- 💡 Lack of clutter, cables, leads, inputs and outputs.

1.2 – Types of Computers - Netbooks

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Exam Question

- ▶ **Netbook** – This is a term used to describe a computer that can almost fit into your hand and is a smaller version of a Laptop. They used to be known as **Palmtop** computers but this term now generally applies to much smaller devices which use touch screens and often a stylus to key in data.
- ▶ **Advantages** – They have many of the features of Laptops therefore have similar advantages.
 - They are more portable and use less battery life due to their limited functionality.
 - Tend to have no moving parts (therefore better battery usage).
- ▶ **Disadvantages** – They do not have optical drives (CD, DVD) which makes installing difficult.
 - The keyboards are only about 80% the size of Laptop keyboards.
 - They lack some of the features found in larger machines, principally due to the size constraints.
 - Cheaper to purchase due to their limited capacity.



THINK ABOUT

- 💡 Small and easy to put away
- 💡 Comparison to tablets.
- 💡 How a school could use them in a class.
- 💡 Smaller screen so more difficult to read.
- 💡 Desk space (footprint).
- 💡 Noise levels
- 💡 Lack of clutter, cables, leads, inputs and outputs.
- 💡 Screen displays web pages in a similar way to a computer and not a tablet.

1.2 – Types of Computers – PDA's

Scenario

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Exam Question

- ▶ **Personal Digital Assistant (PDA)** – These are small handheld computers that usually come with a touch screen that is activated using a stylus. Data (e.g. text) is entered by using a keyboard that appears on the touch screen. Originally these devices were used as personal organisers but their use has expanded to include new generation mobile phones, **data loggers**, satellite navigation systems (GPS), personal fitness measures etc. Many PDA's now have a basic database, **word-processing** and **spreadsheet** facilities.
- ▶ **Advantages** – They can be used anywhere because of their size.
 - They are very lightweight and more portable than laptop computers.
 - They can be used to sign for packages because of the stylus design.
 - They can have GPS or RFID tracking to measure the delivery time of drivers.
- ▶ **Disadvantages** – It is difficult to enter text quickly.
 - They have very limited capabilities due to the software and the operating system used.



THINK ABOUT

- 💡 Small and easy to put away
- 💡 Comparison to tablets.
- 💡 How a school could use them in a class.
- 💡 Smaller screen so more difficult to read.
- 💡 Desk space (footprint).
- 💡 Noise levels
- 💡 Lack of clutter, cables, leads, inputs and outputs.
- 💡 Screen displays web pages in a similar way to a computer and not a tablet.

1.2 – Types of Computers - Mainframes

Scenario

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Exam Question

- ▶ **Mainframe Computers** – This is a term for large, very powerful, computer systems. The name comes from the days when the individual components were housed in large (room sized) frames.
- ▶ **Uses** – Their main purpose is to run commercial applications, such as banking and insurance, where large amount of data needs to be processed each day. Their main features of these include:
 - They can have several CPU's each and huge amounts of storage capacity.
 - They have very fast processor speeds and huge internal memory.
 - They can support multiple operating systems.
 - They often operate using time sharing or batch processing (discussed later)
- ▶ **Advantages** – Due to the above, they can do very large jobs which require large memories and very fast processing time.
 - They are used in Time-Sharing systems to allow users a time slice of the very powerful facilities afforded by a mainframe system.
 - They are capable of very large number crunching and deal with complex mathematical functions which are very time consuming.
- ▶ **Disadvantages** – Mainframe computers need to be permanently housed in large rooms so they cannot be moved around.
- ▶ They are very expensive to operate and maintain.

Task 8 – Research Colossus, Logic gates and its processing capacity compared to todays standards.

Task 9 – A Film Company, Traffic Warden, and Field Scientist all need a computer for their work. Define their needs and the devices best suitable to meet those needs.



THINK ABOUT

- 💡 **Render farms**
- 💡 How long it takes to make a Pixar Movie.
- 💡 **The difference in animations technologies.**
- 💡 The Last Starfighter CGI sequence
- 💡 **Cray XMP and Big Blue.**
- 💡 How to cool them down
- 💡 **What they will be like in twenty years.**
- 💡 The amount of data we use now than 20 years ago and how fast it is growing.

1.3 – Communication Methods - Input Devices - Keyboards

Scenario

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Exam Question

- ▶ **Input Devices** – As the name suggests, input devices are hardware devices that allow data to be input into a computer. Many such devices exist, ranging from the more common ones such as Keyboards, through to the more specialist ones, such as Barcode Readers.
- ▶ **Keyboards** – These are the most common input devices and are used to input text, numbers and instructions into the computer. Most use the QWERTY layout. (Top row)

Task 10 – Research other layouts like French and explain why they are laid out in this way).

- ▶ Ergonomic Keyboards are a new thing. They are designed to reduce health related issues associated with the standard keyboard (e.g. Carpal Tunnel Syndrome or repetitive strain injury RSI).



THINK ABOUT

- 💡 102 keys plus shortcuts +shift options.
- 💡 All the keyboard shortcuts you know already.
- 💡 How a laptop keyboard is the same but smaller.
- 💡 The keypad on the right hand side, who uses it.
- 💡 Look at ergonomic keyboards and see if you think you could use them.
- 💡 What alternative could you use.

1.3 – Communication Methods - Input Devices - Keyboards

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Exam Question

- ▶ **Advantages** – Keyboards enable fast entry of new text into a document.
- ▶ They have been around for a long time and people are well practiced in their use.
- ▶ It is easy to do **verification** checks as data is entered, as it appears on the screen immediately.
- ▶ **Disadvantages** – User with restricted arm/wrist use can find keyboards difficult to use
- ▶ Entering data using a keyboard is slow in comparison to direct data entry (Optical Character Recognition)
- ▶ Keyboards are fairly large devices that take up desk space.

Task 11 – Research Concept Keyboards and design one for a different company, like a Bakers, Mechanics or a Pharmacy

THINK ABOUT

- 💡 102 keys plus shortcuts +shift options.
- 💡 All the keyboard shortcuts you know already.
- 💡 How a laptop keyboard is the same but smaller.
- 💡 The keypad on the right hand side, who uses it.
- 💡 Look at ergonomic keyboards and see if you think you could use them.
- 💡 What alternative could you use.

1.3 – Communication Methods - Input Devices - Numeric Keypads

Scenario

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Exam Question

- ▶ A **Numeric Keypad** is used to enter numbers only along with the most common mathematical functions.
- ▶ **Uses** – Numeric Keypads are used in Automatic Teller Machines (ATM's) where customers can key in their **personal identification number (PIN)**, an amount of money etc.
- ▶ Telephones have Numeric Keypads to allow phone numbers to be entered.
- ▶ **Electronic Point of Sales (EPOS) terminals** have Numeric Keypads in case the barcode reader fails to read and the number has to be typed in manually.
- ▶ Chip and PIN devices have Numeric Keypads for PIN entry, amount of money etc.
- ▶ They are used by accountants to fast entry the input of numbers into spreadsheets and ledgers.
- ▶ **Advantages** – Numeric Keypads are faster than standard keyboards for entry of numeric data
- ▶ Since many are on small devices (mobile phones, PIN readers etc.) they are very easy to carry around.
- ▶ **Disadvantages** – They can be difficult to use since they have small keys.
- ▶ It is difficult to use them for entering text.
- ▶ Sometimes the order of the numbers on the keypad isn't intuitive.



THINK ABOUT

- 💡 102 keys plus shortcuts +shift options.
- 💡 All the keyboard shortcuts you know already.
- 💡 How a laptop keyboard is the same but smaller.
- 💡 The keypad on the right hand side, who uses it.
- 💡 Look at ergonomic keyboards and see if you think you could use them.
- 💡 What alternative could you use.

1.3 – Communication Methods - Input Devices - Mice

Scenario

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Exam Question

- ▶ The **Mouse** is an example of a **pointing device**. A ball or laser light is used underneath the mouse to detect movement so the user can control the position of the cursor by moving it.
- ▶ There are usually 2 buttons which have different functions: very often left button is used to select something and the right button to open up an options dialog box.
- ▶ Most packages use double click to select areas or triple click to select a larger area.
- ▶ Many mice also have a scroll button or wheel which speeds up the process of moving or scrolling through a document.
- ▶ Recent developments have produced the **optical mouse** (where movement is detected by reflected light) and the **cordless mouse** (an example of a wireless device). The advantage of an optical mouse is that it has no moving parts and does not pick up dirt making it more robust and improves its performance since the older mice could skid on certain surfaces.



THINK ABOUT

- 💡 Before a mouse there was a tracker ball, what is it.
- 💡 Look at how hard core gamers use their mice.
- 💡 Can you use a touch screen faster than a mouse.
- 💡 New 3D programs use pinch and 3D rotate, could a mouse do this.
- 💡 Could you design an alternative mouse.
- 💡 When Apple Mice had one button..

1.3 – Communication Methods - Input Devices - Mice

Scenario

Glossary

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Exam Question

- ▶ **Uses** – Mice can be used for opening, closing and minimizing applications.
- ▶ They can be used for grouping, moving and deleting files.
- ▶ They are very useful when editing images, for example controlling the size and position of a drawing pasted into a document.
- ▶ Mice are used to control the position of a cursor on the screen to allow the selection from a menu or selecting an icon.
- ▶ **Advantages** – It can be faster to select an option using a mouse than with a keyboard,
- ▶ Mice enable rapid navigation through applications and the internet.
- ▶ Mice are small and take up little area.
- ▶ **Disadvantages** – people with restricted hand/wrist movement can find it hard to operate a mouse.
- ▶ Mice are easily damaged and the older ones can get clogged up with dirt.
- ▶ They are difficult to use if there is no flat surface readily available.

Task 12 – Research alternatives to mice, multi-button gaming mice and Disability friendly Mice.



THINK ABOUT

- 💡 Before a mouse there was a tracker ball, what is it.
- 💡 Look at how hard core gamers use their mice.
- 💡 Can you use a touch screen faster than a mouse.
- 💡 New 3D programs use pinch and 3D rotate, could a mouse do this.
- 💡 Could you design an alternative mouse.
- 💡 When Apple Mice had one button..

1.3 – Communication Methods - Input Devices - Touchpads

Scenario

Glossary

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Exam Question

- ▶ **Touchpads** are used in many laptops as a pointing device. The pointer is controlled by finger movement on the pad and tapping to simulate a left button mouse click. They also have buttons under at the bottom of the pad which act as left and right mouse buttons.
- ▶ **Uses** – The same as a mouse, to move and highlight.
- ▶ **Advantages** – Faster to select an option rather than using a mouse
- ▶ Quicker navigation through applications and the Internet.
- ▶ Since they are built in to a laptop, there is no need for an external mouse, aiding portability.
- ▶ They can be used even when there are no flat surfaces.
- ▶ **Disadvantages** – People with limited hand/wrist movement find touchpads difficult to use.
- ▶ It can be more difficult to control a pointer compared to a mouse.
- ▶ They are more difficult for certain functions like “drag and drop.”



THINK ABOUT

- 💡 Can use Pinch to zoom in and out.
- 💡 No moving parts so they do not get internally dirty.
- 💡 More and more common in laptops.
- 💡 Think of how you could add a second one to a laptop for shortcuts.
- 💡 Could you design an alternative touchpad.
- 💡 All the tech is underneath so they rarely break..

1.3 – Communication Methods - Input Devices - Trackerballs

Scenario

Glossary

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Exam Question

- ▶ **Trackerballs** are similar to a mouse except the ball is on the top of it and the user controls the pointer on the screen by rotating it with the hand. Some have 2 buttons which have the same function as a mouse. If they have a third button it is the equivalent as a double click.
- ▶ **Uses** – They have the same pointing/cursor control as a mouse.
- ▶ They are used in applications where the user has is restricted like RSI.
- ▶ They are used in control room environments where it is faster than a mouse to navigate through process screens and is more robust than a mouse.
- ▶ **Advantages** – They do not need the same fine control as a mouse.
- ▶ People with limited hand/wrist movement find it easier than a mouse.
- ▶ They take up less desk space than a mouse because they are stationary.
- ▶ **Disadvantages** – They are not supplied with the computer as standard so they are more expensive.
- ▶ Users may need training since they are not standard.



THINK ABOUT

- ▶ Cannot pinch with them
- ▶ Not restricted to working at a desk with some of them.
- ▶ Combined with tilt they are good for gaming.
- ▶ Means one hand has to be by the device
- ▶ Very similar to joystick controls
- ▶ Think of large surface machines and the use of Trackerballs.

1.3 – Communication Methods - Input Devices – Remote Controls

Scenario

Glossary

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Exam Question

- ▶ A **Remote Control** is used to control the operation of other devices remotely by using infra red signals. The buttons are used to select options (such as TV stations, sound levels on a hifi, timings on a DVD recorder etc.)
- ▶ **Uses** – Most home entertainment devices such as a TV, Satellite and DVD, Hifi etc. all have remotes.
- ▶ They are used in industrial applications to remotely control processes, stop and start machinery etc.
- ▶ **Advantages** – They can operate devices from a distance, which is useful for people with disabilities.
- ▶ Some hazardous chemical processes need remote to operate from a distance because of the danger.
- ▶ **Disadvantages** – People with limited hand/wrist movement can find them hard to use.
- ▶ The signal between the remote and the device can be easily blocked.



