Thomas More Catholic Academy
FAITH | EXCELLENCE | RESPECT

Computer Science Curriculum Sequence – Key Stage 4

	KS3 National Curriculum prior learning	**By the end of the term, students can:**	Year 10 Half Term 1	Year 10 Half Term 2	Year 10 Half Term 3	Year 10 Half Term 4	Year 10 Half Term 5	Year 10 Half Term 6
			2.4.1 Boolean Logis 1.2.3 Units 1.2.4 Data Storage 2.1.1 Computational Thinking	2.2.1 Programming Fundamentals 1.2.4 Data Storage 2.1.2 Designing, creating and refining Algorithms 1.2.5 Data Storage Compression	1.1.1 Architecture of the CPU 1.1.2 CPU Performance 2.2.1 Programming fundamentals 2.2.2 Data Types	1.1.1 Architecture of the CPU 1.2.1 Primary Storage (Memory) 1.1.3 Embedded systems 1.2.2 Secondary Storage 2.2 Practical Programming 2.2.3 Additional Programming techniques	1.3.1 Networks and topologies 1.3.2 Wired and wireless networks, protocols, and layers 2.2 Practical Programming 2.2.3 Additional Programming techniques	1.3.1 Networks and topologies 1.3.2 Wired and wireless networks, protocols, and layers 2.2 Practical Programming 2.2.3 Additional Programming techniques
What we want our students to know and remember	*How are you supporting transition of knowledge from KS3 to KS4?*	Define the key tier 3 **vocabulary**:	Transistors Logic Gate Bit (Binary digit) AND OR NOT (Invertor Truth Table Logic circuit Bit Nibble Byte Binary Denary Hexadecimal Overflow Error Left Shift Right Shift ASCII Unicode Computational thinking Algorithm Abstraction Decomposition Variable Constant Interpreter	Flowchart Process Decision Sub-program Sub-routine Pseudocode Dry Run Trace Table Bugs Bug-fix Compression Lossy Lossless Modulus division Integer division Exponents	Arithmetic Logic Unit (ALU), Control Unit(CU),Registers, Accumulator, Processor, CPU, Instruction, Input/output, Devices, Execute, Fetch, Decode, Storage, Efficiency, Structured, Sequence, IF, ELSE IF, ELSE, SELECT CASE, Nested, Condition	RAM, ROM, CPU, Embedded system, Function, Microprocessor, UI (User Interface), Central Processing Unit, Primary Storage, RAM, Volatile, ROM, Non-Volatile, BIOS, Disk thrashing, Firmware, Hard Disk, Portable, Internal, External.	Network, LAN, WAN, PAN, Wireless Access Point, WAP, Router, Switch, Network Interface card, NIC, Transmission Media, Fibre Optics, Copper, Co-axe, ASA, Firewall, L3 Switch	Packet Switching, Circuit Switching, Layers, Data-Link, Physical Layer, TCP/IP, MAC, IP Address, OSI 4 layer model, Standards, HTTP, HTTPS, POP, SMTP, IMAP, FTP, Protocols, Encryption, Wired, Ethernet, WI-FI, Bluetooth, Topology, Bus Network, Ring Network, Mesh Network, Star Network, Partial Mesh, Full Mesh.

