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HALF TERM 1: How data is processed in a computer system

KQ1 - What is the purpose of the CPU? (1.1.1)

(a) CPU Purpose

-Process instructions inside the computer

-Perform the fetch-decode-execute cycle

KQ2 - How are instructions processed in the CPU? (1.1.1)

(a) The fetch-execute cycle

-Fetch: An instruction is fetched from primary memory by the CPU

-Decode: The instruction is then decoded

-Execute: The decoded instruction is then executed so that the CPU performs continuously

-The process is repeated

-1 fetch-decode-execute-cycle is 1 instruction, which measures 1hz

KQ3 - How can common characteristics of CPUs affect their performance? (1.1.2)

(a) Clock Speed

-The number of instructions that a processor can process per second

-The processing of instructions is measured in hertz

-1 hertz = 1 instruction, 1mhz = 1 million instructions, 1ghz = 1 billion instructions

-The higher the clock speed, the more instructions that a processor can perform per second

-If more instructions are completed per second a processor can perform tasks quicker

(b) Cache Size

-Cache stores instructions / data that is frequently used / previously used / next to be used

-Data does not then need to be fetched from RAM

-Speeds up access to data / data is transferred faster

-It is faster to transfer to and from cache than transferring to and from RAM, which makes a CPU more efficient

(c) Number of Cores

Multi-core: A CPU with multiple processors. Each process or can perform instructions simultaneously

Single Core: A CPU with one processor. Only one instruction can be performed at a time.

Dual Core: A CPU with two processors. Two instructions can be performed simultaneously.

Quad Core: A CPU with four processors. Four instructions can be performed simultaneously.

-Tasks can split between the processors so tasks / processes / software / can be processed faster as more processes completed per second

(d) Inefficiencies of multiple cores

-Software may be designed to run on 1 core and not multiple cores as some tasks cannot be split across cores

-One task may be completed faster/slower

KQ4 – What are the components that allow the CPU to process instructions? (1.1.1)

(a) Components

-ALU (Arithmetic Logic Unit): Performs arithmetic and logic in the CPU.

-CU (Control Unit): Controls the operation of the processor and its components.

Knowlwdge book used for the delivery of HT1 theory content.

Explanation of the factors that affect the performance of a CPU.

Peer discussion/presentation/questioning of the journey of a piece of data through a computer system.

Links to maths – Binary and hexadecimal number systems, convertion between number systems, and binary addition, multiplication and division

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-Cache: Stores data/instructions that may need to be used by the CPU frequently (b) Buses -Buses: A bus transports data/instructions from the CPU to other components. They are not part of the CPU and are located on the motherboard. Address Bus – Transports addresses of instructions that need to be fetched, to the CPU. Data Bus – Transports data/instructions from the RAM to the CPU. (c) Registers -Registers: A register stores data/instructions. They are located within the CPU. **KQ5 – How are instructions processed in the Von Neumann architecture? (1.1.1)** (a) Components -Address – The location where a piece of data/instruction is stored. -Instruction – An instruction that needs to be performed by the CPU e.g. add two numbers -Data – A piece of data e.g. a number that is used as part of a calculation that needs to be processed. MAR (Memory Address Register): -Stores the address/location where data/instruction will be read/written/accessed/fetched -Stores the address/location of data/instruction next to be processed MDR (Memory Data Register): -Stores the data/instruction that has been fetched/read from memory -Stores the data/instruction from the address in the MAR -Stores the data that is to be written back to memory Program counter: -Stores the address/location of the next instruction to be run -Is incremented by 1 when the previous address has been sent to the RAM Accumulator: -Stores the result of any manipulation/processing/calculation performed by the ALUs (b) The effect of the fetch-execute cycle on registers -The program counter is incremented, -The address of the instruction to be fetched is placed in the MAR. -The instruction is transferred to the MDR. -The instruction is then executed by the ALU and the result placed in the ACC. **KQ6 – What is an embedded system? (1.1.3)** (a) Characteristics -A computer system that is built into another device / not a general-purpose computer or has one/limited/specific/dedicated function. -e.g. a Smart watch has a microprocessor on a single circuit board It is a computer system that is built within the -- -Has a built-in OS / difficult to change/manipulate the OS/function of the device (b) Examples		