THINK ABOUT

- ▶ Difficult to play TV games with
- ▶ Requires batteries
- ▶ Can easily get lost down the back of the sofa.
- ▶ Notice that industrial ones are all yellow. Why?
- ▶ Is there an App for that?
- ▶ After a while the buttons wear down.
- ▶ Count how many remotes do you have in your sitting room.

1.3 – Communication Methods - Input Devices - Joysticks

Scenario

Glossary

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Exam Question

- ▶ **Joysticks** have similar functionality to mice and Trackerballs. By gripping the stick, a pointer on the screen can be controlled and buttons are used to make selections. Often they have another button on the top that is used for gaming purposes e.g. to fire a weapon.
- ▶ **Uses** – Video/Computer Gaming are usually controlled by a joystick
- ▶ They are used for **simulators**, such as flight, to mimic actual controls.
- ▶ **Advantages** – It is easier to navigate around a screen using a joystick than a keyboard.
- ▶ Control is in 3 dimensions.
- ▶ **Disadvantages** – It is more difficult to control the on-screen pointer with a joystick than with other devices such as a mouse.



THINK ABOUT

- ▶ Useful for flight controls
- ▶ Has a full 360 degree tilt and swivel.
- ▶ Can be removed from the desk.
- ▶ Difference between left and right handed.
- ▶ Often used with secondary device or stick.
- ▶ Use of Yaw, Pitch and Roll.
- ▶ How Kinect does not work as well

1.3 – Communication Methods - Input Devices – Touch Screens

Scenario

Glossary

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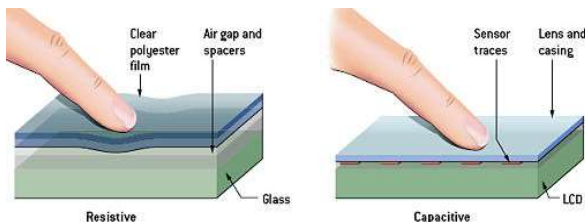
1.6

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Exam Question

- ▶ **Touch Screens** – With this the user can choose an option by simply touching the button/icon on the screen. The selection is automatically made without the need for any pointing device.
- ▶ **Uses** – Used for Self-Service tills e.g. ATM's, Supermarkets, EPOS, Airports or petrol stations, where the user just touches the screen to make a choice like fuel and payment method.
- ▶ PDA's, Smart phones, and Sat-Navs.
- ▶ Interactive whiteboards are large touch screens.
- ▶ Computer based training (CBT) where touch screens are used to select answers.
- ▶ **Advantages** – Faster entry of options than a keyboard or mouse.
- ▶ User friendly and no training necessary.
- ▶ Tamper proof to prevent keying in information that is not wanted, e.g. unmanned ticket booths.
- ▶ **Disadvantages** – There is a limited number of options available.
- ▶ Using them frequently can lead to RSI and muscle strain.
- ▶ They get dirty easily from constant touching.

Task 13 – In terms of disability access, define the pitfalls of touchscreens.



THINK ABOUT

- ▶ Can use Pinch to zoom in and out.
- ▶ No moving parts so they do not get internally dirty.
- ▶ More common in modern devices.
- ▶ Technology is getting better.
- ▶ Sensitivity can be changed for disability access.
- ▶ All the tech is underneath so they rarely break.
- ▶ The bigger they are, the more delicate they are.

1.3 – Communication Methods - Input Devices – Magnetic Strip Readers

Scenario

Glossary

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Exam Question

- ▶ **Magnetic Readers** are used to read information on the **Magnetic Stripe** such as the back of a credit card. Credit card strips can contain information such as account numbers, sort codes, expiry dates and start date.
- ▶ **Uses** – Credit and debit cards have these so they can be used in ATM's or EFTPOS.
- ▶ Security cards for entry to buildings and hotel rooms or Travel systems (e.g. train and underground tickets).
- ▶ **Advantages** – Data entry is very fast compared to keying in information.
- ▶ The system is error free as no typing is required and secure because it cannot be read directly and there is nothing to observe.
- ▶ They can prevent access to restricted areas.
- ▶ They are robust as they have no moving parts and are not affect by oil, water or moisture
- ▶ **Disadvantages** – They are affected by a string magnetic field or over use, data can be lost.
- ▶ Needs to be in contact with the reader.
- ▶ Information is not printed on the card so a human cannot read it.

Task 14 – Research and define the problem with Magnetic Strips and Mobile Phones usage.



THINK ABOUT

- ▶ Sometimes called a Fob.
- ▶ Cards can be cloned using specialist devices.
- ▶ More secure facilities combine these with retina scans.
- ▶ Can be read through other cards.
- ▶ Often used by staff to scrape icy windows.
- ▶ Technology has been around for some time.

1.3 – Communication Methods - Input Devices – Smart Card Reader

Scenario

Glossary

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Exam Question

- ▶ **Smart Cards** contain chips and are similar to magnetic strips cards. With these cards the information is stored on the chip such as PIN and personal data. This data can be updated (e.g. loyalty cards) such as Oil companies use these, when a customer buys fuel the card is swiped and loyalty points added. These points can be used for air miles, money off purchases etc. The storage capacity is greater than a stripe so more can be stored.
- ▶ **Uses** – Loyalty cards, ID cards, and public transport passes.
- ▶ Used to track customer or passenger movement including passports.
- ▶ Used by satellite systems to decode program signals.
- ▶ **Advantages** – Often used instead of money (Oyster) reducing theft and loss.
- ▶ Does not need to be in contact with the reader so there is less damage compared to a magnetic stripe.
- ▶ Data is more secure since it is easier to copy information since cloning does not work as well with chips.
- ▶ **Disadvantages** – If the card is lost, the information could be used for identity theft.
- ▶ Can still be cloned using specific technologies.



Photo courtesy of
Precise Biometrics



THINK ABOUT

- ▶ Tap and Go technology
- ▶ All credit cards have this now.
- ▶ Similar to RFID and can be tracked.
- ▶ Can store previous purchases to customise EPOS offers.
- ▶ Small enough to store on wallets.
- ▶ Rarely break but can get dirty easily.

1.3 – Communication Methods - Input Devices - Chip and Pin Readers

Scenario

Glossary

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Exam Question

- ▶ **Chip and Pin Readers** are similar to smart card readers but they are used at EFTPOS terminals. The device has a slot for the card and the chip is read. The pin is entered using the keypad. A small screen is part of the reader which gives instructions to the user.
- ▶ **Uses** – Used where payments are made using cards (cafes, supermarkets, travel agents etc.)
- ▶ **Advantages** – They provide a more secure payment system than requiring a signature or using a magnetic stripe since the typed PIN must match the Pin stored on the chip.
- ▶ They are more robust than magnetic stripe readers since the chip does not need to be in contact with the reader.
- ▶ **Disadvantages** – Since the customer types in the pin, they need to make sure no-one else reads it opening it up for fraud.



THINK ABOUT

- ▶ **Fast, easy and reliable.**
- ▶ No moving parts so they do not get internally dirty.
- ▶ **More and more common in shops and cafes.**
- ▶ New phone apps are being developed to act as a reader.
- ▶ **Would you trust your phone to act as your credit card.**
- ▶ Can sometimes fall out of a credit card.

1.3 – Communication Methods - Input Devices - Scanners

Scenario

Glossary

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Exam Question

- ▶ **Scanner** are used to enter information on hard copy (text documents, photographs, pages of a book) into a computer for manipulation. The common type is flat bed which is made up of a glass panel and lid. The hard copy document is scanned by a light source and produces a computer readable image for manipulation using a drawing package, or OCR (Optical Character Recognition) so it can be placed in a word processing, DTP or Presentation package. Some scanners are more specific like a barcode or optical mark reader.
- ▶ **Uses** – Used to scan in documents and covert them to a usable format.
- ▶ Old and valuable books can be scanned, thus protecting the originals from damage or producing records of paper copies.
- ▶ Non-digital photographs need to be scanned if they are to be stored on computer.
- ▶ **Advantages** – Images can be stored for editing.
- ▶ Much faster and more accurate, no typing errors, than typing.
- ▶ It is possible to recover lost documents and photos by scanning them.
- ▶ **Disadvantages** – The quality can be limited, depending on the scanner and will never be as good as the original quality.



THINK ABOUT

- 💡 Used to be a common desktop piece of hardware everyone had
- 💡 There is an App for that.
- 💡 3D scanners are becoming more popular.
- 💡 Think of how a 3D scanner and 3D printer could be combined.
- 💡 Document scanners can do 100 pages or more at a time.

1.3 – Communication Methods - Input Devices - Barcode Readers

Scenario

Glossary

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Exam Question

- ▶ **Barcode Readers** are used to read information in the form of bar codes. The reader is usually a scanner, handheld or EPOS mounted, like supermarkets. Handheld scanners or wands are very common when portability is required.
- ▶ **Uses** – They are used in supermarkets and shops where the goods are marked with a barcode and used to give limited information about the product to enable sales or stock control, itemised billing etc.
- ▶ Used in libraries to scan cards and books, to keep track on loans.
- ▶ Used by companies as a safety feature to ensure electrical checking (PAT) on a regular basis. Barcodes are placed to identify the object in a database which holds the information related for re-interrogation.
- ▶ **Advantages** – Very fast method of and fewer mistakes are made.
- ▶ Used to improve safety and enable automatic stock control.
- ▶ When an item is changed, the central database updates the barcodes so there is no need to change the pricing on the item.
- ▶ **Disadvantages** – Relatively expensive since every item in a shop needs a barcode and entered into the database. Also training and IT needed.
- ▶ Not foolproof, barcodes can be swapped around on items.

Task 15 – Research the changes in supermarket technologies before and after barcode integration.



THINK ABOUT

- ▶ See how fast goods can be scanned
- ▶ What was shopping life like before barcode scanning
- ▶ What do those numbers mean.
- ▶ Would individual pricing work today.
- ▶ Supermarkets now have a barcode app to count your own goods.
- ▶ What other ways could you cheat a barcode.

1.3 – Communication Methods - Input Devices - OMR Devices

Scenario

Glossary

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Exam Question

- ▶ **Optical mark Readers (OMR)** is a system which can read marks written in pen or pencil. The places where the marks are made are clearly shown on the form, for example: 1 ●—● 2 ● ● 3 ● ●
- ▶ In this example, a pencil mark has been made between the dots on answer 1. The position of the mark is stored in the computers memory after being read by the OMR device.
- ▶ **Uses** – They are used to read questionnaires, multiple choice examination papers and other types of forms where responses are registered in the form of lines or shaded areas.
- ▶ **Advantages** – It is a very fast way on inputting awkward information like survey results, the documents are fed in automatically with no user input.
- ▶ No typing therefor more accurate than keying in data and more accurate than OCR.
- ▶ **Disadvantages** – The forms need to be carefully designed to make sure that the marks and shading are correctly positioned for accuracy.
- ▶ There are issues when the form is not filled in correctly and sometimes have to be manually checked before being read by the OMR which is time consuming.



THINK ABOUT

- ▶ How shops scan lottery tickets.
- ▶ Remember the days of the football pools and Littlewoods.
- ▶ Research Hanging Chads and George Bush.
- ▶ Some School registers are still done in a similar way.
- ▶ What if the questions are not just Yes/No.
- ▶ How light can the mark be.

1.3 – Communication Methods - Input Devices - OCR Readers

Scenario

Glossary

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Exam Question

- ▶ **Optical Character Recognition (OCR)** is the name given to software that takes scanned text and converts it into a computer readable form to be used in Word processing, DTP and presentation packages.
- ▶ **Uses** – One of the most common uses is in Passports and Identity Cards.
- ▶ OCR is used when scanning in documents so they can be modified.
- ▶ **Advantages** – It is a much faster data entry system than manually keying in data
- ▶ Since there is no manual data entry, the number of errors is reduced.
- ▶ **Disadvantages** – The system has difficulty reading handwriting.
- ▶ It is still not very accurate and requires post processing (Spellchecking and grammar checking)



THINK ABOUT

- ▶ Look at Google scanning old books for Google library.
- ▶ Thousands of files kept by companies before computers were around.
- ▶ Old manuscripts that can only be read under special observation.
- ▶ The time it would take to retype a book
- ▶ Will E-books replace printed books

1.3 – Communication Methods - Input Devices - MICR Devices

Scenario

Glossary

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Exam Question

- ▶ **Magnetic Ink Character Recognition (MICR)** is a system which can read characters printed in a special ink (containing iron particles). Only certain characters written in a standard font can be read like the characters at the bottom of a check. These are then converted into a form that the computer can understand and stored in a computer file.
- ▶ **Uses** – It is primarily used to process checks in banks. When a check is presented its value is then printed on the check in special ink. The checks are all gathered together at the end of the day or period and then read using a **batch processing** method.
- ▶ **Advantages** – MICR offers greater security than OCR since the printed characters cannot be altered.
- ▶ There is no manual input therefor errors are reduced.
- ▶ Even if someone writes over the magnetic strip, they can still be read.
- ▶ **Disadvantages** – Only certain characters can be read and the number of characters is limited.
- ▶ It is a more expensive method than other methods used in direct data entry.

Task 16 – The following workers will need a method of data input: warehouse worker, exams officer and photographer. Define the technology they will use within their daily tasks.



THINK ABOUT

- ▶ Companies process salary checks for all staff at the end of the month.
- ▶ Think of the money counting machines, it is the same as MICR
- ▶ Anything that saves a company money is worth doing.
- ▶ As long as the computer knows, then the numbers are unreadable by a human.
- ▶ Could there be an app for this.