	How will this sequencing support transition from KS4 to KS5 and beyond?	Recall the **knowledge**:	What does a logic gate do? How does a NOT gate work? What is a transistor? What does binary represent? What does A ^ B mean? What does A v B mean? How do we work out the number of rows needed for a truth table? What is the difference between an AND gate and an OR gate? What is a high level programming language? How do we Output to a monitor in programming? What is a variable? What is an IDE? What is ASCII? What is UNICODE? What is an Algorithm? What is Abstraction? What is decomposition? What is the difference between base 2 and base 10? What is Hexadecimal? What is a left shift? What is a right shift?	What is a vector image? What is a bitmap image? What is colour depth? What is metadata? What is a pixel? What is sub-routine? What is pseudocode? What is a process? Why do we use flowcharts? What is concatenation? What is a variable? What is a constant? What do we mean by the term sample frequency? What is sample rate? What is a trace table? What is a bug? What is meant by the term but rate? How is sound stored in digital form? What is compression? What is lossy compression? What is lossless compression? Why do we complete trace tables? What is a bug? Why do we need to fix bugs? What is resolution? What are RGB values used for? What is a process look like in a flowchart?	What does the ALU do? What is the CU used for? How many different types of registers are there? What are accumulators used for? What is the fetch, decode, execute cycle? What is a CPU? What is an instruction? What is a variable? What is iteration? What is selection? What does nested mean? What is a condition? What is casting? What data type are integers used for? What data type are floats used for? What data types are strings used for? What is the name of the data type that uses True or False? What is a FOR loop? What is a WHILE loop? What is count controlled looping? What is condition controlled loop? What is Von Neumann architecture? What is a substring? What is an escapes character?	What does RAM stand for? What does ROM stand for? What is an Embedded system? What is a microprocessor? What is a user interface? What is meant by the term volatile? What is the BIOS used for? Explain what is meant by disk thrashing. What is Firmware used for? What is the difference between internal and external storage? What is the difference between volatile and non-volatile memory? What is virtual memory? What is the use of primary storage? What is the use of secondary storage? What difference is there between Optical, Magnetic and Solid state drives? Explain why we cast different data types. What is the difference between a logical operators and an arithmetic operator? What is meant by the term string manipulation?	What is a variable? What is the difference between logical and arithmetic operators? How can we use casting to change data types? What is selection? What is iteration? How can we use string manipulation to correctly display information on a monitor? What different types of transmission media are there? What are the main differences between wireless and wired connections? What is an advantage of using Fibre Optic over other types of transmission medias? What is a Firewall? What does an ASA do? What is the difference between a Layer 2 switch and a Layer 3 switch? Where would a WAN be used? Where would a LAN be used? Why is a PAN different to other types of networks? What is the OSI 4 layer model used for?	What is a star topology? What is a mesh topology? What is a wired connection? What is a wi-fi connection? What is an IP address used for? What is a MAC address used for? what is the difference of IP and MAC addressing and which layer that each is used at? What is encryption? Why are standards in computer networks always essential? What are protocol? What do the different protocols have in common and where do they differ? What are the names of the seven types of protocols that are in use? Why do we use Packet Switching instead of Circuit switching? What is a DHCP server? Why do we use DNS? What is the cloud? What is hosting? What are web servers and what are they used for? How is DNS essential for the internet?
What we want our students to do	*How are you supporting transition of skills from KS3 to KS4?*	Demonstrate excellence in these **skills**:	Explain why data needs to be in binary form. Explain the properties of the three Logic gates. Draw logic diagrams for the operators AND, OR and NOT gates. Create complex logic circuit diagrams from logic statements. Create truth tables from complex logic statements and diagrams. Explain the use of binary codes to represent characters. Demonstrate how to convert whole, positive numbers from denary into binary. Demonstrate how to convert whole, positive numbers from binary to denary. Demonstrate how to convert whole, positive numbers from denary into hexadecimal.	