Curriculum Knowledge Map

Year 10

Year 10	AUTUMN		SPRING		SUMMER	
Computational Thinking	**Algorithms & Programming Part 1: Sequence**	**Programming Part 2: Selection**	**Programming Part 3: Iteration**	**Programming Part 4: Sub-routines**	**Programming Part 5: Strings & lists**	**Algorithms Part 2**
	Determine the need for translators. Use sequence, variables, and input in Python. Design programs using a flowchart.	Use randomisation in programs. Work with arithmetic and logical expressions. Use selection and nested selection in Python.	Use a while loop and a for loop in Python. Perform validation checks on data entry. Design programs using pseudocode.	Explain the differences between a procedure and a function. Describe scope of variables. Use functions and procedures as part of the structured approach to programming. Test a program for robustness.	Define the term 'graphical user interface' (GUI). Perform string handling operations. Describe the differences between a list and an array. Manipulate a list. Work with 2D lists.	Describe a linear and binary search. Explain the key algorithms for a bubble, merge, and insertion sort.
Declarative *What should they know?*	• Define the terms decomposition, abstraction and algorithmic thinking • Describe the difference between algorithms and computer programs • Algorithms are represented as written description, flowcharts and code • Describe what a high-level / low-level language are. • Explain the need for translators • Describe characteristics of	• flowchart symbols and describe how to use them (start, end, input, output, subroutine) • Algorithms can be translated from flowcharts – program and vice versa • How to generate random numbers in python • Explain the purpose of pre-built libraries and functions • Describe what is meant by true random	• Define iteration as a group of instructions that are repeatedly executed • Define a while loop • Define a for loop • State the purpose of a trace table • Describe the purpose of pseudocode • Design a program using pseudocode	• Describe a subroutine • Describe the purpose of parameters in subroutines • Describe how subroutines are used for decomposition • List the advantages of subroutines • Describe a procedure • Describe what a function does (input, process, output) • Explain the differences between a function and a procedure • Describe scope of variables • Describe how parameters can reduce	• Define the term GUI • Describe the function of string operators • Define the term ASCII • Define a data structure • Define an array • Define a list • Describe differences between lists and arrays • Describe a 2D list • Design a program that uses 2D lists	• Trace tables walk through code that contains loops, selection and lists • Define the searching problem (finding the position of an item in a list of items • Describe linear search • Describe binary search • The difference between both search algorithms

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	compilers & interpreters • The tools of an IDE • What is meant by syntax and logic errors • Variable declaration, assignment, and initialisation • Runtime errors • Data types and their function • Validation checks • Flowchart symbols	• Define a condition as an expression that can be evaluated as True or False • Interpret a flow chart that includes conditions • Syntax relevant to and regarding selection. • The concept of nested selection.		the need for global variables • Describe the purpose of a constant in programming • Design a program that involves function calls • Describe the structured approach to programming • List the advantages of the structured approach • Describe iterative testing • Describe types of testing (boundary, erroneous, normal) • Design a program that builds on skills developed		
Procedural *What should they be able to do?*	• Apply decomposition, abstraction and algorithmic thinking to solve a problem • Recognise scenarios where computational thinking techniques are applied • Analyse and create flowcharts using flowchart symbols • Use an IDE to write and execute a Python program	• Use Python documentation to inform correct use of syntax • Use commenting appropriately within a program • Use random in a program • Import modules into programs • Evaluate arithmetic expressions using rules of operator precedence	• Perform a code walkthrough of a while loop • Use variables as counters in iterative programs • Use a trace table to track variables in iterative programs • Perform a code walkthrough of a for loop • Use while & for loops to control the flow of program execution	• Perform a walkthrough of procedures that accept parameters • Use procedures that accept parameters • Perform a walkthrough of function code given the arguments provided during the call • Use functions to return values in programs	• Use string-handling techniques • Traverse a string • Access a substring • Perform ASCII conversions • Create a program that uses string-handling techniques • Append elements to a list • Traverse a list • Use Python documentation to investigate list operations	• Perform linear search to find the position of an item in a list containing sample data • Perform a binary search to find the position of an item in a list • Interpret and analyse the code for linear search and binary search • Trace code for linear search and binary search with input data