1.3 – Communication Methods - Input Devices - Digital Cameras

Scenario

Glossary

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Exam Question

- ▶ **Digital Cameras** have generally replaced traditional film based cameras. Once photos are stored in memory they are easily transferred to a computer using a USB cable. Once saved the images can be manipulated.
- ▶ **Uses** – Digital cameras produce photos directly to a computer or onto a card for printing.
- ▶ Most cameras also record videos.
- ▶ Photos can be updated directly into packages like Presentation or Art.
- ▶ **Advantages** – it is easier to upload and produce better quality photos than with a traditional camera or through scanning.
- ▶ No need to process and dark room develop the images saving money and the environment.
- ▶ It is easy to delete an image from memory and take it again.
- ▶ Memory cards can store thousands of images whereas film was limited to 24 or 36.
- ▶ **Disadvantages** – The user needs to be computer literate for using the camera and for transferring the files.
- ▶ Some artistry is lost in the process since software corrects flaws like red-eye.
- ▶ Quality though good is still not as good as a traditional cameras (it's all about pixels)
- ▶ It is possible to fill the computer quickly or be forced to compress the images.



THINK ABOUT

- ▶ Do you have one at home.
- ▶ Do you consider your smart phone is a quality camera.
- ▶ How many old cameras do you have.
- ▶ Why do some people still have those large ones.
- ▶ Could you do a photography course without using Photoshop
- ▶ Is losing the art of photography a bad thing.

1.3 – Communication Methods - Input Devices - Webcams

Scenario

Glossary

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Exam Question

- ▶ **Webcams** are and do not have a memory. to digital video cameras; however they are connected directly to the computer (USB). The information the webcam sees is transmitted live to the computer. Many computers now have them built into the monitor.
- ▶ **Uses** – When chatting online, many people use a webcam as a more personal way of conversing.
- ▶ They are used to enable video conferencing (see section 4).
- ▶ **Advantages** – Webcams can be left on constantly and activated when necessary.
- ▶ They allow people to keep in contact with each other over long, non travelled distances making them useful to the elderly and disabled.
- ▶ **Disadvantages** – They have limited features and the picture is often poor quality.
- ▶ They need to be connected to the computer, (except most laptops)

Task 17 – Define the following terms: Megapixel, Interpolation, DPI, Baud Rate, and F-Stop.



THINK ABOUT

- ▶ Mobile phones have them but people rarely use them, why?
- ▶ No moving parts so they do not get internally dirty.
- ▶ More and more common in laptops.
- ▶ How they have been hacked.
- ▶ Integrating it with 3D or VR.
- ▶ How often do you check if the light is on as children often leave them running.

1.3 – Communication Methods - Input Devices - Microphones

Scenario

Glossary

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Exam Question

- ▶ **Microphones** can be connected directly to the computer. Sounds can be inputted and then manipulated. The input sound is converted to an analogue signal and then converted to a digital signal. The computers sound card does this automatically (**ADC**).
- ▶ **Uses** – They are used to input speech/sounds to be used in various applications e.g. presentations, film and music sampling, special effects.
- ▶ They are used in voice recognition software which have a number of purposes:
 - ▶ Conversion of speech into text for use in a word processor.
 - ▶ Recognition of commands like voice activated cars or Siri.
- ▶ **Advantages** – It is faster to read in text than to type it with a keyboard.
- ▶ Using specialist manipulation software it is possible to edit sounds in real time instead of using live studio techniques.
- ▶ If used in voice activation then it is more secure than passwords also reducing the need for drivers to remove their hands from steering.
- ▶ **Disadvantages** – Sound files take up computer space and memory.
- ▶ Voice recognition software is not as accurate as typing manually (think of words like **there** and **their** and **they're**)

THINK ABOUT

- 💡 How you could use a voice dictation program.
- 💡 Voice quality on cheap mics when skypeing.
- 💡 How they are integrated to laptops but not PC's.
- 💡 The people who talk to the earphone cable in the street.
- 💡 How your earphones are also microphones if you plug them into the other socket.

1.3 – Communication Methods - Input Devices - Sensors

Scenario

Glossary

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Exam Question

- ▶ **Sensors (analog)** is a device which inputs data to a computer where the data is a measurement of some physical quantity which is always changing e.g. temperature, light, moisture, movement) These physical qualities are analog in nature. These will need converting into digital for the computer to understand using an ADC (Analog to digital converter)
- ▶ **Uses** – They are used in monitoring and control applications, depending on the situation. When monitoring, the data sent to the computer goes to a spreadsheet and processed.

Type of Sensor	Applications
Temperature	Automatic Washing machines, central heating systems, greenhouses and ovens.
Pressure	Burglar alarm systems, washing machines, robotics, environmental monitoring.
Light	Automatic greenhouses, doors, burglar alarms, street lighting control.
Sound	Burglar alarms, monitoring liquid and powder flow in pipes
Humidity / Moisture	Automatic greenhouses, environmental monitoring, factories where moisture levels are crucial like microchips or paint spraying.
pH	Automatic greenhouses, chemical processes, environmental monitoring.

THINK ABOUT

- 💡 Does your car have a parking detector.
- 💡 The number of sensors in your house right now (washing machine, microwave etc.)
- 💡 The few nuclear accidents due to sensor or human error.
- 💡 How your phone has a light setting for outdoors and indoors.
- 💡 Shops have them to watch what the customers are buying and not buying.

1.3 – Communication Methods - Input Devices - Sensors

Scenario

Glossary

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Exam Question

- ▶ **Advantages** – Readings taken over sensors are generally more accurate than those taken by human operators.
- ▶ Readings are continuous, so there is no break in monitoring, therefor and necessary action (control systems) or warning (monitoring systems) will be initiated immediately.
- ▶ The system can be automatic, removing the need for human intervention, specifically important when dealing with hazardous materials or chemicals.
- ▶ **Disadvantages** – Faulty sensors can give erroneous responses such as rear bumper sensors on a car can get dirty and give false readings.

Task 18 – Define the lifestyle advantages and disadvantages of sensor usage in the modern home.



THINK ABOUT

- ▶ Does your car have a parking detector.
- ▶ The number of sensors in your house right now (washing machine, microwave etc.)
- ▶ The few nuclear accidents due to sensor or human error.
- ▶ How your phone has a light setting for outdoors and indoors.
- ▶ Shops have them to watch what the customers are buying and not buying.

1.3 – Communication Methods - Input Devices - Graphics Tablets

Scenario

Glossary

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Exam Question

- ▶ **A Graphics Tablet** is used with a stylus to produce freehand drawing. The images produced can then be stored in a computer file or used directly on the screen.
- ▶ **Uses** – Used to produce drawings and computer graphics and in Modelling and CAD work (Computer Aided Design).
- ▶ In countries where characters are complex like China and Japan, they are used as a form of input since it is faster than typing in the characters than a keyboard.
- ▶ **Advantages** – It is possible to modify the drawings before they are input.
- ▶ They can be pressure sensitive for thicker lines of drawing.
- ▶ They offer a very accurate method of drawing which is better than using a mouse or tracker ball.
- ▶ **Disadvantages** – They are more expensive than other pointing devices.



THINK ABOUT

- ▶ The accuracy you have when drawing with a pencil compared to the physical movement of a mouse.
- ▶ No moving parts so they do not get internally dirty.
- ▶ They are pressure sensitive.
- ▶ Tablets can have programmed shortcuts as buttons on the device.
- ▶ 3D packages for modelling and how a stylus and tablet would help.

1.3 – Communication Methods - Input Devices - Light Pens

Scenario

Glossary

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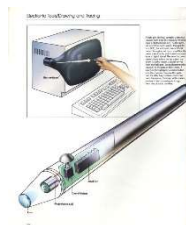
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Exam Question

- ▶ **Light Pens** contain sensors that send signals to a computer whenever light changes are detected. They only work on **Cathode Ray Tube (CRT)** monitors because of the way the screens are made. The screens are refreshed 50 times a second so the computer is able to determine the pens position by noting exactly when the light pen detected the electron beam passing its tip. (TFT is being developed)
- ▶ **Uses** – or drawing on screen (e.g. CAD packages)
- ▶ **Advantages** – used for selecting objects on the CRT screens.
- ▶ Also used re more accurate than touch screens due to the thin point of the pen.
- ▶ They are small, pen size, so they can be used where space is an issue.
- ▶ Simple to use.
- ▶ **Disadvantages** – There are problems with lag when drawing on screen.
- ▶ Only work at the moment with CRT monitors.
- ▶ Accuracy is not good when drawing.



THINK ABOUT

- ▶ Used when there are no tablets or touch screens.
- ▶ Getting more rare now there are less CRT's
- ▶ Think of the pens used on Smart Boards.
- ▶ Used in lessons as interactive.
- ▶ Only one pen can be used so no pinching or capacitive control.
- ▶ Used a lot in mechanics but being replaced.

1.3 – Communication Methods - Output Devices - CRT Monitors

Scenario

Glossary

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Exam Question

- ▶ **Output devices** are hardware devices those that allow data to be output. Some hold information temporarily like printers whereas others have a permanent output in the form of a hard copy.
- ▶ **CRT Monitors** – These are the least expensive monitor and becoming more rare as TFT is taking over. They come in various sizes and use an electron gun to fire against a phosphor screen which creates a picture made up of small dots either Red, Green or Blue.
- ▶ **Uses** – They are used as the primary output of base computers so the user can see what they are typing in.
- ▶ They are used with Light Pens to allow designs to be created on screen.
- ▶ **Advantages** – They still produce a higher quality image than TFT monitors.
- ▶ The angle of viewing is still better than a TFT monitor.
- ▶ They work with Light Pens in CAD/CAM applications.
- ▶ **Disadvantages** – They tend to be heavy and often a weigh hazard.
- ▶ If they are older, they run hot due to gathered dust on the metal plates.
- ▶ They use more power than any other monitor type.
- ▶ They can flicker, which causes headaches and eyesight problems with prolonged use.



THINK ABOUT

- ▶ The average 24" one can weight 6 stone.
- ▶ The screen is curved, TFT's are flat, why?
- ▶ Are there any left in your school?
- ▶ All energy causes heat, feel how hot the top of the monitor is.
- ▶ They do not have a cable that disconnects like TFT.
- ▶ Desk space Footprint?

1.3 – Communication Methods - Output Devices - TFT Monitors

Scenario

Glossary

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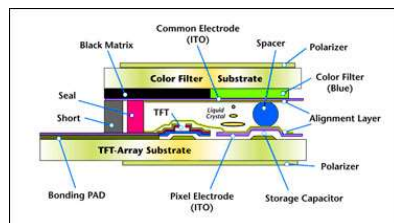
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Exam Question

- ▶ **TFT Monitors** – They are replacing CRT's as the standard main output device. Laptop development is because of the advancement in the technology of TFT's. The screen is made up of thousands of tiny pixels which are transistors controlled by a microprocessor. Each pixel has 3 transistors, Red, green and Blue, the intensity of each is what is seen.
- ▶ **Uses** – They are the primary output device to see what is being typed.
- ▶ They are an integrated part of a Laptop.
- ▶ **Advantages** – They are lightweight so they are less risky than CRT's
- ▶ They produce less glare and emit less radiation, use less power and generate less heat.
- ▶ **Disadvantages** – The angle of viewing is critical, the image is unclear when viewed from the side which is an issue when more than one person is looking at it.
- ▶ The definition is not as good as CRT's.
- ▶ They cannot be used by light pens reducing down their CAD ability.

Task 19 – Describe how the resolution and size of a monitor works, the different resolution rates and what it means in terms of memory usage and definition.



THINK ABOUT

- 💡 Why you would still prefer a TFT than a CRT
- 💡 Modern ones that have the computer build into the display like an iMac.
- 💡 Why some people have more than 1 display.
- 💡 Why do they hide the buttons on the right hand side.
- 💡 If you could project your tablet to one without cables, would you want one.

1.3 – Communication Methods - Output Devices - Inkjet Printers

Scenario

Glossary

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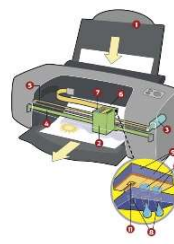
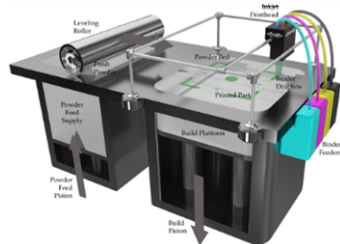
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Exam Question

- ▶ **Inkjet printers** are used to produce good quality hard copies, usually in colour. They are not as good as laser printers but are far better than dot matrix. They do not have large memory buffers so printing is done a bit at a time, causing the print job to pause and think and get more data.
- ▶ **Uses** – They are used when there is low volume required or if colour is required or good quality single jobs like Photo printing.
- ▶ 3D inkjet printers are now being used in industry producing prototypes.
- ▶ **Advantages** – The output is high quality and are cheaper to buy than laser printers.
- ▶ They are light with a small footprint.
- ▶ They do not produce ozone and volatile organic compounds unlike laser printers.
- ▶ **Disadvantages** – The output is slow for multiple copies and they have a small memory buffer for jobs.
- ▶ Ink cartridges run out quickly and can smudge if the user is not careful.