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- e.g. Dishwasher, MP3 player, washing machine, mobile phone, manufacturing equipment **KQ7– Why must data be stored in binary format? (1.2.3)** (a) Binary – -Computers consist of transistors / switches / logic circuits / gates… -Which have two states / values / -On or off / 1 or 0 / open or closed **KQ8 – How is the size of files/capacity of devices measured? (1.2.3)** (a) Units -Order of computing units: Bit (single binary digit, 1 or 0), Nibble (4 bits), Byte (8 bits), Kilobyte (1,000 bytes or 1 KB), Megabyte (1,000 KB), Gigabyte (1,000 MB), Terabyte (1,000 GB), Petabyte (1,000 TB) (Use of 1,024 or 1,000 for conversions) (b) Conversion/Calculation -Convert from/to capacity units using multiplication/division e.g. Convert 5000MB to GB. -Calculate the space required for given files e.g. How many GB is required to store 1000 10 MB files. **KQ9 – How are numbers represented using the binary number system? (1.2.4)** (a) Binary Number System -The symbols used – 1 and 0. -The importance of the 'binary scale' 16 8 4 2 1 etc. -Each column increases in powers of 2 e.g. 2^2 2^1 2^0 -The terms most significant bit, and least significant bit (b) Conversion -Convert positive denary whole numbers to binary numbers (up to and including 8 bits) -Convert positive binary numbers to denary whole numbers (up to and including 8 bits) (c) Addition -Add two binary integers together (up to and including 8 bits) using the column method -Overflow errors -The result of the addition is larger than 8 bits (the space available to store the result) -There is an extra carry -The result is greater than 255 / 11111111 (d) Binary Shift -Left shift increases the value of a number – multiplication -1 place left multiplies by 2, 2 places multiplies by 4, 3 places multiplies by 8 etc. -Perform a left binary shift on a binary value -Right shift decreases the value of a number – division -1 place right divides by 2, 2 places divides by 4, 3 places divides by 8 etc. -Perform a right binary shift on a binary value -A right shift is not always accurate as decimal numbers are not represented/a bit is lost. -Performs integer/DIV division.		

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KQ10 – How are numbers represented using the hexadecimal number system? (1.2.4) (a) Hexadecimal Number System -The symbols used – 0-9, A-F -Each column increases in powers of 16 e.g. 16^1 16^0 (b) Conversion -Convert positive denary whole numbers into 2-digit hexadecimal numbers -Convert positive 2-digit hexadecimal numbers into denary whole numbers -Convert binary integers to their hexadecimal equivalents -Convert hexadecimal values to their binary equivalents		
HALF TERM 2: How data is stored in a computer system **KQ1 – Why is primary storage needed in a computer system? (1.2.1)** (a) The need for primary storage -Is utilised in the processing of data/instructions by the CPU – the fetch-execute cycle. -Provides the CPU with fast access to the data and instructions that the primary storage holds, which allows the computer to perform tasks efficiently. -RAM, ROM, cache are forms of primary storage. (c) The purpose of RAM in a computer system -Stores the parts of the OS / programs that are currently running -Stores any data/files that are currently in use -For access by the CPU during the fetch-decode-execute cycle (b) The purpose of ROM in a computer system -Stores the bootstrap loader / BIOS / boot programs that are needed to load the computer. -Used to start the computer / loads the operating system -BIOS: Basic Input Output System – manages the loading of the computer's internal components -Bootstrap loader – Loads the OS intro primary storage. (d) Difference between RAM and ROM -RAM is volatile / ROM is non-volatile -RAM is read-write / ROM is read-only -RAM is larger / ROM is much smaller -The purpose of the two components **KQ2 - What happens if the RAM is full?** (a) Virtual memory -Part of the secondary storage used as (temporary) RAM when RAM is full -Data from RAM is moved to the secondary storage/virtual memory to make space in RAM -RAM can then be filled with new data -When data in virtual memory is needed it is moved back to RAM -More RAM would improve the performance of the computer as virtual memory is slower than accessing the RAM directly as data needs to be transferred, which uses CPU time. **KQ3 How is data store in a computer system long-term? (1.2.2)**	   	Knowlwdge book used for the delivery of HT2 theory content. The characteristics/benefits/drawbacks of different storage types. Comparisson of the different storage types, in a variety of scenarios. Peer discussion of the characteristics of different secondary storage types – optical, magnetic and solid state. -

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(a) The need for secondary storage -The long term/permanent non-volatile storage of data/files -To store the files / e.g. operating system, even when the system is switched off. (b) Common types of storage – Optical -CD/DVD/Blu-ray -Data is recorded by making marks/patterns in a disk which can be read back using a beam of light. -Capacity: Capacity varies, Blu-ray 25GB. -Cost: Low cost per disk -Portability: Small physical size -Durability: Scratched very easily. -Speed: Slow read speed as data needs to be located on the disk -Reliability: -Used when selling software/games, due to cheap production costs. (c) Common types of storage – Magnetic -Data stored on disks using magnets. Part of disk is magnetised to store data. The disks spin around and there is an arm which moves over the disk to read data. -Capacity: Tend to be large capacity -Cost: Relatively cheap, cheapest cost per GB -Portability: Large physical size -Durability: Sensitive to movement of system due to moving parts -Reliability: Moving parts can fail due to wear and tear -Speed: Faster than CD, slower than SSD due to moving parts -Used to store large amounts of data in a desktop computer/server. (d) Common types of storage - Solid state -Stores data electronically and has no moving parts. -Cost: Relatively expensive so tend to be of smaller capacity, due to being a newer form of technology. -Speed: Fast access to data as there are no moving parts. -Durability: No moveable parts so it is very durable/not sensitive to movement. -Portability: Very small/lightweight. -Reliability: Reliable as no moving parts reduces risk of failure. -Low power consumption so are often used in portable/chargeable devices. -Used in portable devices – tablets, phones, memory sticks etc., (e) Characteristics: -Capacity – the typical amount of data that can be stored by a device. -Speed – The speed of reading from/writing to a device. -Portability – How portable the storage media is (relating to physical size). -Durability – How robust the storage media is. -Reliability – The quality of a storage media of being trustworthy or of performing consistently well -Cost – The cost of the storage media in terms of cost per GB.		