Demonstrate how to abstract a given algorithm or problem. Demonstrate how to decompose a given algorithm or problem. Demonstrate how able to produce an algorithm using a flowchart. Demonstrate how able to produce an algorithm using pseudocode or Reference Language. Demonstrate how to complete image storage calculations ensuring that the correct storage size prefix is being used. Explain how sound can be stored in digital form. Demonstrate you are able to complete trace tables for intermediate and complex algorithms. Classify the differences between lossy and	Demonstrate how to find the length of a string and convert a string to upper case or lower case. Demonstrate how to extract a substring. Demonstrate how to change a character to its ASCII value, and back. Demonstrate how to use escape characters in a string. Explain how clock speed affect a CPUs performance. Explain how cache size affect a CPUs performance. Explain how number of cores affect a CPUs performance. Conclude how the best performing CPUs use clock speed, cache size and number of cores to the CPUs advantage. Explain the two common types of iteration: WHILE	Demonstrates the ability to create software artefacts of varying difficulty and parameters using good metacognition practices. Demonstrates good problem solving abilities when resolving issues within given code blocks. Explain the characteristics of embedded systems. Explain the purpose of embedded systems. Describe the two main types of primary storage in a computer. Discuss why you need these two types. Explain why they are different. Explain what happens if you do not have enough memory. Demonstrate how to output the contents of the text file	Explain why we network computers together. Explain what is meant by a LAN. Explain what is meant by a WAN. Demonstrates the ability to create software artefacts of varying difficulty and parameters using good metacognition practices. Demonstrates good problem solving abilities when resolving issues within given code blocks. Identify the components required to create a LAN. Describe the role of each component in a LAN. Explain what is meant by the performance of a network and why this is important. Explain the advantages of using Fibre optic over copper transmission media.	Explain the internet is a worldwide collection of computers. Explain the role of DNS as part of the internet. Explain what is meant by hosting. Explain what is meant by the cloud. Explain how web servers and clients work together. Identify a star and mesh topology. Explain the difference between a partial and a full mesh. Discuss the advantages of using different topologies. Identify the key differences between wired Ethernet and Wi-Fi. Explain the advantages and disadvantages of wired Ethernet and Wi-Fi. Identify an IP address and a MAC address. Identify that an IP address is dynamic, and

			Demonstrate how to convert whole, positive numbers from binary to hexadecimal.	lossless compression. Analyse when lossy and lossless would be used.	(condition-controlled) and FOR COUNTER (counter-controlled) and apply the most suitable for the problem. Demonstrate how to rewrite any FOR loop as a WHILE loop, and some WHILE loops as FOR loops.	to screen. Demonstrate how to write a string variable to a file. Explain that text files are in string format and need string manipulation and casting. Demonstrate the ability to, given a path(or file name) open a serial/text file (e.g., txt, csv, anything that can be read as plain text in a program like Notepad) and store its contents in a variable or an array. (HAPs)	Explain what is meant by a client-server network. Explain what is meant by a peer-to-peer network	a MAC address is static, and why this distinction is useful. Understand the need for encryption. Explain why standards are essential in computer networks. Describe what protocols are. Identify the purpose of seven key protocols.
Key assessment questions:			Complete the truth table for the Boolean statement p = NOT (A and B). Complete the truth table for the Boolean statement p = NOT (A OR B). Create a logic diagram for the following expression Q=(NOT A) AND B. Create a logic diagram for the following expression Q=(A OR B) AND C. Create a logic diagram for the following expression Q=NOT(A OR B) AND C . Explain what is meant by the term ASCII. Explain what UNICODE is used for. Demonstrate how to write a PRINT statement in a high level programming language. Demonstrate how to convert a denary number into a binary or hexadecimal number. Explain what happens when we left shift a binary number.	Write a pseudocode statement to assign a value to a variable with a specific identifier. What is the most appropriate data type for the variable for date? Draw the following algorithm as a flow chart. Convert this binary value 11010111 into hexadecimal. Covert this binary value into denary 11110000. Covert this denary number into hexadecimal 28. Covert this hexadecimal number into denary A3. Calculate the size of this bitmap image that is 100x80 pixels with a colour depth of 8. What information is likely to be held in a metadata header? In pseudocode write a program that asks for a user's name and age, stores them in variables, then use concatenation to display both variables on one line. Describe how an analogue sound is	Explain what the three parts of the FDE cycles are. Explain the difference between a FOR loop and a WHILE loop. Describe how an exit condition stops a loop. Write an algorithm for a count controlled loop that will complete thirty iterations. Explain what the following arithmetic operators are used for "=, ==, *, /, //, %". State the different types of registers in a CPU and what they are used for. Explain how differing amounts of CPU cores can affect CPU performance. When running a 3D flight simulator, Computer 