THINK ABOUT

- ▶ New versions have Wi-Fi, card slots and screens
- ▶ Lots of moving parts and small paper trays
- ▶ When one ink runs out you can replace it easily.
- ▶ Most people get a laser and do away with the inkjet, why?
- ▶ Sometimes they cost less than the printer cartridge so it is cheaper to get a new one when the ink runs out.



1.3 – Communication Methods - Output Devices - 3D Printers

Scenario

Glossary

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Exam Question

- ▶ **3D Printers** are a new type of printer that can produce 3D models using modified inkjet technology, known as “tomography” which layers thin levels of powder (plaster, resin and starch) which bonds together as a 3D model as the layer builds up, each layer being about 0.25mm thick.
- ▶ **Uses** – Inkjet printers are used to produce prototypes which work from CAD packages, photograph images and stored drawings.
- ▶ Scale models are produced in colour before the real versions are manufactured.
- ▶ The ultimate objective is to produce organic objects using layering like human organs.
- ▶ **Advantages** – They save a lot of money since prototypes are very time consuming by other methods.
- ▶ Physical scale models are produced with working parts which gives a better idea of how the end product will look.
- ▶ The powders used can be ground up and reused.
- ▶ **Disadvantages** – They are expensive to buy and slow at making models.
- ▶ The end product can be a little rough and often needs additional work.



THINK ABOUT

- ▶ Think of what can be produced now and then image 10 years time.
- ▶ They are working on food versions.
- ▶ They flew one to the MIR space station recently.
- ▶ Google the term Physibles.
- ▶ One day they will print a working car.
- ▶ Research is fast developing, human tissue is not far off, they have printed veins.

1.3 – Communication Methods - Output Devices – Plotters

Scenario

Glossary

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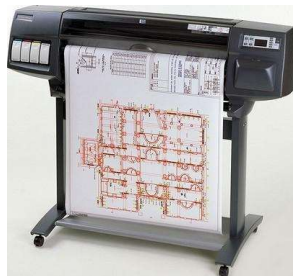
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Exam Question

- ▶ **Plotters** or **Graph Plotters** are devices that produce hard copies but differently than printers. They are not limited to normal paper sizes and are capable of producing highly accurate, very large drawings and posters. Pen plotters are the most common which use coloured pens to draw, and there are electrostatic (similar to laser) and inkjet plotters. With pen plotters the coloured pens are controlled by the computer and the paper can move backwards and forwards to allow accurate shapes to be drawn.
- ▶ **Uses** – They are used to produce large blueprints of buildings, factories etc. and often used with CAD packages.
- ▶ They are used for billboards and large posters and can print on plastic coated paper.
- ▶ If the pens are replaced with cutting tools then they can be used as stencils or to make large signs.
- ▶ **Advantages** – They produce large printouts and the quality is very high.
- ▶ **Disadvantages** – They are slow and expensive to buy and maintain.



THINK ABOUT

- ▶ Before these architects used to hand draw large designs.
- ▶ Some are very large, large enough to walk under.
- ▶ More common now to save the file and print it professionally.
- ▶ Think of a large poster and then think wall size large.
- ▶ Very rare to see them but in business they are more common.

1.3 – Communication Methods - Output Devices – Dot Matrix Printers

Scenario

Glossary

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Exam Question

- ▶ **Dot Matrix Printers** are a type of impact printer where a print head (made up of a matrix of pins) presses against an inked ribbon. They tend to be slow, noisy and the output is not good quality. They are still useful where multi-part or continuous stationery, perforated paper is used.
- ▶ **Uses** – They can be used in noisy environments (e.g. garage workshops) and in applications where print quality is not important.
- ▶ **Advantages** – They are used in environments which would be a problem for Laser or Inkjet printers (dusty, dirty or moist)
 - ▶ Carbon copies or multi-part outputs can be produced.
 - ▶ They are cheap to run and maintain.
 - ▶ They are easy to use if continuous stationery is required like wage slips.
- ▶ **Disadvantages** – They are very noisy and not good in an office space.
 - ▶ They cost more than an inkjet to buy.
 - ▶ They are slow and the quality is poor.



THINK ABOUT

- ▶ Some companies put them in a sound box
- ▶ Every printer was different so the ribbons were not universal.
- ▶ It was possible to turn the ribbon over on some.
- ▶ Paper jams were so much worse.
- ▶ They had no complicated menus, just 3 buttons.
- ▶ They were always white or cream.

1.3 – Communication Methods - Output Devices - Laser Printers

Scenario

Glossary

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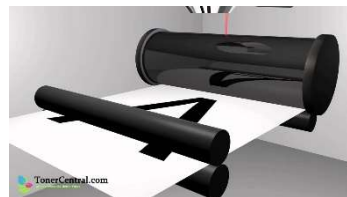
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Exam Question

- ▶ **Laser Printer** produce very high quality hard copy output. The print rate per page is very quick for large print jobs. They have large buffer memories where the data for the whole document is stored before the data is printed out.
- ▶ **Uses** – Laser printers are used where noise levels need to be kept low.
- ▶ They are the best option for fast high quality volume printing
- ▶ **Advantages** – Printing is fast for bulk, but not for just a few pages.
- ▶ They require less servicing and ink replacement as they print a lot more pages making them more cost effective for B&W printing.
- ▶ They handle very large print jobs due to high memory capacity with consistent high quality.
- ▶ **Disadvantages** – They are more expensive to buy. Colour versions are very expensive to buy and run since they require 4 cartridges as well as diffuser kits and toner bins.

Task 20 – Describe the most suitable printer for the following people: an architect, exams officer, designer, and photographer.



THINK ABOUT

- ▶ Why are there so many old looking ones in the room?
- ▶ Can you repair a paper jam.
- ▶ Does anyone ever use the built in menu.
- ▶ What if there was a par ton top for quick copying.
- ▶ Why are they always square.
- ▶ Did you know that the toner ink is very toxic?

1.3 – Communication Methods - Output Devices – Speakers

Scenario

Glossary

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Exam Question

- ▶ **Speakers** can be connected directly to a computer or built into the monitor or casing like a laptop. Digital data from the computer is converted into analogue form using a Digital to Analog Converter (DAC) and then amplified through the speaker.
- ▶ **Uses** – They output sound from multimedia presentations, home entertainment centres and downloaded sound files.
- ▶ They can help blind people (together with speech generated software) to through audio output of the text on the screen.
- ▶ **Advantages** – They are better quality externally than laptop speakers.
- ▶ There have been advance in 5.1 and 7.1 technology.
- ▶ **Disadvantages** – They take up desk space and give off a magnetic field which can corrupt cards and disks..



THINK ABOUT

- 💡 Have you tried to use an external speaker on your phone or computer.
- 💡 With music computers these are essential when it comes to quality.
- 💡 There are some very large speakers.
- 💡 The larger they are, the more need for an amplifier.
- 💡 They can be customised to blend in with the furniture.

1.3 – Communication Methods - Output Devices – Multimedia Projectors

Scenario

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Exam Question

- ▶ **Multimedia projectors** receive analog or digital signals, usually from a computer TV or DVD player. The image from the source is magnified and projected onto a large screen. They usually have a remote control, but a virtual mouse is becoming popular with new ones.
- ▶ **Uses** – They are used for training presentations to show to a large audience.
- ▶ They are also used for advertising presentations at exhibitions, shopping malls etc.
- ▶ Home cinema systems using projected DVD's
- ▶ **Advantages** – They enable larger audiences than a screen or TV
- ▶ Used in classes to watch videos or PPT's rather than a network.
- ▶ **Disadvantages** – Images are sometimes fuzzy.
- ▶ They are expensive to buy and difficult to set up in terms of space.



THINK ABOUT

- ▶ Would you like one for the bedroom to watch TV on.
- ▶ Very similar technology to film projectors.
- ▶ There will be a device for your phone that can do the same.
- ▶ Research Keystone.
- ▶ Requires a darker room than normal to view the images.
- ▶ Watch almost any movie and spot them being used..

1.3 – Communication Methods - Control Devices – Actuators and Motors

Scenario

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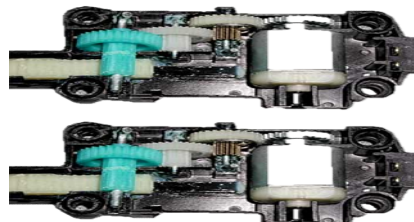
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Exam Question

- ▶ **Control Devices** are another type of output device used to control processes in conjunction with sensor input devices, covered in more depth in PowerPoint 7.
- ▶ **Actuators** are **transducers** are used to make signals from a computer and convert them into some form of motion, e.g. operating motors, pumps, switches and valves. As part of the process, digital signals are sent from the computer to an Actuator to operate a device. Usually, conversion of the digital signal to analogue is required first (DAC)
- ▶ **Motors** – The motor is turned on or off by the actuator.
- ▶ **Uses** – Used in many domestic appliances such as washing machines (to make the drum rotate), cookers (to switch on fans), water pumps in central heating systems and automatic greenhouses to open windows and switch on fans.
- ▶ In industry, they are used to control robot arms.
- ▶ In computers, they operate fans, disk and DVD drives.



THINK ABOUT

- 💡 If anything electronic turns on anything physical it will use an actuator and motor.
- 💡 They have been around since the beginnings of the circuit board.
- 💡 They can be very, very small.
- 💡 Artificial heart valves have these inside.
- 💡 It is rare for them to break down.
- 💡 But when they do it is a pain to fix.

1.3 – Communication Methods - Control Devices – Buzzers, Lights and Heaters

Scenario

Glossary

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Exam Question

- ▶ **Buzzers** are switched on and off by the actuator
- ▶ **Uses** – Buzzers are used in cookers and microwave ovens to tell the user when the cooking process is over.
- ▶ They are used in burglar alarms to warn if intruders are present.
- ▶ **Lights** – The actuator is connected to switches that turn the lights on and off.
- ▶ **Uses** – They are used for security lighting and in greenhouses to control the lighting conditions.
- ▶ **Heaters** – Actuators are connected to switches which turn the heater on and off.
- ▶ **Uses** – Heaters are used in automatic washing machines, cookers and central heating systems.
- ▶ Heaters are used on automatic greenhouses to control the temperature.

Task 21 – Describe and draw the method of control and sensors used between an automated Greenhouse and a modelling application.



THINK ABOUT

- ▶ If anything electronic turns on anything physical it will use an actuator and motor.
- ▶ They have been around since the beginnings of the circuit board.
- ▶ They can be very, very small.
- ▶ Artificial heart valves have these inside.
- ▶ It is rare for them to break down.
- ▶ But when they do it is a pain to fix.

1.4 – Communication Hardware - Networks

Scenario

Glossary

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Exam Question

- ▶ Most computer systems are now connected together in some way to form what is known as a **network**. This ranges from basic school/home networks of only a few computers (often set up to share resources such as printers and software) to large networks such as the **internet**, which effectively allows any computer connected to it to communicate with any other computer similarly connected.
- ▶ This chapter considers the type of network that exist and many of the features that are available because of networking. You will learn that devices such as **hubs** and **switches** are needed to distribute data within a network; that local area networks (**LAN's**) can be connected together using **bridges**; and that devices such as **modems** and **routers** are needed to connect these LAN's or single computers to external networks, such as the internet.

THINK ABOUT

- ▶ What a network manager does
- ▶ How do all the wires connect together
- ▶ When I play games in school, how do they talk to each other
- ▶ Why is wireless slower
- ▶ What is a Proxy, VPN, Tunnel.
- ▶ In hacking films, what does the terminology mean
- ▶ Should I set up a home network

1.4 – Communication Hardware – Network - Modem

Scenario

Glossary

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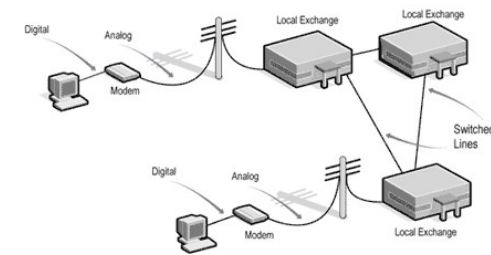
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Exam Question

- ▶ **Modem** means ‘**modulator demodulator**’ and is a device that converts (i.e. modulates) a computer’s digital signal into an analogue signal for transmission over an existing telephone line. It also does the reverse process, in that it converts analogue signals from a telephone line into digital signals (demodulates), to enable the computer to process the data.
- ▶ Modems are essentially used to allow computers to connect to networks (e.g. the internet) over long distances using the existing telephone networks.
- ▶ **Dial-up modems** operate at transmission speeds of about 60 kilobits per second, which is extremely slow by today’s standard (*60 kilobits = 60,000 bits, 1 bit refers to a **binary digit** and has the value of 1 or 0*).



