GCSE Computer Science Checklist
Unit 1 - Understanding Computer Science
(Written Exam: 1 hour 45 Minutes - 100 Marks - 50% of Qualification)

Topic	Sub-Topic	Explanation	I can statement	Studied	R	A	G
Hardware	Architecture	Describe the characteristics of CPU architecture, including Von Neumann architectures.	I can explain what the CPU is.				
			I can explain how each of the different components in the CPU work.				
			I can explain how the data, address and control buses work within the Von Neumann architecture structure.				
			I can explain how the Von Neumann and Harvard architecture structures are different from each other.				
		Identify and explain the role of the components of the CPU in the fetch-decode-execute cycle.	I can explain what is meant by the fetch-decode-execute cycle.				
			I can explain how the fetch-decode-execute cycle model works.				
			I can explain how the program counter (PC), memory address (MAR) and current instruction (CIR) registers all work.				
			I can explain how the clock unit (CU) decodes program instructions in the current instruction register (CIR).				
		Explain how performance is affected by the cache size, clock speed and number of cores.	I can explain how cache memory can affect the performance of the CPU.				
			I can explain how clock speed affects the performance of the CPU.				
			I can explain how the number of cores can affect the performance of the CPU.				
		Explain the difference between RISC and CISC types of processors.	I can explain the difference between a RISC and a CISC processor.				
	Input and Output	Describe the use and characteristics of input and output devices.	I can describe the difference between an input and output device.				

			I can list contemporary input and output devices.				
			I can relate the use of input devices to a range of given contexts.				
			I can explain how different input and output devices work.				
	Primary Memory (Storage)	Explain the functional characteristics of Random Access Memory (RAM), Read Only Memory (ROM), flash memory and cache memory.	I can explain the difference between RAM, ROM, flash and cache memory.				
			I can give uses for different types of primary memory in different contexts.				
	Secondary Storage	Describe the characteristics of contemporary secondary storage technologies including magnetic, optical and solid state devices in terms of suitability, durability, portability and speed.	I know the difference between magnetic, optical and solid-state storage devices.				
			I can give examples of secondary storage devices.				
			I can relate secondary storage devices to a situation or use.				
	Units of Storage	Describe the relationship between data storage units, including bit, nybble, byte, kilobyte and additional prefix multipliers.	I can list all of the units of data in size from a bit to a yottabyte.				
			I can identify the abbreviations and values for units of data ranging from a byte to a yottabyte.				
			I can convert between units.				
		Describe data capacity and calculate data capacity requirements.	I can explain how data capacity is determined.				
			I can calculate data capacity requirements.				
	Additional Hardware	Describe the characteristics and role of additional hardware, including GPU, sound cards and motherboards.	I can explain how a GPU (graphic processing unit), sound card and motherboard work.				
			I can explain the difference between an integrated and dedicated GPU.				
	Embedded Systems	Describe the use and give examples of embedded systems.	I can explain what is meant by the term "embedded system".				
			I can explain how an embedded system works.				
			I can give examples of different types of embedded systems.				
Computer Logic	**Logical Operators**	Use AND, OR, NOT and XOR logical operators, combinations of these, and	I can explain what a truth table is.				
			I can explain how the AND, OR, NOT and XOR logical operators work.				

		their application in appropriate truth tables to solve problems.	I can draw the correct symbols for the AND, OR, NOT and XOR logical operators.						
			I can produce truth tables for the AND, OR, NOT and XOR logical operators.						
			I can solve problems by using a range of logical operators.						
			I can produce diagrams which contain multiple logical operators combined together.						
			I can produce truth tables which combine multiple logical operators together.						
	Boolean Logic	Simplify Boolean expressions using Boolean identities and rules.	I can use annulment law.						
			I can use identity law.						
			I can use idempotent law.						
			I can use complement law.						
			I can use commutative law.						
			I can use double complement law.						
			I can use distributive law.						
			I can use absorptive law.						
			I can use associative law.						
			I can use De Morgans law.						
Communication	Networks	Explain the characteristics of networks and the importance of different network types, including LAN and WAN.	I can explain the difference between a LAN (local area network) and a WAN (wide area network).						
			I can explain a range of hardware devices which are required to construct a network.						
			I can explain the different between a Personal Area Networks (PAN), Metropolitan area networks (MAN) and a Virtual Private Network.						
		Describe the importance of common network topologies, including ring, star, bus and mesh, and their advantages and disadvantages.	I can explain the difference between ring, star, bus and mesh network topologies.						
			I can produce diagrams of ring, star, bus and mesh network topologies.						
			I can outline the advantages and disadvantages of ring, star, bus and mesh network topologies.						