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KQ1 – How can decisions be made from binary values? (2.4.1) (a) Logic gates/circuits – -Building block of a circuit in a CPU. -In its most basic form computers are circuits and transistors. -A logic circuit is a series of transistors that are designed to process electronic signals (binary) and make decisions, store etc. -AND gate – both inputs must be true to output true. -OR gate – if either input is true, the output is true. -NOT gate – inverts the input. -The drawn symbol for each diagram. -The textual notation - AND Λ, OR V, NOT ¬ (b) Draw/Complete Logic Diagrams – -Skill - Follow logic diagrams up to two levels, stating the output for a given input. -Skill - Draw logic diagrams for a given Boolean expression, up to two levels. **KQ2 – How can the outputs of a logic diagram be represented?** (a) Truth Tables – -Are used to show all possible inputs and their outputs, for a given logic diagram. -The truth table for each logic gate - AND, OR and NOT (b) Completing Truth Tables – -Skill - Complete a truth table for the AND, OR and NOT gates. -Skill - Complete a truth table for a logic diagram to two levels.		
HALF TERM 3: How computer systems are programmed **KQ1 – How are computer programs written using Python? (2.2.1)** Skill - The use of variables, constants, operators, inputs, outputs and assignments (a) Variables Variables – A named memory address that holds a value. The value held in a variable can (and usually does) change as the program is running. Identifier – The name given to a variable. Can contain number and letters. Must start with a litter. Cannot contain spaces. Should be meaningful. Declaring – Identifying a variable before a value is assigned to it Assignment - Giving a variable a value. A variable must be assigned a value before it can be used. Local – A variable that is confined to a subprogram and cannot be accessed/used outside of it. Global – A variable that can be accessed and changed throughout the program. It has to declare that the variable is a global (b) Constants Constant - Allows a value to be assigned a name. The value cannot be changed whilst the programming in running. - Declared and assigned once, but can be accessed multiple times throughout the program.		Knowlwdge book used for the delivery of HT3 theory content. Use of websites to support the development of programming skills and knowledge
		Written explanation of computer programs that have been written.
		Peer explanation of computer programs that have been written.
		Links to maths – Mathematical operations in computer programming.

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(c) Operators Comparison - Compares two values/variables within an if statement. Returns true or false. Arithmetic - Performs an arithmetic operation on two values/variables. Logical - Allow a program to make a decision based on multiple conditions. (d) Input/output Inputs – Allow the user to enter a piece of data into a program. Outputs – Allow a piece of data from the program to be output. **KQ2 How do we used to control the flow of a computer program:** Programming Construct – Different programming concepts which control the flow/path through a computer program. (a) Sequence -The order in which instructions are processed. -In programming, statements are executed one after another, line by line. -Instructions need to be ordered in the correct sequence to complete the required task. (b) Selection -The process of making a decision. -The result of the decision decides which path the program will take. -Decisions can be made on data contained within variables, by comparing them with the comparison operators. -Use of if statements and switch/case statements. (c) Iteration -Known as a loop in programming. -Is the repeated execution of a line/section of code when a program is running. Count-controlled loops (For loop): -Repeatedly executes a section of code a fixed number of times. -Uses the 'for' command word followed by the criteria and the 'next' command word to return to the beginning of the loop -A variable is given a starting value and an end value. -Every time the code is iterated, the value of count increases by one. -Every time an iteration takes place the start and end value are compared. -If the result is false, the code loops back to the start. -If it is true, the iteration ends. Condition-controlled loops (While loop) -Repeatedly executes a section of code until a condition is met or no longer met. While loops: -Uses the 'while' command word followed by the criteria, with the endwhile declaring the end of the loop. -While loops test the condition at the beginning of the loop, using a comparison operator. -If the condition is true, the code within the loop is executed before the program loops back to test the condition again.		