1 is likely to run faster than Computer 2. Using the information in Fig. 1, identify one reason for this. Explain one reason why the cache size affects the performance of the CPU. The Sat Nav contains an embedded system. Define what is	A restaurant has a computer-based ordering system which is running slowly. A technician has said that the hard disc drive is fragmented. The technician has suggested using utility software to defragment the drive. (a) Explain how the restaurant's hard disc could have become fragmented. b) Explain how defragmentation software could overcome the issue of the slow computer system. Nina wants to transfer photos from a digital camera to an external secondary storage device. (a) Define what is meant by 'secondary storage'. (b) Identify the three common types of storage Nina can choose from. (c) State four characteristics of secondary storage devices that Nina should consider when choosing a device.	The owners of a large bakery have a Local Area Network (LAN) with a star topology. They order their supplies over the Internet. When data is transmitted from the bakery to the supplier, network protocols are used. (a) Define what is meant by a 'network protocol' (b) TCP/IP is a set of protocols based on layers. (I) With regards to network protocols, define what is meant by a 'layer'. (ii) Describe one advantage of using layers to construct network protocols. (c) Give two reasons why the bakery may use a star network topology for their LAN. A law company currently use a Local Area Network (LAN) linked to a Wide Area Network (WAN). They want to upgrade their system to utilise cloud storage. (a) Define what is meant by a Wide Area Network. (b) Explain two advantages	A second program needs to perform the following tasks: • Input a number from the user • Double the number input and print the result • Repeat bullets 1 and 2 until the user enters a number less than 0. Write an algorithm for this program. Hope has a network in her house. The main devices are shown in the diagram. (a) State whether Hope's network is a LAN or a WAN. Justify your choice. (b) Devices on the network do not currently have Internet access. Identify one device that Hope can use to connect her home network to the Internet. (c) The network has one wireless access point in the kitchen that transmits data on the 5 GHz frequency. (i) When the laptop is in the kitchen, it has better network performance. Explain why the laptop's network performance is

				converted to a digital sound.	meant by an 'embedded system'.		to the law company of storing their data in the Cloud. (c) Explain two disadvantages to the law company of storing their data in the Cloud.	lower in the bedroom. (ii) State two ways Hope could improve the wireless network performance in the bedroom. (d) Explain why Hope's network uses a peer-to-peer model and not a client-server model.
Disciplinary Rigour		What makes your subject different to other subjects? What are the expectations for students in your subject area in the KS4 National Curriculum if applicable / KS4 qualification specification?	Using logic diagrams to accurately predict the presence of electrical signals whilst extrapolating information about the binary state. Creating a visualised diagram to show the results. Being able to work out character sets from binary sequences. Links into KS3 with I/O and binary sequences.	Creating flowcharts to predict and plan algorithms that have been designed in a bespoke manner from a brief. Able to create bitmap images from binary streams . Creating Software artefacts from a flow chart or reference language that achieves a specific goal. Links into KS3 with basic Python programming and Scratch.	Using fundamental programming skills to create complex, bespoke algorithms to solve specific problems given by a specific brief. Understanding how a central processing unit is constructed and what components are used to help run a computer. Able to explain what a BUS is and how it communicates with hardware on the motherboard. Links into KS3 with hardware/software, Scratch programming and Python programming.	Using fundamental programming skills to create complex, bespoke algorithms to solve specific problems given by a specific brief. Understanding how different storage mediums operator with different tolerances. Be able to explain what non-volatile memory and what volatile memory are and how they relate to computer systems. KS3 with hardware/software, Scratch programming and Python programming.	Developing programming skills to create complex, bespoke algorithms to solve specific problems with full creative autonomy in completion of the software artefact. Will be able to understand the different layers in networks and how they interact and intertwine whilst being able to identify topologies and justifications for different uses of transmission media. KS3 links with networks, Scratch programming and Python programming.	Mastering programming skills to create complex, bespoke algorithms to solve specific problems with full creative autonomy in completion of the software artefact. Will be able to explain and justify the different layers in networks and how they interact and intertwine whilst being able to identify topologies and justifications for different uses of transmission media. KS3 links with networks, Scratch programming and Python programming.