1.4 – Communication Hardware – Network - ADSL

Scenario

Glossary

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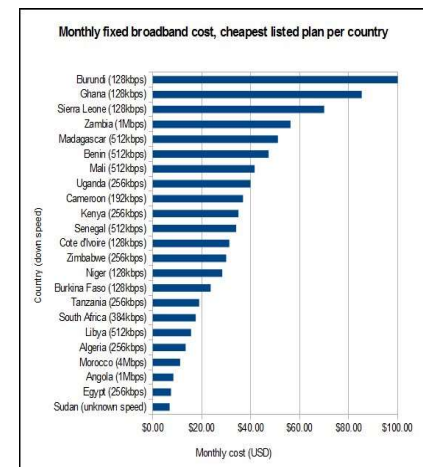
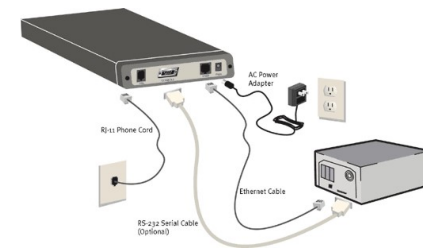
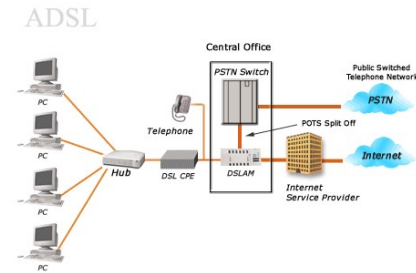
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Exam Question

- ▶ Modern broadband or **ADSL (asymmetric digital subscriber line)** modems operate at up to 100Megabits per second (12.5 Mbytes / second)(**1 byte = 8 bits; 100 megabits = 100 million bits*) when using fibre optic cables (although the old technology copper cables usually only offer a maximum of 20 Mbits/second), The term ‘asymmetric’ actually means that the modem is faster at **downloading** data (i.e. receiving data) than it is at **uploading data** (i.e. sending data).
- ▶ Although ADSL modems still use the existing telephone network, unlike dial-up modems they do **not** tie up the line while accessing the internet – they can always be ‘on’, so internet access is available 24 hours if necessary, and the landline telephone can be used at the same time because of the wide bandwidth signal used (different frequencies are used to transmit internet signals so they don’t interfere with normal telephone traffic). Cable modems also exist, which allow cable television providers to offer internet access as well as receiving television signals.



1.4 – Communication Hardware – Network - Switch

Scenario

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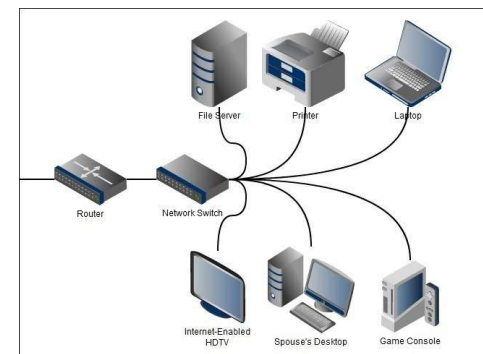
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Exam Question

- ▶ **Switches** are similar to hubs but are much more efficient in the way that they distribute data packets. As with hubs, they connect a number of devices or computers together to form a LAN.
- ▶ However, unlike a hub, the switch checks the data packet received and works out its destination address (or addresses) and sends the data to the appropriate computer(s) *only*. This makes using a switch a more secure way of distributing data.
- ▶ Each device or computer on a network has a **media access control (MAC)** address that uniquely identifies it. Data packets sent to switches will have a MAC address identifying the source of the data and additional addresses identifying each device that should receive the data (see 4.1.2 for more on MAC addresses).



1.4 – Communication Hardware – Network - Bridge

Scenario

Glossary

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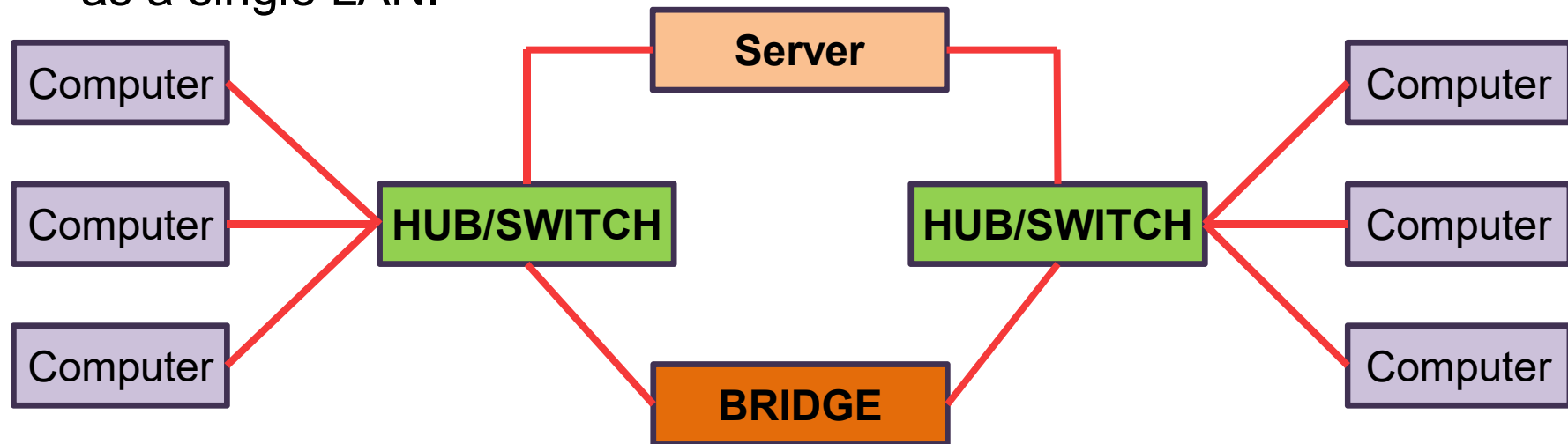
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Exam Question

- ▶ **Bridges** are devices that connect one LAN to another LAN that uses the same protocol (communication rules). They are often used to connect together different parts of LAN so that they can function as a single LAN.



- ▶ Bridges tend to be used to interconnect LAN's (or parts of LAN's) since sending out every data packet to all possible destinations would quickly flood larger networks with unnecessary traffic. For this reason a router is used to communicate with other networks, such as the internet.

1.4 – Communication Hardware – Network - Router

Scenario

Glossary

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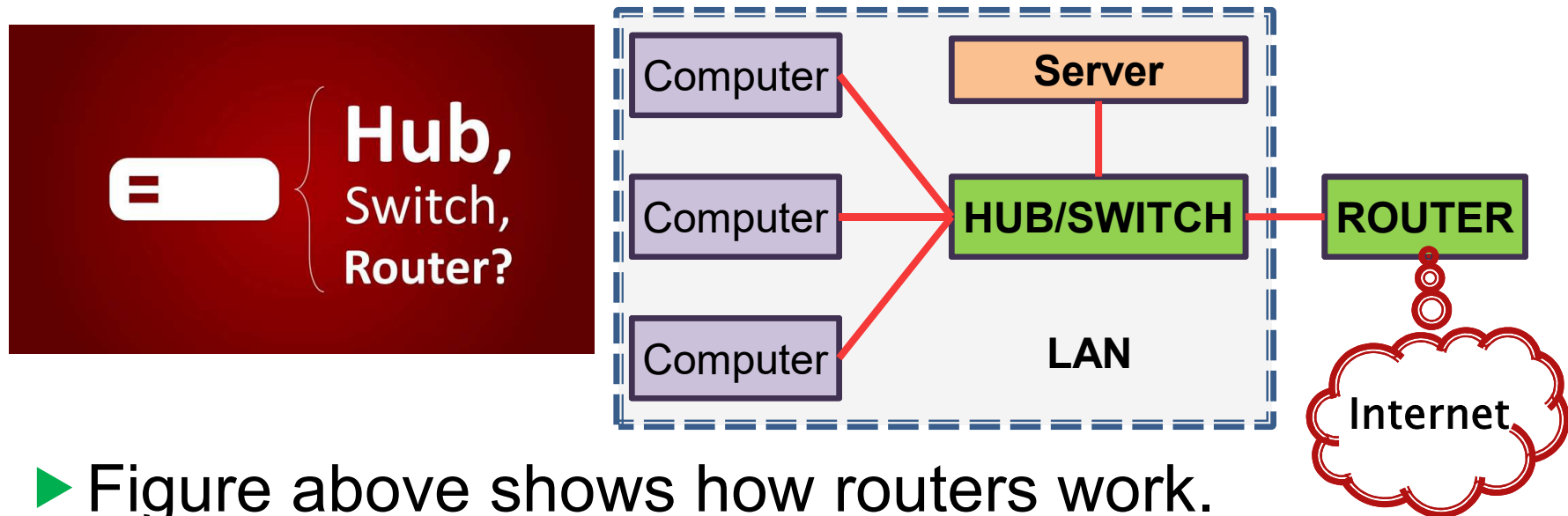
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Exam Question

- ▶ **Routers** enable data packets to be routed between the different networks, e.g. to join a LAN to a wide area network (WAN). A router would typically have an internet cable plugged into it and several cables connecting to computers and other devices on the LAN.



- ▶ Figure above shows how routers work.

1.4 – Communication Hardware – Network - Router

Scenario

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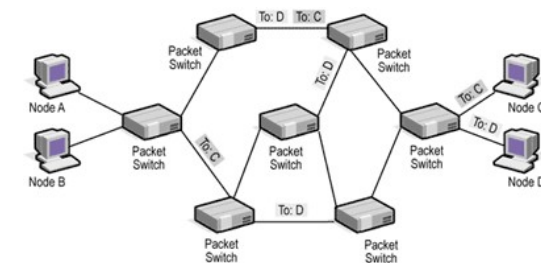
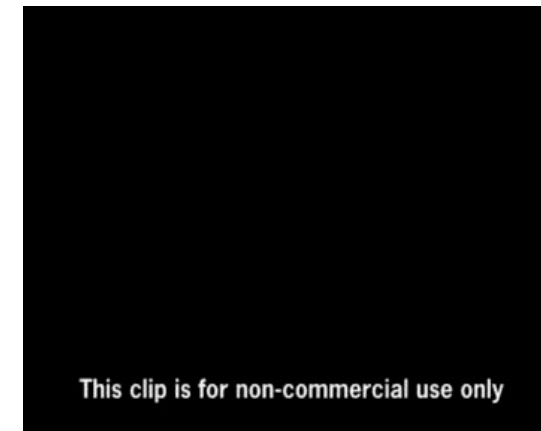
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Exam Question

- ▶ Broadband routers sit behind a firewall. The firewall protects the computers on a network. The router's main function is to transmit internet and transmission protocols between two networks and also allow private networks to be connected together.
- ▶ Routers inspect the data packets (see next slide) sent to it from any computer on any of the networks connected to it. Since every computer on the same network has the same part of an **internet protocol (IP)** address, the router is able to send the data packet to the appropriate switch and it will then be delivered using the MAC destination address (see 4.1.2). If the MAC address doesn't match any device on the network, it passes on to another switch on the same network until the appropriate device is found.



1.4 – Communication Hardware – Network - Hub

Scenario

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Exam Question

- ▶ **Hubs** are hardware devices that can have a number of devices or computers connected to them. They are often used to connect together a number of devices to form a LAN – e.g. a star network.
- ▶ Its main task is to take any **data packet** (this is a group of data being transmitted) received at one of its ports and broadcast to **every** computer in the network. This essentially means that using a hub is not a very secure or efficient method of data distribution.

Task 22 – Research, design and explain the Network layout of your school, including hubs, switches, routers and bridges.



1.4 – Communication Hardware – Network – Data Packets

Scenario

Glossary

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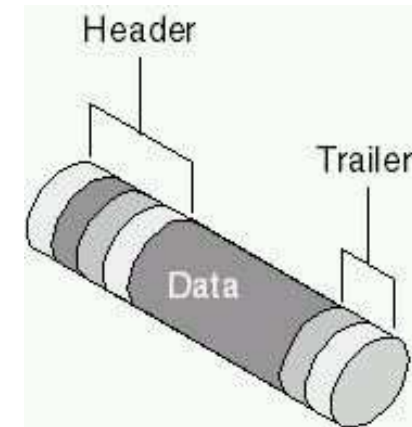
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Exam Question

- ▶ The data is carried in the packet according to which protocol (set of rules) is used. Packets of data usually contain the following information:
 - Some form of header to identify the data packets
 - The sender's IP address
 - The receiver's IP address
 - How many data packets make up the whole 'message'
 - The identity number of each packet
- ▶ This information allows the router to route a packet across the network to its correct destination and allows the data packets to be reassembled in their correct order according to identity number at the receiving station.
- ▶ When a router receives a packet of data, it checks the IP address against the stored routing table. The routing table stores the MAC address of the device, the assigned IP address and the lease time the assigned IP address is assigned for. The bits forming the destination IP address in the data packet are used to point to the correct route. The packet is sent to a number of routers until it reaches its final destination.



Packet - E-mail Example

Header	Sender's IP address Receiver's IP address Protocol Packet number	96 bits
Payload	Data	896 bits
Trailer	Data to show end of packet Error correction	32 bits

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This clip is for non-commercial use only

1.4 – Communication Hardware – Network - Other

Scenario

Glossary

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Exam Question

Gateway

- ▶ A **Gateway** is a network point (or **Node**) that acts as an entrance to another network. It is a key point for data on its way to and from other networks. All networks will have boundaries so that all communication within the network is conducted using devices such as switches or routers, If a network node needs to communicate outside its network, it needs to use a gateway.

Network Interface Card

- ▶ A **Network Interface Card (NIC)** is needed to allow a device to connect to a network (e.g. the internet). It is usually part of the device hardware and frequently contains the MAC address generated at the manufacturing stage.