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-If the condition is false, the code within the loop is not executed. -Because the condition is tested at the start of the loop, it is possible for the code within it to never be executed. Repeat loops: -Uses the 'do' command word to declare the beginning of the loop and the 'until' command word followed by the criteria. -Works in the same way as a while loop but the condition is tested at the end of the loop: -The repeat statement defines the start of the loop. The until statement tests the condition. -Because the condition is tested at the end, the code within the loop is always executed at least once. (d) Comparison operators -Compares two values/variables within an if statement. Returns true or false. == Equal to, != Not equal to, < Less than, <= Less than or equal to, > Greater than, >= Greater than or equal to (e) Arithmetic operators -Performs an arithmetic operation on two values/variables. + Addition, – Subtraction, * Multiplication, / Division, MOD Modulus – division where the remainder is returned, DIV Quotient – integer division which returns the whole number, ^ Exponentiation – to the power of (f) Boolean operators -Allow a program to make a decision based on multiple conditions. Used in if statements. -AND – both conditions must be true, OR - one of the conditions must be true, NOT – the condition must be false. Skill - Practical use of the techniques in a high-level language within the **KQ1 - Which types of data can be represented in computer programs? (2.2.2)** (a) Data Types Skill - Practical use of the data types in a high-level language Skill - Ability to choose suitable data types for data in a given scenario Integer – a whole number, -int() Real – a decimal number. -float(), real() Boolean – a true / false value. -bool() Character and string – One or more alphanumeric characters. -str() (b) Casting Skill - Practical use of the casting a high-level language Change the data type of a variable/value, temporarily while the code is running e.g. an integer to a string -e.g. In order to be displayed as part of a message. -e.g. To write integers to a file. str(345), int("3"), float("4.52"), real("4.52"), bool("True")		

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HALF TERM 4: The importance of algorithms in computing **KQ1 – What are the skills required to effectively write algorithms? (2.1.1)** (a) Abstraction -Simplifies the problem / focuses on the important detail -Removing / hiding / obscuring / ignoring unnecessary detail from a problem -Simplifies the problem - reduces complexity, concentrates on details that are needed to solve the problem. -e.g. unnecessary detail could be removed from a driving simulator -This would make the problem easier to solve and reduce the required processing power (b) Decomposition -Breaking down a complex problem or into smaller parts/problems -So that are more manageable and easier to understand. -Smaller parts/problems can be solved individually and are simpler to work with -If a problem is not decomposed, it is much harder to solve. (c) Algorithmic thinking -A way of getting to a solution to a problem through the clear definition of the steps needed -i.e. solving computer related problems by writing algorithms. **KQ1 – How can problems be broken down to make them easier to solve? (2.1.2)** (a) Inputs Identify the inputs required to solve a given programming/pseudocode scenario -Anything which needs to be supplied to the program to meet its goals. -Often input by the user. (b) Processing Identify the processing required to solve a given programming/pseudocode scenario. -Consider the calculations that need to be performed while the program is running. - Consider whether the data needs to change format or data type. (c) Outputs Identify the outputs required to solve a given programming/pseudocode scenario -Consider what the program needs to output -Consider what form this output needs to take -Consider an appropriate variable name and data type for any output. **KQ2 - How can problems be decomposed using structure diagrams?** (a) Structure Diagrams -Help to decompose problems, taking a structured approach. Uses a process known as step-wise refinement. -Each subsequent level breaks down a problem into smaller parts.		Knowlwdge book used for the delivery of HT4 theory content.
		Explanation of algorithms that have been written using flow diagrams/pseudocode
		Explanation of algorithms that have been written using flow diagrams/pseudocode
		Links to technology – use of flow diagrams to represent a program

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e.g. -Level 0 – the main problem. -Level 1 – the main parts needed to solve the problem. -Level 2 – the tasks needed to solve the main parts of the problem. Etc. -Further levels are required where problems are still complex and require breaking down further. -Each lowest level node should achieve a single task. -They can then be coded as a single module/sub-program **KQ3 - How can algorithms be represented using diagrams?** a) Flow diagram uses – -Represents a sequence of steps in diagrammatic form. -Can follow the different paths through the algorithm caused by decisions. (b) Flow diagram symbols – -Terminator – Used to start and end the diagram. Input/output – Used to show where data will be input/output. -Decision – Used to enable the program to take multiple paths. Allows for a single yes/no or true/false decision. -Process/action – Where an action is performed e.g. a calculation. This action is usually a task performed by the computer. -Sub-program – Can be used to represent a larger process, which should be represented in a separate flow diagram. This symbol 'calls' the sub-program. (c) Drawing flow diagrams – Create, interpret, correct, and complete algorithms for real world situations, using flow diagrams. (d) Identify errors Skill - Identify syntax/logic errors in diagrams and suggest fixes. **KQ4 - How can algorithms be represented using text?** a) Pseudocode -Uses English-like words to represent the an algorithm. -Represents a sequence of steps in text form. -Uses the logic of programming code, without the strict rules/syntax. -More generic code that can be applied to any programming language. -There are no established conventions/rules. So OCR Reference Language will be used. (b) OCR Reference Language – -A standard for pseudocode that will be used in exams. (c) Writing pseudocode/OCR reference language – -Create, interpret, correct, and complete algorithms for real world situations, using OCR reference language. **Techniques** -Programming fundamentals**:** Variables, constants, operators(Comparison, Arithmetic, Logical), input/output, sequence, selection (if statements, switch/case statements), iteration (Count-controlled loops, condition-controlled loops), operators (comparison, arithmetic, Boolean) -Data types: Data Types, casting		

