KS4 Curriculum Map – Computer Science:

Topic	Knowledge *Substantive knowledge*: This is the specific, factual content for the topic, which should be connected into a careful sequence of learning.	Skills *Disciplinary knowledge*: This is the action taken within a particular topic in order to gain substantive knowledge.	Assessment Opportunities What assessments will be used to measure student progress?

Algorithms	• Computational thinking
	  ○ Abstraction
	  ○ Decomposition
	  ○ Algorithmic Thinking.
	• Designing, creating and refining algorithms
	  ○ Pseudocode
	  ○ Flowcharts
	  ○ Reference language/high-level programming language
	  ○ Trace tables
	• Searching and sorting algorithms
	  ○ Binary search
	  ○ Linear search
	  ○ Bubble, Merge, Insertion sort
		Understand and use different types of search
		• Linear search
		• Understand arithmetic operators and variables Define the data types integer, real, Boolean, character, string
		• Understand the principles of
		• computational thinking including
		• Abstraction
		• Decomposition
		• Algorithmic thinking
		• Understand and use different types of search
		• Binary search
		• Understand the standard sort algorithms:
		• Bubble sort, Insertion sort, Merge sort
			• Worksheets/homeworks
			• End of unit test
			• Mid-year assessment
			• Know it All Ninja quizzes
			• Mini exam style tests

Programming fundamentals	• Programming fundamentals
	  ○ The use of variables, constants, operators, inputs, outputs and assignments
	  ○ Sequence, Selection, Iteration (count- and condition- controlled loops)
	  ○ The common arithmetic operators
		• Understand and use data types: integer, real, Boolean, character and string
		• Declare and use constants and variables
		• Use random number generation
		• Use arithmetic operators including MOD and DIV
		• Use string handling and conversion functions
			• Programming project
			• Worksheets/homeworks
			• End of unit test
			• Know it All Ninja quizzes
			• Mid-year assessment
			• Mini exam style tests

	○ The common Boolean operators AND, OR, NOT • Data types ○ Integer, Real, Boolean, Character and string • Additional programming techniques ○ The use of basic string manipulation ○ The use of basic file handling ○ The use of records to store data ○ The use of SQL to search for data ○ Arrays • Sub programs	• Use selection and nested selection statements with NOT, AND and OR when creating Boolean expressions • Understand and use iteration in an algorithm • Write algorithms in pseudocode involving sequence, selection and iteration • Use one- and two-dimensional arrays in the design of solutions to simple problems • Understand the concept of subroutines • Understand and use basic file handling operations Use SQL (Structured Query Language) statements to search for data	
Data Representation	• The units of data storage • How data is converted to binary format • Data capacity and requirements • Denary, binary and hexadecimal conversions • Binary shifts • Binary addition • Compression	• Define the terms bit, byte, kilobyte, megabyte, gigabyte, • Convert positive denary whole numbers (0-255) into 8-bit binary numbers and vice versa • Convert between binary, denary and hexadecimal equivalents of the same number • Add two 8-bit binary integers and explain overflow errors which may occur • Understand the use of binary shifts • Understand the use of binary codes to represent characters • Understand the term 'character set' • Explain how sampling intervals and resolution affect the size of a sound file using the terms: ○ Sample rate ○ Bit depth	• Worksheets/homeworks • End of unit test • Know it All Ninja quizzes • Mid-year assessment • Mini exam style tests

Systems architecture	• The purpose of the CPU o The fetch-execute cycle • Common CPU components and their function: o ALU (Arithmetic Logic Unit) o CU (Control Unit) o Cache o Registers • Von Neumann architecture: o MAR (Memory Address Register) o MDR (Memory Data Register) o Program Counter o Accumulator • How common characteristics of CPUs affect their performance: o Clock speed o Cache size o Number of Cores • The purpose and characteristics of embedded systems Examples of embedded systems • Primary and secondary storage • RAM and ROM • Common types of storage • Suitable secondary storage devices • Characteristics of storage media	• Understand the purpose of the CPU • Identify actions occur at each stage of the fetch-execute cycle • The role/purpose of each component and what it manages, stores, or controls during the fetch-execute cycle Common CPU components and their function • The purpose of each register, what it stores (data or address) • LMC to demonstrate the FDE cycle • Explain the function of the ALU and CU function • Understand how cache, clock speed and number of cores affects the performance of the CPU • Identify examples and characteristics of an embedded system • The need for primary storage and key characteristics of RAM and ROM • Understand how virtual memory works • Identify the different types of storage • Understand how optical, magnetic and solid-state function • Name the key characteristics of each storage media: capacity, speed, portability, durability, reliability and cost	• Worksheets/homeworks • Exam style questions • Little man computer activities • End of unit test • Know it All Ninja quizzes • Mid-year assessment • Mini exam style tests