Network Cables

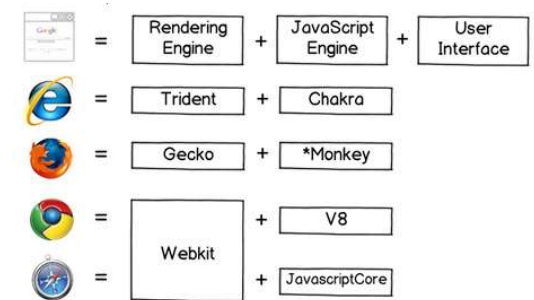
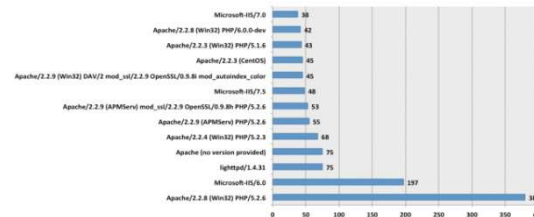
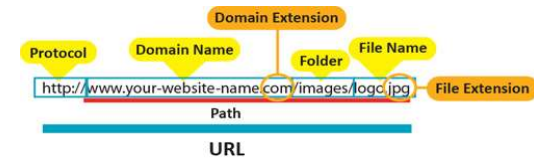
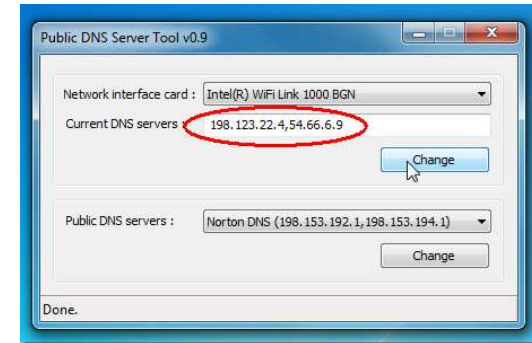
- ▶ Even though many computer systems use Wi-Fi, **network cables** are still used because they have the following advantages over Wi-Fi.
 - Faster data transfer rates
 - Can be more secure than wireless networks
- ▶ The cables can be either copper or fibre optics – the latter offers higher data transfer rates and also better security (see notes on quantum cryptography).

1.4 – Communication Hardware – Network – IP and MAC Address

- Scenario
- Glossary
- 1.1
- 1.2
- 1.3
- 1.4
- 1.5
- 1.6
- 1.7
- Exam Question

- ▶ A MAC address is a unique number that identifies a device connected to the Internet. SO what is the difference between an IP address and a MAC address? The IP address gives the *location* of a device on the internet, whereas the MAC address *identifies* the device connected to the Internet
- ▶ You can think of the IP as the address if the house you live in (it will have some unique ways of identifying it, such as a post or zone code). Using this example, the MAC address can be thought of as a way if uniquely identifying each person living in that house. It is possible to move house (so your IP address will change) but the same people will be living in the new house (so their MAC address will remain unchanged).

Task 23 – Using the previous task, explain how your school uses Gateways, Data Packets, IP and MAC addresses to transport and monitor network traffic.



SR1

SR1

Anatomy of 2,000 Compromised Web Servers in 2000

Stephen Rafferty, 4/18/2016

1.4 – Communication Hardware – Network – Wi-Fi and Bluetooth

Scenario

Glossary

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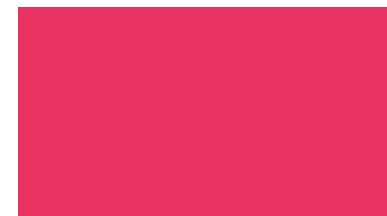
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Exam Question

- ▶ Both Wi-Fi and Bluetooth offer wireless communication between devices. They both use radio frequencies as the carrier of data transmission.

How Computers use Wi-Fi and Bluetooth to connect to Networks

- ▶ **Wi-Fi**
- ▶ A wireless transmitter (WAP) receives information from a network via its connection (e.g. a broadband connection if the internet is used). This transmitter converts the received information into radio waves and then transmits them.
- ▶ A device (e.g. a computer) receives the radio waves via an installed wireless adaptor which allows it to download the information from the data source. This, of course, works in reverse when the device wishes to transmit data over the network.
- ▶ Wi-Fi is best suited to operating full-scale networks since it offers much faster data transfer rates, better range and better security than Bluetooth. A Wi-Fi-enabled device (such as a computer or smartphone) can access, for example, the internet wirelessly at any **access point (AP)** or **hot spot** up to 100M away.



Or Click here

1.4 – Communication Hardware – Network – Wi-Fi and Bluetooth

Scenario

Glossary

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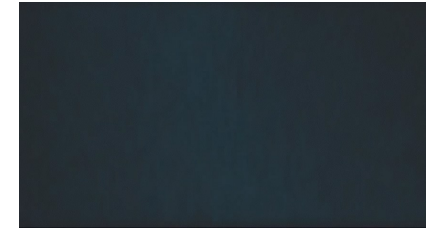
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Exam Question

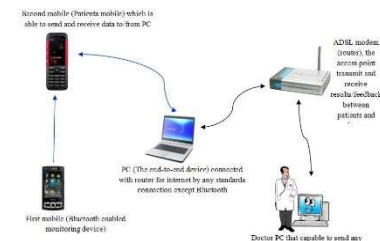
Bluetooth

- ▶ Bluetooth sends and receives radio waves in a band of 79 different frequencies (known as channels). These are all centered on a 2.45GHz frequency.
- ▶ Devices using Bluetooth automatically detect and connect to each other, but they don't interfere with other devices since each communicating pair uses a different channel (from the 79 options)
- ▶ When a device wants to communicate, it picks one of the 79 channels at random. If the channel is already being used, it randomly picks another channel. This is known as **spread-spectrum frequency hopping**.
- ▶ To further minimise the risk of interference with other devices, the communication pairs constantly change the frequencies (channels) they are using (several times a second).

Task 23 – Using the previous tasks, explain how your school uses Wi-Fi and Bluetooth to benefit network traffic.



Or Click here



1.4 – Communication Hardware – Network – Wi-Fi and Bluetooth

Scenario

Glossary

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Exam Question

- ▶ Essentially, Bluetooth is useful:
 - When transferring data between two or more devices that are very close together (<30m distance)
 - When the speed of data transmission is not critical
 - For low bandwidth applications (e.g. when sending music files from a mobile-phone to a headset)
- ▶ Bluetooth creates a secure **wireless personal area network (WPAN)** based on key encryption.
- ▶ Table below summarises some of the differences between Wi-Fi and Bluetooth.

Feature	Bluetooth	Wi-Fi
Transmission frequency used	2.4GHz	2.4, 3.6, 5.0GHz
Data transfer rate (maximum)	25 Mbits/second (- 3.1 Mbytes/second)	250 Mbits/second (-31 Mbytes/Second)
Maximum effective range (metres)	30M	100m (but can be obstructed by walls etc. reducing effective range to only a few metres)
Maximum number of devices connected	Up to 7	Depends on the router used (can be one or many devices)
Type of data transmission security	Key matching encryption	WEP (wireless equivalent privacy) and WPA (Wi-Fi protected access) are the most common security systems.

1.4 – How to set up and configure a small network

Scenario

Glossary

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Exam Question

- ▶ Suppose you were asked to set up and configure a small network of 10 computers. You would need to consider the following points in the next slide:
- ▶ Apart from all the hardware and software, you would also have to think about doing the following:
 - Setting an IP account if internet access is required
 - Setting up the system (or buying appropriate hardware correctly configured) to allow for wireless connectivity
 - Configuring all the hardware and software so that they work correctly together
 - If internet is required, ensuring that a high-speed broadband connection exists
 - Putting all the common software onto a server and also making sure that a network license has been acquired so that all network users can make use of the software
 - Setting up privileges so that each user can only access their own area or common shared area
 - Setting up a network-manager-level of privilege so that they can monitor network usage, change passwords etc.

1.4 – How to set up and configure a small network.

Scenario

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Exam Question

Purchase of software and hardware

```
graph LR; A[Purchase of software and hardware] --> B[Switches, hubs and other devices needed to link everything together on the network]; A --> C[Network cables to connect devices together]; A --> D[If a connection to the internet is needed, then a router is required to do this]; A --> E[A firewall (either hardware or software) is needed to help protect the network against hacking]; A --> F[Servers to manage network security, store common software and files, etc.]
```

Switches, hubs and other devices needed to link everything together on the network

Network cables to connect devices together

If a connection to the internet is needed, then a router is required to do this

A firewall (either hardware or software) is needed to help protect the network against hacking

Servers to manage network security, store common software and files, etc.

Task 25 – Find out any other hardware or tasks that need to be carried out when setting up a small network. Ask questions such as ‘would Wi-Fi or Bluetooth be the best type of connectivity?’. ‘Should PC’s or Laptops be used?’ etc.

1.5 – Hardware Troubleshooting

Scenario

Glossary

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Exam Question

- ▶ There are many different things that could cause a problem with your computer. No matter what's causing the issue, troubleshooting will always be a process of **trial and error**—in some cases, you may need to use several different approaches before you can find a solution; other problems may be easy to fix. We recommend starting by using the following tips.
- ▶ **Write down your steps:** Once you start troubleshooting, you may want to **write down** each step you take. This way, you'll be able to remember exactly what you've done and can avoid repeating the same mistakes. If you end up asking other people for help, it will be much easier if they know exactly what you've tried already.
- ▶ **Take notes about error messages:** If your computer gives you an **error message**, be sure to write down as much information as possible. You may be able to use this information later to find out if other people are having the same error.
- ▶ **Always check the cables:** If you're having trouble with a specific piece of computer **hardware**, such as your monitor or keyboard, an easy first step is to check all related cables to make sure they're properly connected.
- ▶ **Restart the computer:** When all else fails, **restarting the computer** is a good thing to try. This can solve a lot of basic issues you may experience with your computer.



THINK ABOUT

- ▶ What a network manager does
- ▶ How do all the wires connect together
- ▶ How often does turning it off and on again work
- ▶ What is built in redundancy
- ▶ What is a Proxy, VPN, Tunnel.
- ▶ In hacking films, what does the terminology mean
- ▶ Why buy when it is cheaper to upgrade

1.5 – Hardware Troubleshooting

Scenario

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Exam Question

- ▶ **Scenario:**
- ▶ Let's say you're trying to print out invitations for a birthday party, but the printer won't print. You have some ideas about what could be causing this, so you go through them one by one to see if you can **eliminate** any possible causes.
- ▶ First, you check the printer to see that it's turned on and plugged in to the **surge protector**. It is, so that's not the issue. Next, you check to make sure the printer's **ink cartridge** still has ink and that there is paper loaded in the **paper tray**. Things look good in both cases, so you know the issue has nothing to do with ink or paper.
- ▶ Now you want to make sure the printer and computer are **communicating correctly**. If you recently downloaded an **update to your operating system**, it might interfere with the printer. But you know there haven't been any recent updates and the printer was working yesterday, so you'll have to look elsewhere.
- ▶ You check the printer's **USB cord** and find that it's not plugged in. You must have unplugged it accidentally when you plugged something else into the computer earlier. Once you plug in the USB cord, the printer starts working again. It looks like this printer issue is solved!
- ▶ This is just one example of an issue you might encounter while using a computer. In the rest of this lesson, we'll talk about other common computer problems and some ways to solve them.

THINK ABOUT

- ▶ What a network manager does
- ▶ How do all the wires connect together
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- ▶ In hacking films, what does the terminology mean
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1.5 – Hardware Troubleshooting

Scenario

Glossary

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Exam Question

- ▶ Simple solutions to common problems:
- ▶ Most of the time, problems can be fixed using simple troubleshooting techniques, like **closing** and **reopening** the program. It's important to try these simple solutions before resorting to more extreme measures. If the problem still isn't fixed, you can try other troubleshooting techniques.

Problem: Power button will not start computer

- ▶ **Solution 1:** If your computer **does not start**, begin by checking the power cord to confirm that it is plugged securely into the back of the computer case and the power outlet.
- ▶ **Solution 2:** If it is plugged into an outlet, make sure it is a **working outlet**. To check your outlet, you can plug in another **electrical device**, such as a lamp.
- ▶ **Solution 3:** If the computer is plugged in to a **surge protector**, verify that it is turned on. You may have to **reset** the surge protector by turning it off and then back on. You can also plug a lamp or other device into the surge protector to verify that it's working correctly.
- ▶ **Solution 4:** If you are using a **laptop**, the **battery** may not be charged. Plug the **AC adapter** into the wall, then try to turn on the laptop. If it still doesn't start up, you may need to wait a few minutes and try again.