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	• Perform a code walkthrough of a sequence • Arrange program statements in a sequence • Call subroutines (procedures) in a program • Locate and correct common syntax errors • Use meaningful identifiers • Use variables in programs • Use appropriate naming conventions • Obtain input from the keyboard • Recognise the input/output states of the input function • Translate a flowchart into a program sequence	• Use arithmetic expressions • Evaluate logical expressions • Perform code walkthroughs of selection statements • Evaluate logical expressions that contain Boolean operators • Perform code walkthroughs of nested selection statements • Use nested selection to control the flow of execution in programs • Use binary selection to control the flow of program execution	• Perform a code walkthrough of iterative validation checks • Translate pseudocode into a program • Identify when to implement iterative statements • Create a program that uses iteration	• Identify global and local variables in programs • Identify when to implement global variables • Use Python naming conventions for constants • Create a program that involves function calls • Use the structured approach in programming • Create a program that builds on skills developed • Use testing whilst creating a program • Use subroutines to control the flow of execution in programs	• Manipulate a list • Create a custom-built function • Use lists to display output on a physical computing device • Use randomisation to append items to a list • Use a 2D list	• Identify factors that could influence efficiency of a linear search implementation.

Curriculum Knowledge Map

Disciplinary Literacy (Tier 3 Vocab)	• Interpret
	• Instructions
	• High level Languages
	• Low level languages
	• Translators
	• Compiler
	• Interpreter
	• IDE
	• Editors
	• Error Diagnostic
	• Run-time environment
	• Subroutines
	• Sequence
	• Executed
	• Logic
	• Syntax
	• Identifiers
	• Variables
	• Declaration
	• Initialisation
	• Assignment
	• Naming conventions
	• Data types
	• Commenting
	• Randomness and using modules
	• Arithmetic operators and expressions
	• Selection (binary)
	• Comparison operators in logical expressions
	• Comparison operators in logical expressions
	• Boolean operators and expressions
	• String methods
		• Modules
		• Flowchart
		• Random
		• Arithmetic expressions
		• BIDMAS
		• Arithmetic operators (add, subtract, multiply, real division, integer division, MOD, to the power)
		• If
		• Elif
		• Else
		• Comparison Operators
		  ○ Equal to
		  ○ Not equal to
		  ○ Less than
		  ○ Greater than
		  ○ LTOET
		  ○ GTOET
		• Boolean/logical operators
		• Nested selection
			• Iteration – While/for
			• Exception handling
			• Trace Tables
			• Errors
			• Range
			• Validation
			• Try
			• Except
			•
				• Subroutines
				• Functions
				• Procedures
				• Constants
				• Parameters
				• Arguments
				• Decomposition
				• Return
				• Global/Local Variables
				•
					• String handling
					  ○ Len
					  ○ Isdecimal
					  ○ Chr
					  ○ Ord
					  ○ Append
					  ○ Remove
					  ○ Index
					  ○ Insert
					  ○ Pop
					  ○ Count
					  ○ Reverse
					  ○ Sort
					  ○ In
					• String operators
					• Data Structure
					• List
					• Array
					• Append
					• 1D
					• 2D
					•
						• Search Algorithms
						  ○ Linear
						  ○ Binary
						• Sort Algorithms
						  ○ Bubble
						  ○ Merge
						  ○ Insertion
						• Efficiency
						• Midpoint DIV 2
						• Traverse

Curriculum Knowledge Map

Computer Systems	Computer Systems	Computer Systems	Computer Systems	Data Representation	Data Representation	Data Representation
	Describe the role of the CPU. Explain the processes of the fetch-decode-execute cycle	Determine the role of main memory and secondary storage	Construct truth tables for three input logic circuits. Write a program using assembly language (LMC).	Explain how numbers are represented using binary digits & performing operations and conversion between number systems	Explain how text, images, and sound are represented using binary digits.	Measurements of storage and Compression

