Computer Science Yr 10 Curriculum Map

	Autumn term	Spring term	Summer term
Unit of Work	**Python 101**	**Software**	**Network Security**
Fertile Questions	How can I create a quiz that keeps track of the user's score and teaches them what they got wrong?	How does a computer and a user communicate to one another?	How do you keep your data secure when it's connected to other devices?

Key Concepts	• Computational Thinking skills can be broken down into
	  ○ Abstraction – ignoring irrelevant data
	  ○ Decomposition – breaking down larger problems into smaller more manageable chunks
	  ○ Algorithmic thinking – thinking in logical steps
	• Pseudocode being a language that sits between English and Python. It should be read as a code but easier to understand than Python
	• Flowcharts are a tool to visually display and organise a program prior to coding it.
	• Errors will prevent the code from running (syntax errors) or running as the user intended (logic errors)
	• print() will allow the user to see a message. Useful for displaying text.
	• input() will allow the user to see a message as well as input a response.
	• Programming constructs are the fundamental building blocks that all programs will have.
	  ○ Sequence – the order of the instructions
	  ○ Selection – if, elif and else used to allow choice in the code
	  ○ Iteration – count controlled and condition controlled loops of code
	• Variables and constants are stored under identifiers which are used to store data in memory that can be later called upon in code
	• There are 5 different data types (string, float, integer, boolean and character) that exist in Python and are stored differently in the program
	• Mathematical operators are used in Python code and used to perform calculations
	  ○ DIV (//) is used to determine the whole number when dividing two values
	  ○ MOD (%) is used to determine the remainder when dividing two values
		• An operating system is software that a computer runs which provides an interface that allows a user and a computer to interact with one another
		• There are 5 purposes of the operating system:
		  ○ User interface – how the computer appears on a monitor to a user including:
		  ▪ Graphical User Interface – which uses icons, mouses and windows to show the user where they are
		  ▪ Command Line Interface – which relies on the user entering command prompts to the computer
		  ○ User management – logs username and passwords
		  ○ File management – keeps files in folders
		  ○ Memory management – moves items in and out of RAM that are being used
		  ○ Peripheral management – installs device drivers for peripheral (mouse, keyboard, etc.) hardware to communicate with the CPU
		• Utility software is designed to maintain the computer running efficiently. This can include:
		  ○ Anti-malware software which removes malware from a computer
		  ○ Compression software which allows the user to save more files
		  ○ Encryption software which keeps data being sent scrambled and can only be decrypted with a key
		  ○ Defragmentation software which is used on HDD once a HDD has been fragmented by deleting files which create gaps in the HDD. Defragmentation moves all the file fragments together in order and moves all the gaps to the end
			• There are different forms of attacks that can take place on a device when it is connected to other devices:
			  ○ Malware- worms, trojans or viruses are downloaded onto a device causing information to be stolen, deleted or modified without the user's consent.
			  ○ Social engineering- using people as the weak point into a system including phishing
			  ○ Brute force attacks- repeatedly trying different login credentials to gain access into accounts
			  ○ Denial of service attacks- bombarding a server with useless requests causing it to be overwhelmed and not able to process legitimate requests
			  ○ Data interception- wireless data is intercepted and collected
			  ○ SQL injections- SQL commands are used when a program has a weak spot which would allow access into accounts
			• Threats can be combated with prevention methods
			  ○ Penetration testing- trying to get into a secure site and reporting areas of weakness to then fix these
			  ○ Anti-malware software- when files are downloaded, they are checked against the anti-malware to see if there are any matches and thus malware on the download. If so, the file is quarantined to prevent it from running
			  ○ Firewalls- checks all incoming and outgoing data requests to ensure they are compliant with the firewall rules. If not, the request is denied
			  ○ User access levels- accounts have different titles which allow them certain access to files and whether they can read or write to them
			  ○ Passwords- users need to have strong passwords that have a capital, lowercase,