💡 THINK ABOUT

- 💡 What a network manager does
- 💡 How do all the wires connect together
- 💡 How often does turning it off and on again work
- 💡 What is built in redundancy
- 💡 What is a Proxy, VPN, Tunnel.
- 💡 In hacking films, what does the terminology mean
- 💡 Why buy when it is cheaper to upgrade

1.5 – Hardware Troubleshooting

Scenario

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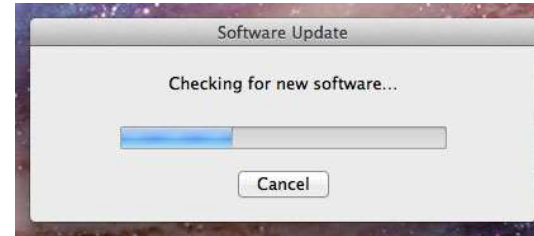
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Exam Question

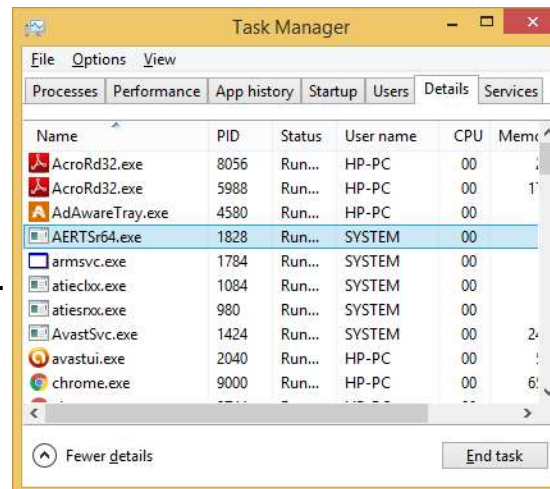
Problem: An application is running slowly

- ▶ **Solution 1:** Close and reopen the application.
- ▶ **Solution 2:** Update the application. To do this, click the **Help** menu and look for an option to check for **Updates**. If you don't find this option, another idea is to run an online search for application updates.



Problem: An application is frozen

- ▶ Sometimes an application may become stuck, or **frozen**. When this happens, you won't be able to close the window or click any buttons within the application.
- ▶ **Solution 1:** Force quit the application. On a PC, you can press (and hold) **Ctrl+Alt+Delete** (the Control, Alt, and Delete keys) on your keyboard to open the **Task Manager**. On a Mac, press and hold **Command+Option+Esc**. unresponsive application and click **End task** (or **Force Quit** on a Mac) to close it.
- ▶ **Solution 2:** Restart the computer. If you are unable to force quit an application, **restarting** your computer will close all open apps.



THINK ABOUT

- ▶ What a network manager does
- ▶ How do all the wires connect together
- ▶ How often does turning it off and on again work
- ▶ What is built in redundancy
- ▶ What is a Proxy, VPN, Tunnel.
- ▶ In hacking films, what does the terminology mean
- ▶ Why buy when it is cheaper to upgrade

1.5 – Hardware Troubleshooting

Scenario

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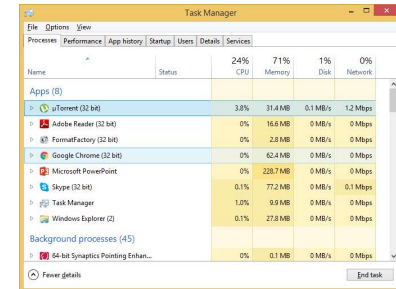
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Exam Question

Problem: All programs on the computer run slowly

- ▶ **Solution 1:** Run a **virus scanner**. You may have **malware** running in the background that is slowing things down.
- ▶ **Solution 2:** Your computer may be running out of hard drive space. Try **deleting** any files or programs you don't need.
- ▶ **Solution 3:** If you're using a **PC**, you can run **Disk Defragmenter**.



Process	Status	24%	71%	1%	0%
		CPU	Memory	Disk	Network
Apps (8)					
uTorrent (32 bit)		3.8%	31.4 MB	0.1 MB/s	1.2 Mbps
Adobe Reader (32 bit)		0%	16.6 MB	0 MB/s	0 Mbps
FormFactory (32 bit)		0%	2.8 MB	0 MB/s	0 Mbps
Google Chrome (32 bit)		0%	62.4 MB	0 MB/s	0 Mbps
Microsoft PowerPoint		0%	228.7 MB	0 MB/s	0 Mbps
Skype (32 bit)		0.1%	77.2 MB	0 MB/s	0.1 Mbps
Task Manager		1.0%	9.9 MB	0 MB/s	0 Mbps
Windows Explorer (2)		0.1%	27.8 MB	0 MB/s	0 Mbps
Background processes (45)					
64-bit Synaptics Pointing Enhanc...		0%	0.1 MB	0 MB/s	0 Mbps

Problem: The computer is frozen

- ▶ Sometimes your computer may become completely unresponsive, or **frozen**. When this happens, you won't be able to click anywhere on the screen, open or close applications, or access shut-down options.
- ▶ **Solution 1 (Windows only):** Restart Windows Explorer. To do this, press and hold **Ctrl+Alt+Delete** on your keyboard to open the **Task Manager**. Next, locate and select **Windows Explorer** from the **Processes** tab and click **Restart**. You may need to click **More Details** at the bottom of the window to see the Processes tab.
- ▶ **Solution 2 (Mac only):** Restart Finder. To do this, press and hold **Command+Option+Esc** on your keyboard to open the **Force Quit Applications** dialog box. Next, locate and select **Finder**, then click **Relaunch**.
- ▶ **Solution 3:** Press and hold the Power button. The Power button is usually located on the front or side of the computer, typically indicated by the **power symbol**. Press and hold the Power button for **5 to 10 seconds** to force the computer to shut down.
- ▶ **Solution 4:** If the computer still won't shut down, you can **unplug the power cable** from the electrical outlet. If you're using a laptop, you may be able to remove the battery to force the computer to turn off. **Note:** This solution should be your **last resort** after trying the other suggestions above.



1.5 – Hardware Troubleshooting

Scenario

Glossary

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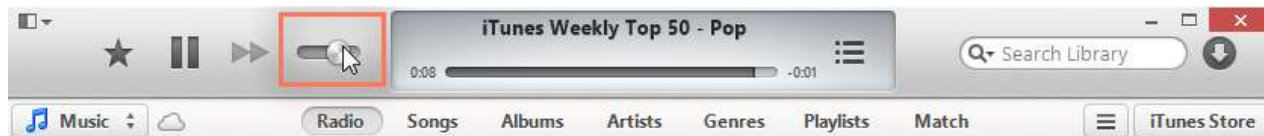
Exam Question

Problem: The mouse or keyboard has stopped working

- ▶ **Solution 1:** If you're using a **wired** mouse or keyboard, make sure it's correctly plugged into the computer.
- ▶ **Solution 2:** If you're using a **wireless** mouse or keyboard, make sure it's turned on and that its batteries are charged.

Problem: The sound isn't working

- ▶ **Solution 1:** Check the volume level. Click the audio button in the top-right or bottom-right corner of the screen to make sure the sound is turned on and that the volume is up.
- ▶ **Solution 2:** Check the audio player controls. Many audio and video players will have their own separate audio controls. Make sure the sound is turned on and that the volume is turned up in the player.



- ▶ **Solution 3:** Check the cables. Make sure external speakers are plugged in, turned on, and connected to the correct audio port or a USB port. If your computer has **color-coded** ports, the audio output port will usually be **green**.
- ▶ **Solution 4:** Connect headphones to the computer to find out if you can hear sound through the headphones.

THINK ABOUT

- ▶ What a network manager does
- ▶ How do all the wires connect together
- ▶ How often does turning it off and on again work
- ▶ What is built in redundancy
- ▶ What is a Proxy, VPN, Tunnel.
- ▶ In hacking films, what does the terminology mean
- ▶ Why buy when it is cheaper to upgrade

1.5 – Hardware Troubleshooting

Scenario

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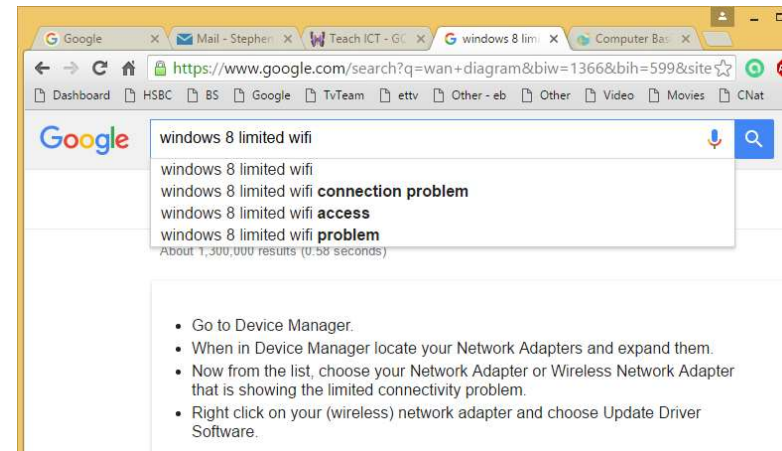
Exam Question

Problem: The screen is blank

- ▶ **Solution 1:** The computer may be in **Sleep** mode. Click the mouse or press any key on the keyboard to wake it.
- ▶ **Solution 2:** Make sure the monitor is **plugged in** and **turned on**.
- ▶ **Solution 3:** Make sure the computer is **plugged in** and **turned on**.
- ▶ **Solution 4:** If you're using a desktop, make sure the monitor cable is properly connected to the computer tower and the monitor.

Solving more difficult problems

- ▶ If you still haven't found a solution to your problem, you may need to ask someone else for help. As an easy starting point, you should **search the Web**. It's possible that other users have had similar problems, and solutions to these problems are often posted online. Also, if you have a friend or family member who knows a lot about computers, they may be able to help you.
- ▶ Keep in mind that most computer problems have simple solutions, although it may take some time to find them. For difficult problems, a **more drastic solution** may be required, like reformatting your hard drive or reinstalling your operating system. If you think you might need a solution like this, we recommend **consulting a professional** first. If you're not a computer expert, it's possible that attempting these solutions could make the situation worse.



1.5 – Hardware Troubleshooting

Scenario

Glossary

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Exam Question

Task 24 – Create a step-by-step user guide with evidence for the following technical issues. You should attempt two problems.

Wi-Fi is not connecting	The computer says No HDD found when switched on	Monitor is changing colours
Windows is not booting up	Mouse is moving but not smoothly	When I type the £, a \$ comes up.
Web page is not fitting on the screen	The game I installed is not compatible	Printer is printing gibberish

This guide should include the following layout:

1. Potential cause of the problem.
2. How to identify the problem with symptoms.
3. At least 3 potential solutions to the problem.
4. The different PC vs MAC solutions.
5. How to prevent further recurrences of the problem.
6. How to find support concerning the problem (with links)

THINK ABOUT

- What a network manager does
- How do all the wires connect together
- How often does turning it off and on again work
- What is built in redundancy
- What is a Proxy, VPN, Tunnel.
- In hacking films, what does the terminology mean
- Why buy when it is cheaper to upgrade

1.6 – Units of Measurements

Scenario

Glossary

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Exam Question

- ▶ **Disks** – First there was CD, 700MB, then DVD, 4400MB, now Blu-Ray. These are still not enough to back up a network drive but they are very useful as timed backups. All systems except Thin Client come with these as standard, they run off the IDE cable to the motherboard and act like a separate hard drive, taking a drive letter.
- ▶ Only certain Drives are RW, rewritable, but disks are so cheap that most people do not bother. This is a big step from the 3.5” and the 5.25” drives that were prevalent until 1999.
- ▶ **Pen drives and memory cards** – These are the more probably method of System storage and backup people will use. The difference is that pen drives plug straight into the USB drive and memory cards go into sockets or bayonets. Size has changed the way we use them, the standard like memory in the machine has doubled almost every 2 years, what was 32mb 15 years ago and seemed like a lot (the equivalent of 24 floppy disks) now the cast away standard is 8gb, with 16, 32, 64 and larger available in shops.
- ▶ Every supermarket sells them, that’s how common they are, businesses give them away with their logos on them for publicity and it works out roughly at £1 per GB.



THINK ABOUT

- ▶ Does size matter (storage)
- ▶ What is the replacement for Hard Drives
- ▶ How often does turning it off and on again work
- ▶ What is built in redundancy
- ▶ What is a Proxy, VPN, Tunnel.
- ▶ In hacking films, what does the terminology mean
- ▶ Why buy when it is cheaper to upgrade

1.6 – Units of Measurements

Scenario

Glossary

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Exam Question

- ▶ **Portable and fixed drives** – Like Pen Drives, these either plug into the USB drive, tend to be large capacity, bigger than Pen Drives, or they are secondary or third drives inside the computer. Second drives and portable hard drives are cheap, working at about 10gb per £1, sizes of 320gb up to 4tb are common.
- ▶ They are basically mass storage, do not need an OS installed, can work on any computer or OS except Phone or most Tablets and are relatively reliable, Fixed drives more so because they do not get moved around. The can either be SATA or IDE, portable ones are housed in a cradle or dock which is then USB connected.