Declarative *What should they know?*	• Difference between embedded and general-purpose systems
	• The role of system software as part of a computer system
	• The role of the operating system and utility software
	• The role and purpose of each component of the CPU in computation
	• The basic components of the CPU
	• The role of each part of the CPU as part of FDE Cycle
	• How the FDE Cycle works by describing what happens at each stage
	• The factors that impacts a CPU's performance
		• The characteristics of RAM and ROM
		• The role of main memory as part of a computer system
		• The purpose and role of CACHE in a computer system
		• Why a computer system needs secondary storage
		• The different types of secondary storage and their functional characteristics
		• The limitations of each secondary storage medium
		• The definition of 'cloud storage' and its characteristics
		•
			• The symbols and truth tables for each logic gate: AND, OR, NOT.
			• Logic gates are used to carry out computation
			• Truth tables are used to show possible combinations of logic gates/circuits
			• Boolean expressions used within logic circuits
			• The difference between high-level and low-level languages
			• The relationship between assembly and machine code
			• Basic commands used within assembly code:
			  ○ INP
			  ○ OUT
			  ○ STA
			  ○ LDA
				• Computers use binary to represent all data and instructions
				• Binary relates to two-state electrical signals
				• The difference and digits that are used in both base-2 and base-10 number systems
				• The conversion table for binary – decimal
				• The rules of binary addition up to three binary numbers
				• The effect of both left and right binary shifts
				• How overflow errors can occur and what the impact is
				• The characters used to represent Hexadecimal
				• Why and where hexadecimal notation is used
				• How to convert from decimal to hexadecimal
					• The maximum number of states that can be represented by a binary pattern of a given length
					• How ASCII is used to represent characters and it's limitations
					• What is meant by the term 'character set'
					• The need for Unicode
					• Unicode uses the same codes as ASCII up to 127.
					• What a pixel is and how they relate to bitmap images
					• The meaning of colour depth and resolution
					• The term Metadata and examples that are applied to bitmap images
					• How to calculate the file size of bitmaps
					• The number of pixels and colour depth affect file sizes.
						• The units of data:
						• Bit
						• Nibble
						• Byte
						• Kilobyte
						• Megabyte
						• Gigabyte
						• Terabyte
						• Petabyte
						• How many units of data make up the ensuing measurement of data
						• What data compression is
						• Why data may be compressed and the different types of compression 'lossy' & 'lossless'

Curriculum Knowledge Map

			○ ADD ○ SUB ○ BRP		• Why analogue sound needs to be converted into binary digits • The concepts of sampling, sample rate, sample resolution • The equation/formula for calculating file size of sound files • The effect of that sample rate, duration and sample resolution have on the playback quality and size of sound files • Examples of metadata that are given to sound files	
Procedural *What should they be able to do?*	• Compare embedded and general purpose computer systems • Describe the role of system software as part of a computer system • Explore the role of the operating system and utility software • Describe the basic components of the CPU • Describe the roles and purpose of each component of the CPU in computation • Explain how the fetch-	• Describe the characteristics of RAM and ROM • Explain the role of main memory as part of a computer system • Define cache memory • Describe the role of cache in a computer system • Explain why a computer system needs secondary storage • State the different types of secondary storage and describe	• Design a logical circuit, combining logic gates to solve a problem • Construct truth tables for a three-input logic circuit • Write a Boolean expression to describe a logical circuit • Describe how combinations of logic gates can perform mathematical operations • Determine that assembly language	• Explain how binary relates to two-state electrical signals • Explain the difference between base-2 and base-10 numbers • Convert between binary and decimal numbers • Count in binary • Perform addition in binary • Perform binary shifts • Describe situations where binary shifts can be used • Explain how overflow errors can occur • Explain why and where hexadecimal notation is used	• Explain how ASCII is used to represent characters and its limitations • Explain what a character set is • Determine the maximum number of states that can be represented by a binary pattern of a given length • Explain the need for Unicode • State that Unicode uses the same codes as ASCII up to 127 • Calculate the number of bytes needed to store a piece of text	○ Define and compare the terms ‘bit’, ‘nibble’, ‘kilobyte’, ‘megabyte’, ‘gigabyte’, ‘terabyte’, and ‘petabyte’ ○ Convert between units of measurement ○ Explain what data compression is ○ Explain why data may be compressed, and that there are different ways to compress data ○ Define ‘lossy compression’ and ‘lossless compression’