Networks and topologies	• Types of networks:
	  • LAN (Local Area Network)
	  • WAN (Wide Area Network)
	• Factors that affect the performance of networks
	• The different roles of computers in a client-server and a peer-to-peer network
	• The hardware needed to connect stand-alone computers into a Local Area Network:
	  • Wireless access points
	  • Routers
	  • Switches
	  • NIC (Network Interface Controller/Card)
	  • Transmission media
	• The Internet as a worldwide collection of computer networks:
	  • DNS (Domain Name Server)
	  • Hosting
	  • The Cloud
	  • Webservers and Clients
	• Star and Mesh network topologies
	• Modes of connection:
	  • Wired
	  • Wireless
	• Encryption
	• IP addressing and MAC addressing
	• Common protocols including:
	  • TCP/IP, HTTP, HTTPS, FTP, POP, IMAP, SMTP
	  • The concept of layers
		• Define a Wide Area Network
		• Describe the difference between a Local Area Network and a Wide Area Network
		• Describe star and mesh network topologies
		• Understand wireless modes of connection, including:
		– Wi-Fi
		– Bluetooth
		• Explain the need for Wireless Access Points to create wireless hotspots
		• Describe what is meant by:
		- Hosting
		- The Cloud
		• Describe the factors that affect network performance
		• Describe the uses of communications protocols including
		• Explain the need for IP addressing of resources on the Internet and how this can be facilitated by the role of DNS services
		• Understand the need for Network Interface Cards and the uses of MAC addressing
		• Explain packet switching
		• Describe routers and switches needed to connect stand-alone computers into a Local Area Network
		  • Explain the use of Ethernet standards to transmit data over a wired network
		  • Understand how encryption is used to secure data across network connections
		  • Explain the role of computers in client-server and peer-to-peer networks
		  • Describe the uses of communications protocols
		Explain the concept of layers in the TCP/IP protocol stack
			• Worksheets/homeworks
			• Exam style questions
			• Network workbook
			• End of unit test
			• Know it All Ninja quizzes
			• Mid-year assessment
			• Mini exam style tests

Threats to computer systems and networks	○ Forms of attack ○ Malware ○ Social engineering, e.g. phishing, people as the 'weak point' ○ Brute-force attacks ○ Denial of service attacks ○ Data interception and theft ○ The concept of SQL injection ○ Common prevention methods: ○ Penetration Testing ○ Anti-malware software ○ Firewalls ○ User access levels ○ Passwords ○ Encryption ○ Physical Security	• Understand a variety forms of attach and threats the pose at a basic level • Identify and understand the prevention of vulnerabilities including the use of: – anti-malware software – passwords – physical security • Explain the need for the following functions of an operating system: – User interface • Understand forms of attack and threats posed to a network including: – Malware – Phishing – Social engineering – Brute force attacks – Data interception and theft • Identify and understand the prevention of vulnerabilities including the use of: – penetration testing – user access levels – encryption	• Worksheets/homeworks • Know it All Ninja quizzes • Exam style questions • Presentation on network threats • End of unit test • End of year assessment • Mini exam style tests

Logic and Languages	• Defensive design considerations: o Anticipating misuse o Authentication • Input validation • Maintainability: o Use of sub programs o Naming conventions o Indentation o Commenting • The purpose and types of testing o Iterative o Final/terminal • Identify syntax and logic errors • Selecting and using suitable test data • Simple logic diagrams using the operations AND, OR and NOT • Truth tables • Characteristics and purpose of different levels of programming language: o High / low-level languages • The purpose of translators • The characteristics of a compiler and an interpreter • Common tools and facilities available in an integrated development environment (IDE)	• Construct truth tables for the following logic gates: – NOT, AND, OR • Understand how to make maintainable programs including: – Naming conventions, Indentation • Create, modify and interpret simple logic circuit diagrams • Describe defensive design considerations: – Input validation – Anticipating misuse – Authentication • Understand how to make maintainable programs including: – Commenting • Understand the purpose of testing, including: – Iterative testing – Final/terminal testing • Identify syntax and logic errors • Select and use suitable test data • Describe the characteristics of a compiler and interpreter • Describe the characteristics and purpose of different levels of programming language	• Worksheets/homeworks • Exam style questions • End of unit test • Mid-year test • Programming questions • Trace table questions • Testing activities • Know it All Ninja quizzes • Mini exam style tests

Systems Software	• The purpose and functionality of operating systems: o User interface o Memory management and multitasking o Peripheral management and drivers o User management o File management • The purpose and functionality of utility software • Utility system software: o Encryption software o Defragmentation o Data Compression	• Explain the need for the following functions of an operating system: – User interface – Memory management and multitasking – Peripheral management and drivers – User management – File management • Describe the purpose and functionality of common utility software including: – Encryption software – Defragmentation software – Data compression software • Explain the need for the following functions of an operating systems including memory management and multitasking	• Worksheets/homeworks • Exam style questions • End of unit test • Know it All Ninja quizzes • Mid-year test • Mini exam style tests
Ethical, legal, cultural and environmental impacts of digital technology	• Impacts of digital technology on wider society including: o Ethical issues o Legal issues o Cultural issues o Environmental issues o Privacy issues • Legislation relevant to Computer Science: o The Data Protection Act 2018 o Computer Misuse Act 1990 o Copyright Designs, Patents Act 1988 o Software licences (i.e. open source and proprietary)	• List ethical issues, cultural issues and environmental issues in relation to a given scenario • List items of legislation that relate to digital technology • Discuss the impacts of digital technology on the wider society including ethical issues, cultural issues and environmental issues • Discuss the impact of manufacture, disposal, upgrading and replacing digital technology • Discuss the impact of e-waste • Discuss the impact of digital technology regarding legal issues and privacy issues • Describe legislation relevant to Computer Science including o The Data Protection Act 2018 o Computer Misuse Act 1990 o Copyright Designs and Patents Act 1988	• Worksheets/homeworks • Exam style questions • End of unit test • Know it All Ninja quizzes • Mid-year test • Mini exam style test

		• Describe the features of open source and proprietary software licences • List the clauses of the Data Protection Act and Computer Misuse Act and give examples of situations in which they are relevant • Evaluate the impact of and issues related to the use of computers in society	