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-Additional programming techniques: String manipulation, file handling (d) Identify errors Skill - Identify syntax/logic errors in code and suggest fixes. **KQ5 – How can a programmer examine their programming code and detect errors?** (a) Trace Tables -Allows a programmer to examine how a program works -Allow a programmer to locate errors in their code. Particularly logic errors. -Test the accuracy of algorithms. -Examining code, moving through it line by line. -Every variable has its own column. -Records the current state of each variable and each output, as it happens. (b) Creating trace tables -Identify each variable, create own column. -Update the row for each variable when it changes. The next blank row is used. -Skill – Create and use trace tables to follow an algorithm.		
HALF TERM 5: How computer systems communicate **KQ1 – Why are computers networked? (1.3.1)** (a) Networking -Multiple computers that are connected together to communicate/exchange data. -Can share files / can work collaboratively on same files -Can share hardware resources e.g. printer etc. -Files can be accessed from any computer. -Share an internet connection. **KQ2 - What are the characteristics of networks types?** (b) LAN - Local Area Network -Computers are connected to each other -Restricted to a small geographical area / site / other suitable example -Dedicated wired or WiFi connections -Has its own infrastructure / cables / network / hardware due to distance / practicalities -e.g. home, school, office etc. (c) WAN - Wide Area Network -The computers are geographically remote/ distanced/cover more than one geographical location. -Data needs to transmit over a large distance. -Uses external hardware / infrastructure / cables / network / communication medium is not owned by the law firm -Multiple LANs connected together. -e.g. satellite, phone lines, Internet (d) Network Topologies -The physical arrangement of the devices/connections in a network. Star Topology -Each device has its own connection, wired or wireless, which connects to a central switch. -If one connection/device fails, the other devices can continue to function.		Knowlwdge book used for the delivery of HT5 theory content. Use of websites detailing to purpose and characteristics of each network device.
		Analysis of the characteristics, advantages and disadvantages of each network topology, and the factors that affect network performance.
		Presentation/peer discussion of the purpose/role of each network device.
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-It is easy to add new devices to the network. New devices only need to be connected to the central switch. -Fewer data collisions occur, than in older network topologies. -If the central switch breaks, the network can no longer function. It has a single point of failure. -Large amounts of cable is needed to install the network as each device needs its own connection. Mesh Topology -There is no central connection point. Each node is connected to at least one other node and usually to more than one. -Each node is capable of sending messages to and receiving messages from other nodes. The nodes act as relays, passing on a message towards its final destination. -There are two types of mesh topology - full mesh topology and partial mesh topology. -Wired mesh networks are more uncommon because connecting all nodes is expensive. Wireless mesh networks are increasingly being used as they are far cheaper/simpler to configure. -Data can be received more quickly if the route to the intended recipient is short -Data should always get through as they have many possible routes on which to travel -Multiple connections mean each node can transmit to and receive from more than one node at the same time -New nodes can be added without interruption or interfering with other nodes -Full mesh networks can be impractical to set up because of the high number of connections needed -Many connections require a lot of maintenance **KQ3 - What factors can affect the performance of a network?** (a) Bandwidth - The maximum rate of data transfer across a given path e.g. the maximum amount of data that can be sent across a cable/connection. -Can be affected by the type of media that you are using to transfer data e.g. copper cable, fibre optic cable, wireless etc. -Can be affected by the distance from the router. -Latency – how long it takes to send a packet of data to a destination device and receive a packet of data back again. (b) Number of devices connected -Bandwidth is divided between the devices that are connected to a network. -A device using a large amount of bandwidth by performing a task e.g. downloading a video, with deprive the other devices of bandwidth. **KQ4 - What are the different roles of computers in a client-server and a peer-to peer network? (1.3.1)** (a) Client-server network -The network has a central server, which clients are dependent on.		