Curriculum Knowledge Map

	• decode-execute cycle works by describing what happens at each stage • Describe the role of each part of the CPU as part of the fetch-decode-execute cycle • Explore the factors that impact a CPU's performance • Select components to create a computer system • Evaluate a computer's suitability for a given task	• their functional characteristics • State how solid-state memory works and describe its characteristics • Apply knowledge of storage devices to compare the three mediums of storage • Apply the knowledge of storage devices to recommend an appropriate device • Describe the limitations of secondary storage • Explain the definition of 'cloud storage' and describe the characteristics of cloud storage	• has a 1:1 relationship with machine code • Explain the basic commands in the LMC's assembly code: INP, OUT, STA, LDA, ADD, SUB, and BRP • Design and write their own program in assembly language	• Explain how numbers are represented using hexadecimal • Convert decimal numbers to and from hexadecimal numbers	• Describe what a pixel is and how pixels relate to bitmap images • Describe colour depth and resolution • Define 'metadata' • Give examples of metadata applied to a bitmap image • Calculate the file size of bitmaps • Describe how the number of pixels and colour depth can affect the file size of a bitmap image, using examples • Explain why analogue sound data needs to be converted into binary digits • Describe the concepts of sampling, sample rate, and sample resolution • Give examples of metadata applied to sound files • Calculate file size requirements of sound files • Describe the effect of sample rate, duration, and sample resolution on the playback quality and the size of a sound file	
Disciplinary Literacy (Tier 3 Vocab)	○ General Purpose ○ Embedded Systems ○ BIOS ○ Memory ○ Storage	○ RAM ○ ROM ○ Cache ○ Main Memory ○ Virtual Memory	○ Boolean ○ AND ○ OR ○ NOT ○ Logic Gate	○ Decimal ○ Denary ○ Base 10 ○ Binary ○ Base-2	○ Character Set ○ ASCII ○ Unicode ○ Character codes ○ Pixel	○ Bit ○ Nibble ○ Byte ○ Kilobyte ○ Megabyte

Curriculum Knowledge Map

	○ System Software
	○ Operating System
	○ Utility Software
	○ Software
	○ Hardware
	○ CPU
	○ Von Neumann Architecture
	○ ALU
	○ Clock
	○ Control Unit
	○ MAR
	○ MDR
	○ CIR
	○ PC
	○ ACC
	○ FETCH
	○ DECODE
	○ EXECUTE
	○ FDE
	○
		○ Volatile
		○ Non-Volatile
		○ Secondary Storage
		○ Solid State
		○ Optical Storage
		○ Magnetic Storage
		○ Clock
		○ Cache
		○ CPU Core
		○ Channels
		○ Overhead
		○ Overclock
			○ Logic Circuit
			○ Assembly Language
			○ Abstraction
			○ Mnemonics
			○ Accumulator
			○ Registers
			○ Commands:
			  ○ INP
			  ○ OUT
			  ○ STA
			  ○ LDA
			  ○ ADD
			  ○ SUB
			  ○ BRP
				○ Binary Shifts
				○ Overflow
				○ Base-16
				○ Hexadecimal
				○ Integer
					○ Bitmap
					○ Colour Depth
					○ Resolution
					○ Metadata
					○ Analogue
					○ Sampling
					○ Sample Rate
					○ Sample Resolution
					○ Duration
					○ Quality
						○ Gigabyte
						○ Terabyte
						○ Petabyte
						○ Compression
						○ Lossy
						○ Lossless