			number, special character and at least 8 characters. 2FA should be used in case password is compromised ○ Encryption- data being sent is scrambled so that should it be intercepted it cannot be understood. Received data is the decrypted using a key ○ Physical security- fire doors, locked server rooms, CCTV are all ways to physically keep network hardware secure
Assessment	• 35 mark exam questions	• 35 mark exam practice questions	• Coded game about network security • 35 mark exam practice questions
Experiences	• Create physical flowcharts on paper that are used to then create that program in IDLE • Moving a dot in a coded game called DotCode where students write the program using programming constructs • Students create programs in CodeBuilder IDE on pacacomputing.uk using selection statements • Students create programs in CodeBuilder IDE on pacacomputing.uk using iteration statements • Use IDLE to create a quiz about the different data types • DIV and MOD PRIMM model of questions to understand how these mathematical terms work	• Use of canva to create infographic comparing two operating systems to see the differences and similarities in OS purposes • Use of a CLI to understand how competent users had to be to use it and why most computers have switched to GUI • Create an information program on IDLE where the user enters one of the utility software and the program outputs information about it	• Creating a bank of questions using arrays to store questions and answers, then using random them will randomly select questions to appear in any order. Students will need to keep track of students scores and can use subprograms or not to do this.
Skills	• Creating new programs in IDLE • How to create variables and constants and call upon them later in the program • Save and open IDLE files	• Creating infographics on Canva and how they are saved in the Cloud system • How to use command line interfacing including prompts to use • Develop Python skills to include importing libraries like time to create a program that appears more human like with pauses	• Creating and calling upon 2D arrays • Randomness in programs • Storing variables in Python to be called upon later • How to check inputs in Python and terminate a program should there be not enough lives left either using a subprogram or normal code
Unit of Work	**Memory and Storage**	**Ethics**	**Programming Fundamentals (Lessons 1-8)**
Fertile Questions	Where is the data you are currently using sit and where does data go when you want to save it for later?	What are the ethical, cultural, legal, environmental and privacy impacts of using and relying on technology?	How can I develop my coding skills to include additional techniques to create a robust and engaging program?
Key Concepts	• How RAM works to hold current applications and will lose data when power is lost • How ROM is used to hold data that cannot be written to and holds the boot up sequence • Virtual memory is used when RAM is full and takes a part of the secondary storage to be used as RAM • Secondary Storage types are used to save data when power is turned off • There are three types of secondary storage: optical, magnetic and solid state. Each with advantages and disadvantages which will better be suited to given scenarios • Examples of secondary storage including CD, HDD, SSD • Characteristics to consider when choosing a	• Technology introduces ethical, legal, cultural, environmental and privacy issues • Ethical issues are what is deemed right and wrong by society • Legal issues are what is deemed right and wrong by legislation • Cultural issues are how certain groups of people are impacted including different age groups and economical status groups • Environmental issues are how the technology would impact the natural world and its resources • Privacy issues include how data is collected, protected and shared with other groups • The Data Protection Act (2018) protects personal data including name, address, date of birth,	• Concatenation is when two or more strings of data are added together • Slicing is when a string is broken into parts of characters are removed from the original string • Randomness can be used in Python programs by importing the library random. This can be used to generate a random number (random.randint(1,10) to pick a random number from 1 to 10) or to use that random number to pick a location from an array • Utilising all the coding techniques learnt throughout the year to create a game from scratch