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-Clients have to connect to the server which provides and manages the information and services. -Services – e.g. print server-request to print, file server-requests to save files, open documents etc., web server-requests to view web pages. -Files are stored centrally, so files can be accessed from any computer -As files are stored centrally, all data can be backed up at the same time -Clients can be monitored to ensure they are working correctly -Computers/users can be managed centrally -Software can be installed/upgraded centrally, so that it does not need to be done individually on each computer -Better in networks with lots of users/devices. (b) Peer-to-peer network -No single device is responsible for being the server. There are no servers or clients. -Each computer is known as a peer. -Peers store their own files, which can be accessed by other peers on the network. -Each computer stores files and acts as a server. Each computer has equal responsibility for providing data. -Files are spread across computers. -Computers have to individually perform their own backups. -Software on computers needs to be upgraded/maintained individually -Better in networks with a smaller amount of users/devices. **KQ5 - What are the roles of the different LAN hardware devices?** (a) Hardware Devices -Wireless access points: Allows devices to connect to a physical network, wirelessly. A wireless connection uses radio signals to send data across networks. -Router: Directs packets/data between networks/across the internet. Receives packets/data from the network/Internet. Forwards packets/data to other computers on the network/Internet, using the most efficient route. Connects (different) networks together e.g. joins home network to Internet. Has the IP address for LAN. -Switches: Allows devices to connect together. Receives/sends data packets around a network, but only to its destination. Uses the MAC address of devices connected to it. -NIC (Network Interface Controller/Card): The component in a computer that allows it to interpret network data and connect to a network. Can be wireless or wired. (b) Transmission Media -The path between transmitter and receiver used to send data. -Copper - The most frequently used connection type. Slower than fibre optic. Data is transmitted as electrical signals. -Fibre Optic – Used to send data over longer distance. Faster than copper. Data is transmitted as light pulses. The table is made of glass.		

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KQ6 - The Internet as a worldwide collection of computer networks (a) DNS (Domain Name Server) -A server on the internet which matches the Uniform Resource Locator (URL) that a user has entered into a browser, with the corresponding IP address. -The website is hosted on a webserver -The website/webserver has an IP address -(Browser) sends URL to DNS -DNS has a list of IP addresses and their corresponding URL -DNS finds the IP and corresponding URL -IP address is sent back to the browser -Browser sends request to IP/webserver -Webserver processes request for the website/webpage -Webserver sends the webpage/file/data to the user (b) Hosting -Hosting is the storing of files and data on a web server. The web server is referred to as a host. -Files need to be hosted on a web server to be accessed on the internet. (c) The Cloud -The cloud is a generic term for remotely accessed storage. Data is stored on a server connected to the internet. -This storage is accessed through the internet. Users do not actually know where their data is stored. Advantages- -The ability to access files from any location or any device, so long as an internet connection exists -Access can be granted to another user so they can remotely access your data -You don't need specialist network skills to set up the data storage. -The third party provides security which can save money. -The third party provides backup. The cloud storage services back up the data for you. -Cheaper as don't need own infrastructure Disadvantages- -You need a constant internet connection to remotely access your data. -Reliant on third party to carry out security procedures and backup. -Data stored in the cloud will be vulnerable to hacking and other threats. (d) Servers -A machine which provides a service, which other devices connect to -Web servers- store and maintain web content, which is downloaded upon request to client computers -Mail servers- handle web-based email -Media servers- allow clients to stream music and videos **KQ1 - What are the different modes of communication on a network? (1.3.2)** (a) Wired Ethernet - -A type of wireless connection used in networking to connect devices to a LAN/WAN e.g. connect devices to your router, connect devices to switches etc.		

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-Bandwidth differs, dependant on type of cable used. (b) Wireless Wi-Fi - -Longer range up 50m indoor, 100m outdoor, dependant on interference. -Connected devices such as laptops to wireless access points, to connect to a network. -Faster than other technologies such as Bluetooth. Bluetooth - -Short range – 10-100 metres, dependant on class. -Connect devices such as phone, to accessories e.g. speakers, earphones etc., to send audio. -Send data between devices such as phones, over a short distance. -Connect accessories to games consoles e.g. control pads etc. (c) Benefits/Drawbacks Wired -More secure than wireless as devices are directly connected and data is sent through a wire. -More bandwidth, as it is faster to transfer data via cable. -Less chance of interference. -Restricted to one location by cable. -More likely that data is sent successfully. Wireless -More freedom to more around as you are not restricted to one location. -Less secure than wireless as data is broadcast through the air and can be intercepted by other devices. -Less bandwidth than transferring data via cable. -Interference by objects e.g. walls, people. -Interference by other signals. -More chance of losing connection. **KQ2 – How files be protected when they are sent between devices?** (a) Encryption -The process of disguising a message so that it cannot be understood by anyone but its intended recipient. -Encryption requires the use of a key. The key is secret as to how the message has been disguised. -A key is needed to decrypt a message and get it back to plain text. -A Caesar cipher is a simple method of encryption. -The cipher works by moving each letter in the alphabet along by a certain number of places. -The key would be the number that the letters have been moved along by. -Most communications sent via the internet are encrypted: purchases made online are encrypted to try to prevent theft of credit card details, documents, such as a spreadsheet emailed to colleagues, satellite TV transmissions are encrypted to prevent users who are not subscribed from watching TV shows **KQ3 – How are computers on a network addressed?** (a) IP addressing		