Curriculum Knowledge Map

Year 11

Year 11	AUTUMN		SPRING		SUMMER	
Computational Thinking	**Programming Part 6**	**Programming Project**	**Databases & SQL**	**EXAM PREP**	**EXAM PREP**	
	Access and modify existing data, file handling.	Complete a complex programming project	Describe a database and list its key terms. Determine the difference between a flat file and a relational database. Use structured query language (SQL) to retrieve and update data in a database.			
Declarative *What should they know?*	The use of basic file handling operations: o Open o Read o Write o Close ○ The purpose of external data files ○ The meaning of CSV files	○ Learners complete their final programming challenge of the unit. This is their formal assessment for the unit. The project is very challenging, but it does cover everything that they have learnt over this unit.	○ Key terminology required to be able to use SQL to search and update a database. ○ SQL commands: ○ SELECT ○ FROM ○ WHERE ○ The purpose of INSERT, UPDATE and DELETE queries.			
Procedural *What should they be able to do?*	○ Read an external data file ○ Write to an external data file ○ Append to an external data file ○ Read data from a CSV file ○ Use the split() method ○ Use the join() method ○ Write data from a 1D list to a CSV file	○ Determine the good habits of a programmer ○ Explore alternative methods for programming solutions ○ Design a challenging program ○ Create a challenging program ○ Test and refine a challenging program	○ Describe a database ○ Define database key terms (table, record, field, primary key, foreign key) ○ Describe the function of SQL ○ Use SQL to retrieve data from a table in a relational database. ○ Use SQL to retrieve data from more than			

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	○ Write data from a 2D list to a CSV file ○ Append to a CSV file		one table in a relational database ○ Describe the function of different data types. ○ Use SQL to insert data into a relational database. ○ Use SQL to update data into a relational database. ○ Use SQL to delete data from a relational database. ○			
Disciplinary Literacy (Tier 3 Vocab)	○ Records ○ Dictionaries ○ Files ○ Read ○ Write ○ Open ○ CSV ○ Append ○ Split	**Consolidate all disciplinary literacy from units:** • Algorithms Part 1 • Algorithms Part 2 • Programming: Sequence • Programming: Selection • Programming: Iteration • Programming: Strings & Lists • Programming: File Handling	○ Database ○ Data inconsistency ○ SQL ○ Structured Query Language ○ Records ○ Fields ○ Tables ○ Primary Key ○ Foreign Key			
Assessment			This unit includes a final summative assessment to be used at the end of the unit			
?						
Computer Systems	**Impacts of technology**	**Networks Part 1**	**Networks Part 2**	**Security**	**EXAMP PREP**	
	Determine the ethical, legal, environmental, and cultural impacts of technology	Describe network components. Explain connectivity and distinguish between the various types.	Describe the four layers of the TCP/IP model. Protect a network from threats.	Describe the various ways that users and organisations can be affected by cyberattacks. Demonstrate		

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				how organisations can prevent cyberattacks.		
Declarative *What should they know?*	○ Technology introduces ethical, legal, cultural, environmental and privacy issues ○ Knowledge of a variety of examples of digital technology and how this impacts on society ○ The purpose of each piece of legislation and the specific actions it allows or prohibits ○ The need to license software and the purpose of a software licence ○ Features of open source (providing access to the source code and the ability to change the software) ○ Features of proprietary (no access to the source code, purchased commonly as off-the-shelf	○ The definition of a Computer Network ○ The role of clients and servers within a network ○ The difference between PAN's LAN's and WAN's ○ The purpose of computer networks ○ The range of hardware available/required regarding computer networks ○ The term topology and the characteristics of each available topology ○ The characteristics, advantages and disadvantages of different methods of data transmission (wired/wireless) ○ Network performance can be affected by a number of factors.	○ How and why the internet was created and how it works now. ○ Web browsers are used to access the WWW using DNS to find the IP of each website ○ How packets are transmitted across networks. ○ The different types of Domain Servers available ○ The term protocol and common networking protocols that are used whilst communicating over a network. ○ The concept of layers ○ The importance of keeping data safe on networks and why networks need to be protected.			
Procedural *What should they be able to do?*	○ Apply the terms 'privacy', 'legal', 'ethical', 'environmental', 'cultural' ○ Explain data legislation ○ Explain the term 'stakeholder' ○ Explain the right to be forgotten	○ Define a computer network ○ Discuss the advantages and disadvantages of computer networks ○ Describe the role of a computer in a peer-to-peer network	○ Describe the internet as a network of computer networks ○ Describe the function of an IP address ○ Describe a DNS and its role in the conversion of a URL to an IP address			