Name	Abbr	Factor	SI size
Kilo	K/k	$2^{10} = 1,024$ (K)	$10^3 = 1,000$ (k)
Mega	M	$2^{20} = 1,048,576$	$10^6 = 1,000,000$
Giga	G	$2^{30} = 1,073,741,824$	$10^9 = 1,000,000,000$
Tera	T	$2^{40} = 1,099,511,627,776$	$10^{12} = 1,000,000,000,000$
Peta	P	$2^{50} = 1,125,899,906,842,624$	$10^{15} = 1,000,000,000,000,000$
Exa	E	$2^{60} = 1,152,921,504,606,846,976$	$10^{18} = 1,000,000,000,000,000,000$
Zetta	Z	$2^{70} = 1,180,591,620,717,411,303,424$	$10^{21} = 1,000,000,000,000,000,000,000$
Yotta	Y	$2^{80} = 1,208,925,819,614,629,174,706,176$	$10^{24} = 1,000,000,000,000,000,000,000,000$

For Example : A 400GB harddisk

Manufacturer uses GB in SI unit, so the harddisk has 400,000,000,000 B capacity

In MS Windows, it use GB as 2^{30} , so the Windows can see the harddisk around 372 GB

THINK ABOUT

- ▶ Does size matter (storage)
- ▶ What is the replacement for Hard Drives
- ▶ How often does turning it off and on again work
- ▶ What is built in redundancy
- ▶ What is a Proxy, VPN, Tunnel.
- ▶ In hacking films, what does the terminology mean
- ▶ Why buy when it is cheaper to upgrade

1.6 – Units of Measurements

Scenario

Glossary

1.1

1.2

1.3

1.4

1.5

1.6

1.7

Exam Question

Task 25 – Research and specify the maximum memory sizes and capacity of the following devices:

Newest Samsung phone	HP Spectre laptop	SSD storage drive
HP Laserjet 4 printer	SanDisk memory stick	Newest nVidia card
Canon ixus camera	Epson Perfection V850	Apple iWatch
Playstation 4 graphics card	xBox One storage	Toshiba Canvio Connect II drive

Create a spreadsheet showing the capacities, calculate the Byte size of each and present this information in the following format:

1. Device name
2. Memory size
3. Byte size
4. Benefits and limitations
5. Upgrade potential

THINK ABOUT

- Does size matter (storage)
- What is the replacement for Hard Drives
- How often does turning it off and on again work
- What is built in redundancy
- What is a Proxy, VPN, Tunnel.
- In hacking films, what does the terminology mean
- Why buy when it is cheaper to upgrade

1.7 – Number Systems – Binary

Scenario

Glossary

1.1

1.2

1.3

1.4

1.5

1.6

1.7

Exam Question

What is a Number System?

- ▶ Simply put, a number system is a way to represent numbers. We are used to using the base-10 number system, which is also called decimal. Other common number systems include base-16 (hexadecimal), base-8 (octal), and base-2 (binary).
- ▶ Click [here](#) to test your colour binary codes.

Looking at Base-10

- ▶ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11... You've counted in base-10 all of your life. Quick, what is $7+5$? If you answered 12, you are thinking in base-10. Let's take a closer look at what you've been doing all these years without ever thinking about it.
- ▶ Let's take a quick look at counting. First, you go through all the digits: 0, 1, 2... Once you hit 9, you have no more digits to represent the next number. So, you change it back to 0, and add 1 to the tens digit, giving you 10. The process repeats over and over, and eventually you get to 99, where you can't make any larger numbers with two digits, so you add another, giving you 100.
- ▶ Although that's all very basic, you shouldn't overlook what is going on. The right-most digit represents the number of ones, the next digit represents the number of tens, the next the number of hundreds, etc.

1.7 – Number Systems – Binary

Scenario

Glossary

1.1

1.2

1.3

1.4

1.5

1.6

1.7

Exam Question

Visualizing Base-10

- ▶ Confused by these descriptions? No problem - below is a demo to help you out. Simply enter a number in the text box and click draw. Try entering a large number, like 2347. You'll see 2 groups of one thousand, 3 groups of one hundred, 4 groups of ten, and 7 individual blocks.
- ▶ Click [here](#) to test your Base-10 knowledge.

Base-10 Mathematically

You may have noticed a pattern by now. Let's look at what is going on mathematically, using 2347 as an example.

- ▶ As you saw, there are 2 groups of a thousand. Not coincidentally, $1000 = 10 \cdot 10 \cdot 10$ which can also be written as 10^3 .
- ▶ There are 3 groups of a hundred. Again, not coincidentally, $100 = 10 \cdot 10$ or 10^2 .
- ▶ There are 4 groups of ten, and, $10 = 10^1$.
- ▶ Finally, there are 7 groups of one, and $1 = 10^0$. (That may seem strange, but *any* number to the power of 0 equals 1, by definition.)
- ▶ This is essentially the definition of base-10. To get a value of a number in base-10, we simply follow that pattern. Here are a few more examples:

$$892 = 8 \cdot 10^2 + 9 \cdot 10^1 + 2 \cdot 10^0$$

$$1147 = 1 \cdot 10^3 + 1 \cdot 10^2 + 4 \cdot 10^1 + 7 \cdot 10^0$$

$$53 = 5 \cdot 10^1 + 3 \cdot 10^0$$

- ▶ Admittedly, this all seems logical. We all know what value a base-10 number is because we always use base-10, and it comes naturally to us, though, if we understand the patterns in the background of base-10, we can understand other bases better.

1.7 – Number Systems – Binary

Scenario

Glossary

1.1

1.2

1.3

1.4

1.5

1.6

1.7

Exam Question

- ▶ **Base-8**
- ▶ On to base-8, also called octal. Base-8 means just what it sounds like: the system is based on the number eight (as opposed to ten). Remember how in base-10 we had ten digits? Now, in base-8, we are limited to only eight digits: 0, 1, 2, 3, 4, 5, 6, and 7. There's no such thing as 8 or 9.
- ▶ We count the same way as we normally would, except with only eight digits. Instead of a lengthy explanation, simply try out the demo below by clicking "Count Up 1" to see how counting in base-8 works.
- ▶ Click [here](#) to test your Base-8 knowledge.
- ▶ You should notice a similar pattern to before; after we get to 7, we run out of different digits for any higher number. We need a way to represent eight of something. So we add another digit, change the 7 back to 0, and end up with 10. Our answer of 10 in base-8 now represents what we would normally think of as 8 in base-10.
- ▶ Talking about numbers written in multiple bases can be confusing. For example, as we have just seen, 10 in base-8 is not the same as 10 in base-10. So, from this point on, I'll use a standard notation where a subscript denotes the base of numbers if needed. For example, our base-8 version of 10 now looks like 10_8 .
- ▶ Great, so we know 10_8 represents eight items. What's the next number after 77_8 ? If you said 100_8 , you're correct. We know from what we've learned so far that the first 7 in 77_8 represents groups of 8, and the second 7 represents individual items. If we add these all up, we have $7 \times 8 + 7 \times 1 = 63$. So we have a total of 63_{10} . So $77_8 = 63_{10}$. We all know 64_{10} comes after 63_{10} .

1.7 – Number Systems – Binary

Scenario

Glossary

1.1

1.2

1.3

1.4

1.5

1.6

1.7

Exam Question

Converting From Base-8 to Base-10

- ▶ Let's look at a wordier example now. John offers to give you 47_8 cookies, and Jane offers to give you 43_{10} cookies. Whose offer do you take? If you want, go ahead and generate the graphic for 47_8 graphic with the first tool. Let's figure out its base-10 value so we can make the best decision!
- ▶ As we saw when counting, the four in 47_8 represents the number of groups of eight. This makes sense - we are in base-8. So, in total, we have four groups of eight and seven groups of one. If we add these all up, we get $4*8 + 7*1 = 39_{10}$. So, 47_8 cookies is the exact same as 39_{10} cookies. Jane's offer seems like the best one now!
- ▶ The pattern we saw before with base-10 holds true here also. We'll look at 523_8 . There are five groups of 8^2 , two groups of 8^1 and three groups of 8^0 (remember, $8^0=1$). If we add these all up, $5*8^2 + 2*8^1 + 3*8^0 = 5*64+2*8+3 = 339$, we get 339_{10} which is our final answer. The diagram below shows the same thing visually:

Converting 523_8 to Base 10

$$\begin{array}{r} 3*8^0 = 3 \text{ --- } \color{red}{\dots} \\ 2*8^1 = 16 \text{ --- } \color{green}{\square\square} \\ + 5*8^2 = 320 \text{ --- } \color{red}{\square\square\square\square\square} \\ \hline =339 \quad \text{[339 Total Blocks]} \end{array}$$

Here are a couple more examples:

- $111_8 = 1*8^2+1*8^1+1*8^0 = 64+8+1 = 73_{10}$
- $43_8 = 4*8^1+3*8^0 = 32+3 = 35_{10}$
- $6123_8 = 6*8^3+1*8^2+2*8^1+3*8^0 = 3072+64+16+3 = 3155_{10}$

1.7 – Number Systems – Hexadecimal

Scenario

Glossary

1.1

1.2

1.3

1.4

1.5

1.6

1.7

Exam Question

Base-16

- ▶ Base-16 is also called **hexadecimal**. It's commonly used in computer programming, so it's very important to understand. Let's start with counting in hexadecimal to make sure we can apply what we've learned about other bases so far.
- ▶ Since we are working with base-16, we have 16 digits. So, we have 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, then we run out of digits, but we still need six more. Perhaps we could use something like a circled 10?
- ▶ Instead, we simply use letters of the alphabet, starting with A and continuing to F. Here's a table with all the digits of base-16:
- ▶ Other than these extra digits, hexadecimal is just like any other base. For example, let's convert $3D_{16}$ to base-10. Following our previous rules, we have:
 $3D_{16} = 3 \cdot 16^1 + 13 \cdot 16^0 = 48 + 13 = 61$. So $3D_{16}$ is equal to 61_{10} . Notice how we use D's value of 13 in our calculation.
- ▶ We can convert from base-10 to base-16 similar to the way we did with base-8. Let's convert 696_{10} to base-16. First, we find the largest power of 16 that is less than 696_{10} . This is 16^2 , or 256. Then:
 1. $696/16^2 = 2$ remainder 184
 2. $184/16^1 = 11$ remainder 8
 3. $8/16^0 = 8$ remainder 0
- ▶ We have to replace 11 with its digit representation B, and we get $2B8_{16}$.

Base 16 Digit	Value
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
A	10
B	11
C	12
D	13
E	14
F	15

1.7 – Number Systems – Hexadecimal

Scenario

Glossary

1.1

1.2

1.3

1.4

1.5

1.6

1.7

Exam Question

Example 1

Base 2 – binary

128	64	32	16	8	4	2	1
0	0	1	1	0	1	0	1

Convert to base 10 – decimal

$$(32 \times 1) + (16 \times 1) + (4 \times 1) + (1 \times 1) = 32 + 16 + 4 + 1 = 53$$

Convert to base 16 – hexadecimal

Split into two 4 bits

8	4	2	1		8	4	2	1
0	0	1	1		0	1	0	1

16	1
3	5

$$\text{Check } (16 \times 3) + (1 \times 5) = 48 + 5 = 53$$

Example 2

Base 2 – binary

128	64	32	16	8	4	2	1
1	1	0	1	0	1	0	0

Convert to base 10 – decimal

$$(128 \times 1) + (64 \times 1) + (16 \times 1) + (4 \times 1) = 128 + 64 + 16 + 4 = 212$$

Convert to base 16 – hexadecimal

split into two 4 bits

8	4	2	1		8	4	2	1
1	1	0	1		0	1	0	0

16	1
D	4

Hexadecimal – 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F

- ▶ For the exam you know will need to know how to convert binary to decimal and hexadecimal. The kind of questions that will appear will be a series of numbers to convert to hex, binary, base 8, 10 or 12 etc. This needs to be a logical method that you will need to revise for.



1.8 – Exam Questions – 2017 – Specimen Paper

Scenario

Glossary

1.1

1.2

1.3

1.4

1.5

1.6

1.7

Exam Question

4 A bank has a number of offices all over the world. Each office has a local area network (LAN). The LANs are connected together to create a wide area network (WAN) for use by its staff.

One of the office managers wants to improve the speed and efficiency of his office LAN. He wants to replace the existing copper cabling with an alternative communication method.

(a) Evaluate **three** alternative methods of transmission the manager could use including optical methods.



Method 1: _____

Method 2: _____

Method 3: _____

[8]

1.8 – Exam Questions – 2014 – Applied ICT International Paper 31

Scenario

Glossary

1.1

1.2

1.3

1.4

1.5

1.6

1.7

Exam Question

4 (a) Identify three different features of a well-designed paper based form that will make it easier for a passenger to fill in. For each feature, state whether OMR or OCR would be the most appropriate method of input to a computer. Evaluate **three** alternative methods of transmission the manager could use including optical methods.



1: _____

2: _____

3: _____

[3]

(b) Discuss the advantages and disadvantages of OMR compared with OCR.

[5]

1.8 – Exam Questions – 2014 – Applied ICT International Paper 31

Scenario

Glossary

1.1

1.2

1.3

1.4

1.5

1.6

1.7

Exam Question

8 - Mrs. Sharif is the head teacher of a large school with over 2000 students. Teachers keep records of test scores on the school's computer system. The total possible mark for each test varies from test to test and subject to subject. Mrs. Sharif wants the teachers to use the test scores of each student so that they can be included in a report to the student's parents. She will need to choose a suitable printer for printing the reports.

(d) Mrs. Sharif wants to use a laser printer to print the reports. Give two reasons why she has chosen a laser printer rather than other types of printer.

1: _____

2: _____

[2]



1.8 – Exam Questions – 2014 – Applied ICT International Paper 33

Scenario

Glossary

1.1

1.2

1.3

1.4

1.5

1.6

1.7

Exam Question

3 (a) Describe the use of three specialised items of computer hardware that are required when using computer simulations to train pilots.

1: _____

2: _____

3: _____

_____ [6]



1.8 – Exam Questions – 2014 – Applied ICT International Paper 33

- Scenario
- Glossary
- 1.1
- 1.2
- 1.3
- 1.4
- 1.5
- 1.6
- 1.7
- Exam Question

10 (a) Describe three network devices which could be used in the school's network. Include details of how each would handle data packets.

Device 1: _____

Device 2: _____

Device 3: _____

[6]