	secondary storage type are: ○ Capacity ○ Read/Write speeds ○ Portability ○ Durability ○ Reliability ○ Cost	medical records, school and employment records • The Data Protection Act (2018) ensures that data must fairly and lawfully processed, obtained for specific purposes, must be non-excessive, accurate and up to date, not kept for longer than necessary and securely held. • The Computer Misuse Act (1990) makes it illegal to create, share or hold malware and to access data you do not have permission to access. • The Copyright, Designs and Patents Act (1988) makes it so that anything someone has created they own it. • Open-source software licencing means that the source code can be viewed and edited by users, and it is free. However open source doesn't typically have employee support or regular updates. • Proprietary software licencing means that the source code cannot be viewed or changed by users, and it cost money to download the software. However proprietary does typically have employee support and regular updates.	
Assessment	• 35 mark exam practice questions	• 35 mark exam questions • 2 Extended writing 8 mark question	• Coded game incorporating skills learnt throughout the year • 35 mark exam questions
Experiences	• Create a RAM/ROM quiz in CodeBuilder on pacacomputing • Create a Python Coded Quiz about Memory and Storage • Create Trump Cards about the secondary storage types using Canva	• Create flowchart to plan for program quiz about legislation • Extension for some to use sub-programs in their quiz • Extension for some to add in time to see how quickly users complete the quiz • Writing programs onto paper to practice exam technique	• Use structure diagrams to plan and organise a large coded game • Extensions for some to use sub-programs and arrays in their program • Extension for some to add in time and randomness to their program • Writing programs onto paper following exam criteria to prepare for exams
Skills	• Creating new programs in IDLE • How to create variables and constants and call upon them later in the program • Save and open IDLE files • How to design in Canva	• Creating new programs in IDLE • How to create variables and constants and call upon them later in the program • Importing libraries like time • Create and call on subprograms • Save and open IDLE files	• Creating new programs in IDLE • Create variables and constants to be later called upon • Importing libraries like time and random to use in their programs • Save and open IDLE files • How to send files over email
Unit of Work	**System Architecture**	**Networks**	
Fertile Questions	How does the CPU work to find data and execute its instruction?	How do devices share information with other devices?	
Key Concepts	• The purpose of the CPU is to complete the fetch-decode-execute cycle to perform tasks • Embedded systems are computers that can complete a limited number of tasks and are built into a larger device. ○ Examples: Dishwasher, microwave, washing machine Computer Hardware: • Motherboard	• A network is when two or more devices are connected • There are two types of networks: ○ LAN- which is a local area network and covers a small geographical area ○ **WAN- which is a wide area network and covers a large geographical area** • **To have a network you need certain hardware including:**	

	• RAM
	• ROM
	• Heat Sink
	• Cooling Fan
	• Power Supply
	• Secondary Storage (Magnetic, Optical, Solid State)
	• Graphics card
	• CPU
	Parts of the CPU:
	• ALU- Arithmetic logic unit where the calculations take place
	• CU- control unit which is responsible for decoding data and controlling the flow of data
	• Cache- small fast memory located in the CPU
	• Registers are small volatile memory stores:
	  • MAR- Memory Address Register used to hold the current address in the FDE cycle
	  • MDR- Memory Data Register used to hold the data from the address
	  • PC- Program Counter used to hold the next address in the FDE cycle
	  • ACC- Accumulator used to hold the result from the ALU
	• The CPU performance can be increased or decreased depending on:
	  ○ Clock speed – the number of FDE cycles completed per second. Measured in HZ
	  ○ Cache size – a larger cache will allow you to hold more frequently used instructions but also a smaller cache will allow you to access the instructions faster
	  ○ Number of cores – the more cores a CPU has the more FDE cycles can be done at once
		○ **Network card- built into a device which holds its MAC address and allows it to connect to other devices**
		○ **Switch- used in a LAN to connect devices by receiving and sending data frames to MAC addresses**
		○ **Router- used in a WAN to connect networks by assigning IP addresses, receiving and sending data packets to other IP addresses**
		○ **WAP- wireless access point that allows devices to send wireless signals**
		○ **Ethernet- transmission media that is faster and more secure than wireless and used to physically connect devices**
		• **Devices can be connected wirelessly or wired:**
		○ **Wired- ethernet is the standard wired connection. It is faster and more secure. Data does not degrade down wire but you are limited to the length of the wire.**
		○ **Wireless- includes Wi-Fi and Bluetooth. Wi-Fi can span further than Bluetooth. Wireless has a limited range but does allow mobility.**
		• **MAC addresses are held in the network card and read by the switch. They cannot be changed. MAC addresses are stored using hexadecimal consisting of six groups of 2 hexadecimal values (e.g. 98-81-55-CD-F2-2F). MAC addresses are used by ethernets on LANs**
		• **IP addresses are assigned when data packets are leaving a LAN to a WAN. They are assigned by the router. These can be assigned automatically or manually. There are two versions of IP addresses:**
		○ **IPv4- uses 32 bits and are stored as denary numbers. It will consist of 4 denary numbers (e.g. 37.153.62.136) There are over 4 billion possible IP addresses**
		○ **IPv6- uses hexadecimal and has 16 bit chunks each one being a hexadecimal value. There are over 2^{128} possible IP addresses**
		• **There are different roles computers can have in different networks:**
		○ **Client-Server- There is one server computer and any number of client devices in a star like topology. Client devices will send requests to the server and the server's job is to approve or deny these. The server will hold the data being requested.**
		○ **Peer-to-Peer- All devices are directly connected in a mesh topology. Devices are all equal so files can be accessed without**	