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-When connected to a network each device is given a unique IP address. -IPv4 - This address consists of four sets of up to three digits, each with a maximum value of 255, which are separated by dots. Takes 32 bits to store. This gives just over 4 billion unique values. -With the number of Ipv6 addresses running out, Ipv6 was created. This address consists of sixteen sets of up to three digits. Takes 128 bits to store. This gives just over 340 billion billion billion billion unique values. -When a device wants to send data to another node, it uses the recipient device's IP address. -A switch on the network knows where the device with this address is and routes the message to it. (b) MAC addressing -Media Access Control -A unique serial number assigned to each network interface controller (NIC). -Assigned by the NIC's manufacturer and cannot be changed. -Allows a network to uniquely identify any device, even when the IP of the device changes. -Wireless access points/routers can grant/deny access to devices using the device's MAC address. -Consists of a string of hexadecimal numbers e.g. 1A:5B:6H:98:78:35 -If a device has more than one NIC, for e.g. a wired NIC and a wireless NIC, each NIC will have its own MAC address. **KQ4 - How is the communication between devices managed?** (a) Standards -Manufacturers/organisations agree to a standard to provide rules for areas of computing, including standards of communication (protocols), use of standard connectors e.g. USB, HDMI etc. -Allows hardware/software to interact across different manufacturers/producers (b) Protocols - A (communication) protocol as a set of rules for transferring data. -Agreed protocols need to be used so that the devices are communicating in the same way. -TCP/IP (Transmission Control Protocol/Internet Protocol) – Organises how data packets divided/sent, including the information that is added to packets e.g. sender IP address, recipients IP address, sequence number etc. -HTTP (Hyper Text Transfer Protocol) - Transfers web pages from the web server to the client's computer, to be viewed in the web browser. -HTTPS (Hyper Text Transfer Protocol Secure) - Transfers web pages from the web server to the client's computer, to be viewed in the web browser, using a secure/encrypted connection. -FTP (File Transfer Protocol) - Transmitting a file over the internet, from a client to a server or vice versa.		

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-POP (Post Office Protocol) – Accessing emails. Downloads emails from a provider's mail server to a device, and deletes them from the server. -SMTP (Simple Mail Transfer Protocol) - Sending an email from one mail server to another. -IMAP (Internet Message Access Protocol) - Accessing emails. Views emails which are on the server. The emails exist on the server until you delete them. (c) The concept of layers -A layer is a group of protocols which have similar functions. Each layer has its own purpose and is self-contained. -Each layer handles a different part of the communication. -Protocols are self-contained. Protocols in each layer can do their job without needing to know what is happening in other layers. -Layers are not physical things inside a computer or network. They're just a way of categorising protocols, of making them easier to think about/work with. Advantages - -Layers can be changed/removed without the other layers being affected. -Having set rules for each layer forces companies to make compatible, universal software, so different brands will work with each other and always working basically the same way. -This can be referred to as the Transmission Control Protocol/Internet Protocol (TCP/IP) model. (d) 4 Layer Model Application layer - encodes/decodes the message in a form that is understood by the sender and the recipient. Transport layer - breaks down the message into packets, giving it a packet number etc. This data is used to reassemble the packets. Network layer - adds the sender's IP address and that of the recipient. The network then knows where to send the message, and where it came from. Data link layer - enables the transfer of packets between nodes on a network, and between one network and another.		
HALF TERM 6: Network threats and prevention methods / Sorting and searching data **KQ1 - What are the forms of attack that pose a threat to computer systems and networks? (1.4.1)** (a) Malware -Malicious software designed to harm the computer/user. -Designed to access/delete/modify files -Scareware - informs you your computer is infected with damaging viruses – forcing you to pay to fix. -Ransomware - locks your files, encrypting them – forced to pay money for the decryption key -Spyware - monitors user's access – e.g. key presses, and sends to hacker. -Viruses – Activated when a user opens infected file. -Worms - self replicate through a network. -Trojans - malware disguised as legitimate software. Don't replicate, but users install by believing it is a real piece of software.		Websites detailing the threats that are posed to a computer network.
		Knowlwdge book used for the delivery of HT6 theory content. Explanation of each networking threat.
		Explanation justification of the method used to prevent each threat, through peer discussion.
		Links to PSHE – staying safe on the internet Links to Technology/Electronics/Science - circuits

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(b) Social engineering, e.g. phishing, people as the 'weak point' -People are usually the weak point in security. -Gaining sensitive information, passwords, or illegally accessing a network by targeting/manipulating humans. -Phishing- A form of attack via email/telephone/text message. -An email/text/phone call is received pretending to be a large company e.g. a bank etc., which people believe to be genuine. -The email/text/phone call is made to look real so that a person enters/gives their information/password, which is then used. -Look for, poor grammar, spelling mistakes, dodgy looking email addresses or links to website which are not the genuine domain. -Shouldering-Looking over a person's shoulder to gain their personal information/password. (c) Brute-force attacks -Used to gain information by 'cracking' passwords -They do this by trial and error -Use of automated software which tests thousands of common passwords – using combinations of letters, numbers and symbols (d) Denial of service attacks --Hackers try to stop users from accessing part of a network or website. - A website/network is flooded with useless data packets/traffic, making it slow or inaccessible (e) Data interception and theft -Intercepting data packets as they are transferred between two devices, to capture data/information that is being sent over a network/the internet. (f) The concept of SQL injection -SQL - structured query language. This is the language used to interact with databases. -Databases are used on websites to store information such as payment details, passwords etc. -Typed into an input box on a website. -If the data input is not validated correctly it will enable the user to gain information from the database. **KQ1 - What are the common prevention methods used to protect computer systems and networks? (1.4.2)** (a) Penetration testing -Authorised by the company/individual -A simulated attack takes place, specifically looking for vulnerabilities that a hacker may use to access the system. -Uses the same techniques a hacker would try, but the aim is to identify the weaknesses. (b) Anti-malware software - reduces the risk of malware -Designed to detect and delete malware that may have been installed. -Allow users to scan their computer and 'quarantine' or delete files that are infected. (c) Firewalls – reduces the risk of DoS attack -A physical device or software that will block unexpected connections/data coming in to a network		