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	○ Distinguish between creative uses and infringement of copyright ○ Define 'downtime' and explain the associated impact on an organisation ○ Identify the implications of having personal data online ○ Explain the Freedom of Information Act (2000) ○ Define 'computer misuse' and the associated offences ○ Identify situations that would be classified as an offence under the Act ○ Explain what is meant by the 'digital divide' and measures to mitigate its effect ○ Identify positive and negative aspects of the use of mobile technology ○ Explain the social and environmental impacts of social media ○ Explain the positive and negative effects of online content ○ Explain the environmental effects of the use of technology ○ Explain the ethical impact of using	○ Describe the role of a computer in a client–server network ○ Describe the purpose of a PAN, LAN, and a WAN ○ Describe the tasks performed by the network hardware: wireless access point, router, switch, hub, NIC, and bridge ○ Define a MAC address ○ Draw and describe a star, bus, mesh, and ring topology ○ Describe the advantages and disadvantages of the star, bus, mesh, and ring topologies ○ Select an appropriate topology for a given scenario ○ Define a wired and a wireless network ○ Define transmission media ○ Describe the attributes of fibre optic and copper cables used in wired networks ○ Describe Bluetooth as a mode of connection	○ Describe the role and function of a web browser ○ Describe how servers are used for hosting services across the internet ○ Describe the role of web servers and clients ○ Describe how the cloud provides services for software and storage ○ List the advantages and disadvantages of the cloud ○ Determine the need for standards in network communications ○ Define the term network protocol ○ Define the purpose and common use of the network protocols: Ethernet, WiFi, HTTP, HTTPS. FTP, POP, SMTP, and IMAP ○ Describe the four layers of the TCP/IP model ○ Determine the need for and importance of network security			

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	○ algorithms to make decisions ○ Explain the ethical issues surrounding the use of AI in society	○ Discuss the advantages and disadvantages of wireless networks compared to wired networks ○ Describe the factors that affect network performance (bandwidth, range, latency, number of devices) ○ Determine how network speeds are measured and construct expressions involving file size, transmission rate, and time ○ Determine methods of routing traffic on a network and calculation of routing costs	○ Identify different forms of attacks on networks (social engineering, malicious software) ○ Explain network security methods			
Disciplinary Literacy (Tier 3 Vocab)	○ **Privacy** ○ **Legal** ○ **Ethical** ○ **Environmental** ○ **Cultural** ○ **Legislation** ○ **Stakeholder** ○ **Right to be forgotten** ○ **Copyright** ○ **Freedom of information act** ○ **Computer Misuse** ○ **Downtime** ○ **Digital Divide**	○ Network ○ Node ○ Client ○ Server ○ Peer-to-peer ○ Client-Server ○ PAN ○ LAN ○ WAN ○ WAP ○ Router ○ Switch ○ HUB ○ NIC	○ Internet ○ IP Address ○ DNS ○ URL ○ Web Browser ○ Servers ○ Hosting ○ Web Servers ○ Clients ○ Cloud ○ Protocol ○ Ethernet ○ WiFi ○ HTTP			

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	○ **Privacy** ○ **Surveillance** ○	○ MAC Address ○ Topologies ○ STAR ○ MESH ○ Wired ○ Wireless ○ Transmission ○ Optic ○ Copper ○ Bluetooth ○ Bandwidth	○ HTTPS ○ FTP ○ POP ○ SMTP ○ IMAP ○ TCP/IP			
Assessment	Students engage in a comprehensive end-of-unit assessment, covering aspects from each of the preceding seven lessons. This includes the previous lessons covered in legal, cultural, environmental, and ethical aspects of the impact of technology.		Recall knowledge of networks through a final, summative assessment - A multiple choice summative assessment has been created for this unit.			

Additional

[Education for a Connected World (publishing.service.gov.uk)]