		requests being made.
		• Network topologies are how the physical network is laid out
		  ○ Star- central server or switch with all other devices connected to it either physically or wirelessly
		  ○ Mesh- all devices are connected to one another either physically or wirelessly
		• Star and mesh topologies each have their advantages and weaknesses:
		  ○ Star advantages- less wiring is needed, backups and security updates can be pushed out by central device, easy to add more devices as it connects to central device only, less data collisions as the central device controls the flow
		  ○ Star disadvantages- if the central device is down all of the devices are down too
		  ○ Mesh advantages- devices are directly connected so data can be transferred quickly directly to device, there is no central weak point device
		  ○ Mesh disadvantages- if devices are connected with wires it can be expensive to connect them all, there are more data collisions when data is sent at the same time, multiple copies of files can exist as they are not stored centrally
		• There are different factors that affect the performance of a network:
		  ○ More devices will result in a slower network
		  ○ Less bandwidth will result in a slower network
		  ○ More interference will result in wireless signals being sent slower
		  ○ Using a wired connection will be faster than wireless
		  ○ Using a frequency that is less busy will result in a faster network
		• The internet is a worldwide collection of computer networks (WAN)
		• A Domain Name Service (DNS) is made up of multiple Doman Name Servers. It's role is to convert a URL (named website) to an IP address (binary numbers)
		• Hosting is where a server computer holds the data of a website and when a client types in the URL the request is made to load the website's content
		  ○ A web server provides web pages
		  ○ File server provides file storage and	

		retrieval
		• **The Cloud is when files and web pages are hosted on file and webservers that are not local or owned by that company. The Cloud will offer storage, software and processing of data that may be paid for but means the company does not need to do those features themselves**
		  ○ **Advantages: Backups and security updates are done by external company, larger storage capacity, access to files from any device that is connected to the internet, don't need to pay specialist IT teams on site**
		  ○ **Disadvantages: May cost money to use Cloud services, devices need to be connected to the internet to access files, unclear on who owns the data being stored by the Cloud**
		• **Standards are used to ensure compatibility across hardware and software from different companies and suppliers**
		• **Network protocols are a set of rules for transferring data**
		  ○ **TCP/IP (Transmission Control Protocol/Internet Protocol) is a set of rules for splitting data into packets and reassembling packets once they've reached the device**
		  ○ **HTTP (Hyper Text Transfer Protocol) is used by web browsers to access websites and communicate with web servers**
		  ○ **HTTPS (HTTP Secure) encrypts information from above being sent and received.**
		  ○ **FTP (File Transfer Protocol) is used to access, edit and move files between devices on a network**
		  ○ **POP3 (Post Office Protocol 3) is used to retrieve emails from a server and will delete the email once its been downloaded**
		  ○ **IMAP (Internet Message Access Protocol) is used to retrieve emails and will hold onto the email until it is deleted**
		  ○ **SMTP (Simple Mail Transfer Protocol) used to send emails.**
		• **Protocols are divided into layers to group similar functions together and make layers self-contained so they don't need to know what's happening in other layers. Working in one layer can be done independently without impacting other layers.**	