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-Allows you to accept or decline connections that are being made -Can also detect and block your computer from connecting to the internet without you being aware. -Most operating systems have a firewall built in (d) User access levels – reduces the effect a successful brute force attack, -A network manager controls the level of access different people have to the network -Users will be given access to the parts that they need. -Less people will be given access to sensitive parts of the network/features that may be able to cause harm. -The more people have access to sensitive parts of the network, the more likely a hacker or a virus might be able to cause damage. You can set user access levels on your home computer. For example, a parent may prevent a child from being able to install software. (e) Passwords – reduces the risk of brute force attack -A weak password makes it easy for someone to try to guess login details – brute force attack. -A strong password has a mix of upper and lower case letters, numbers and special characters -Having a limited amount of login attempts would help prevent a brute force attack. -Other methods: biometrics e.g. finger print, facial recognition / picture passcode. (f) Encryption – reduces the risk of data interception -The process of disguising a message so that it cannot be understood by anyone but its intended recipient. -Encryption requires the use of a key. The key is secret as to how the message has been disguised. -A key is needed to decrypt a message and get it back to plain text. -A Caesar cipher is a simple method of encryption. -The cipher works by moving each letter in the alphabet along by a certain number of places. -The key would be the number that the letters have been moved along by. -Most communications sent via the internet are encrypted: purchases made online are encrypted to try to prevent theft of credit card details, documents, such as a spreadsheet emailed to colleagues, satellite TV transmissions are encrypted to prevent users who are not subscribed from watching TV shows (g) Physical security -Physical locks on doors/access to doors using key cards etc. -If only the correct users can physically access the hardware there is less chance that an attack, where the attacker has to be present, may occur e.g. brute force attack, installing a virus etc. **KQ1 – How do computers search data? (2.1.3)** -Search for a value within a set of values, following the same steps each time. -Skill - Identify the pseudocode for each searching algorithm. (a) Linear Search		

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-Can search for a value regardless of the order of the data set. -Starting at the beginning of the data set, each item of data is examined until the value is found. -Compare the search value to the first value in the list. -If it matches, the value is found. End the search. -Move to the next value and repeat the steps until found. Skill - How to search for a value in a list of values using a linear search. (b) Binary Search -Can search for a value regardless of the order of the data set. -Finds the middle item in an **ordered** list. -Compares the search value to the middle value -If the values are the same, the value has been found. -If the search value is less than the middle value, the middle value and all values to the right are removed. -If the search value is more than the middle value, the middle value and all values to the left are removed. -These steps are repeated until the search value has been found. Skill - How to search for a value in a list of values using a binary search. **KQ7 – How do computers sort data?** -Sort an unordered list of values into order, following the same steps each time -Skill - Identify the pseudocode for each sorting algorithm. (a) Bubble Sort -Look at the first number in the list. -Compare the current number with the next number. -If the next number is smaller than the current number, swap the two numbers. If not, do not swap. -Move to the next number in the list and make this the current number. -Repeat until the last number in the list has been reached. -If any numbers were swapped, repeat again from step 1. -If the end of the list is reached without any swaps, the algorithm will stop. Skill - How to sort a set of data into order using a bubble sort. (b) Merge Sort -More complex sort, but highly efficient. -Uses a technique called divide and conquer. -The list is repeatedly divided into two until all the elements are separated individually, this is done by halving. -e.g. xxxxxxxx, xxxx xxxx, xx xx xx xx, x x x x x x x x -Values are then compared in pairs, placed in order and combined. -This is repeated until the list is back together – in reverse of the separation. Skill - How to sort a set of data into order using a merge sort. (c) Insertion Sort -Less complex and efficient than a merge sort, but more efficient than a bubble sort. -Compares values in turn, starting with the second value in the list		

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-If this value is greater than the value to the left, no changes are made. -If it less than the value to the left, it is repeatedly moved left until a value that is less than it is found. -This is then repeated with the next value until the end of the list is reached. Skill - How to sort a set of data into order using an insertion sort.		