Assessment	• 35 mark exam practice questions	• Coded game about networks • 35 mark exam practice questions	

Experiences	• Use Canva to create an infographic about the computer hardware parts • Create a quiz about the CPU parts, registers and performance in Python which keeps track of score and lives. When lives run out the quiz terminates • How to create and find Text Art to include in their Python quiz • Use a formatted excel sheet to practice acting like a CPU in the FDE cycle to understand the steps • Take part in Postal Fetch game which shows students how their speed in fetching data compares to that of a CPU	• Students create a text-based adventure game where their character needs to navigate around a map. Students have a lesson to develop their gaming map and flowchart for their code. Their character needs to find all the equipment to build a network but can only retrieve their network hardware if they correctly identify it when they find it. Incorrect answers result in a loss of health. • How to create and find Text Art to include in their Python quiz • Students will need to add additional content questions about network protocols, MAC addresses, IP addresses, topologies, layers, the Cloud and DNS to escape their text-based adventure game	
Skills	• Storing variables in Python to be called upon later • Creating infographics on Canva and how they are saved in the Cloud system • How to check inputs in Python and terminate a program should there be not enough lives left	• Storing variables in Python to be called upon later • How to check inputs in Python and terminate a program should there be not enough lives left either using a subprogram or normal code	
Unit of Work	**Data Storage**		
Fertile Questions	How is data stored in a computer?		

Key Concepts	• A computer can only understand binary as it indicates to the computer if electricity if flowing or not
	• All data a computer receives (text, images and sound) must be converted into binary to be stored
	• Data is stored in units. The smallest unit is a bit which is either 1 or 0 standing for on or off
	• 4 bits are a nibble
	• 8 bits are a byte
	• 1000 bytes are a kilobyte
	• 1000 KB are a megabyte
	• 1000MB are a gigabyte
	• 1000GB are a terabyte
	• 1000TB are a petabyte
	• Numbers in denary (the 10-base number system used) need to be converted into binary for a computer (up to 8 bits for GCSE)
	• How to add two binary numbers together
	• If two binary numbers are added together and there are not enough digit spaces to express that number then an overflow error has occurred
	• A binary number can be shifted to the left to multiply the number or shifted to the right to divide the number
	• Hexadecimal is a 16-base number system which is used to easily convert to binary without using as many digits
	• To convert binary to text a character set is used which assigns a binary number to a character
	• There are two character sets to know:
	  ○ ASCII- an earlier character set which uses 7-bit binary
	  ○ Unicode – a newer character set which uses 16-bit binary
	• To store an image, first the number of pixels wide and		

	high (also called resolution) are determined. There will be a bit-depth for each pixel which will determine the number of colours available. This binary code is the then stored in the sequence the pixel colours appear
	• To store a sound file, the height of the sound wave (amplitude) needs to be measured thousands of times per second. This is called the sample rate. There will be a bit-depth for each amplitude measurement. The amplitudes will be recorded in order in binary.
	• Metadata is data about data. It provides information about a file like when it was last saved, the name of the file, how big the file is, etc.
	• Files are be compressed to decrease file save leading to being able to save more files in a set amount of space and upload/download files faster
	• There are two types of compression:
	  ○ Lossy – Permanently removes data causing the file to be dramatically smaller but does remove some quality of the file. This cannot be done on text files
	  ○ Lossless – temporarily removes data causing a small reduction in file size but no loss of quality. This can be done to all file types.		

Assessment	35 mark exam practice questions		
Experiences	• Inspecting file properties to determine size of files. • Converting denary numbers into binary and vice versa in BinaryDrop game on pacacomputing • Converting binary to hexadecimal and vice versa in Python coded game • Learning about different Character sets in Snake game on pacacomputing • Storing pixelated images using pixelart game on pacacomputing		
Skills	• How to inspect a file's properties on a computer • How to compress files • Converting from denary to binary, hexadecimal to binary and vice versa • How to take practical knowledge of data storage and apply it to exam questions		