		Explain the importance of connectivity, both wired and wireless.	I can explain why connectivity is important for the transfer of data.				
			I can describe how to connect to a network using both wired and wireless technologies.				
			I can outline the benefits and disadvantages of wired and wireless network connections.				
		Explain and give advantages and disadvantages of circuit switching and packet switching.	I can explain the difference between circuit and packet switching.				
			I can outline the benefits and disadvantages of circuit and packet switching.				
		Explain the importance and the use of a range of contemporary network protocols, including Ethernet, Wi-Fi, TCP/IP, HTTP, HTTPS, FTP and email protocols.	I can explain what a protocol is.				
			I can explain what the TCP/IP, HTTP, HTTPS, POP3, SMTP and IMAP protocols are.				
		Describe the typical contents of a TCP/IP packet.	I can explain what a TCP/IP packet is.				
			I can explain each of the typical contents found in a TCP/IP packet.				
		Explain the importance of layers and the TCP/IP 5 - layer model.	I can list each of the five layers the TCP/IP model contains.				
			I can explain the purpose of each of the different layers contained in the TCP/IP model.				
			I can put each of the TCP/IP layers in order.				
			I can explain how the TCP/IP model works.				
			I understand the importance of the TCP/IP model.				
		Describe methods of routing traffic on a network and calculate routing costs.	I can explain how data is transmitted in the most efficient manner on a network.				
			I can explain the difference between static and dynamic routing.				
	Internet	Explain how Domain Name System (DNS) servers and Internet Protocol (IP) addresses work.	I can explain the purpose of the Domain Name System (DNS).				
			I can explain how DNS servers are used to convert web addresses into IP addresses.				
Organisation	**Computer Number Systems**		I can convert from denary to binary.				
			I can convert from denary to hexadecimal.				

		Use and convert between denary, binary (up to 16 bits) and hexadecimal counting systems.	I can convert from binary to denary.					
			I can convert from binary to hexadecimal.					
			I can convert from hexadecimal to denary.					
			I can convert from hexadecimal to binary.					
		Explain the use of hexadecimal notation as shorthand for binary numbers.	I can explain what a hexadecimal number is.					
			I can outline the advantages and disadvantages of the hexadecimal number system.					
		Use arithmetic shift functions and explain their effect.	I can explain the effect of a left shift.					
			I can explain the effect of a right shift.					
		Apply binary addition techniques.	I can use the add, subtract, multiply and divide binary numbers					
		Explain the concept of overflow.	I can explain how overflow works.					
	Representing of Graphics and Sound	Explain the digital storage of graphics	I can explain the difference between raster, vector and bitmap images.					
			I can explain what a pixel is.					
		Explain the digital storage and sampling of sound.	I can explain how sampling works.					
			I can explain the difference between sample rate and sample frequency.					
			I can explain how sampling rate and sample frequency affects the quality of a digitalised sound.					
		Describe the use of metadata in files.	I can explain what metadata is.					
			I can give examples of metadata found in sound image, text and game files.					
	Storage Characteristics	Describe how characters are stored as a binary number.	I can explain how characters are represented by binary numbers.					
			I can outline the advantages and disadvantages of the binary number system.					
		Describe standardised character sets, including Unicode and American Standard Code for Information Interchange (ASCII).	I can explain the purpose of standardised character sets.					
			I can explain the difference between the ASCII and Unicode character sets.					
			I can outline the advantages and disadvantages of the ASCII and Unicode character sets.					
			I can explain what a data type is.					

		Describe the concept of data types, including integer, boolean, real, character and string.	I can explain what the integer, boolean, real, character and string data types are.				
			I can give examples of data which is stored in the integer, boolean, real, character and string data types.				
		Describe, design, interpret and manipulate data structures including records, one-dimensional and two dimensional arrays.	I can describe different data structures.				
			I can explain the difference between a list and an array.				
			I can explain the difference between a one and two-dimensional array.				
			I can design an array for a particular purpose.				
			I can utilise a data structure to select data.				
			I can convert a graphical representation of an array to a programmed form.				
			I understand how to add, delete and edit data contained within an array.				
			I can select an appropriate data structure for a given situation.				
	File Design	Design files and records appropriate for a particular application.	I can describe the difference between files and records.				
			I can outline what a record structure contains.				
			I can explain the purpose of having a key field within a record structure.				
			I can design a record for a particular purpose.				
	Data Validation and Verification	Explain and use appropriate techniques for data validation and verification.	I can explain the difference between data validation and verification.				
			I can explain each of the different checks which can be used to validate data.				
			I can explain how double keying and proofreading verification checks work.				
		Design algorithms and programming routines that validate and verify data.	I can design algorithms which validate and verify data.				
			I can produce programming routines which validate and verify data.				
System Software	**Managing Resources**	Describe the purpose and functionality of the operating system in managing	I can explain what an operating system is.				
			I can give examples of different types of operating systems.				

		resources, including peripherals, processes, memory and backing store.	I can explain how an operating system manages its resources.					
	Providing an Interface	Describe the purpose and functionality of the operating system in providing a user interface.	I can explain what a user interface is.					
			I can explain how graphical, command-line and natural-language interfaces work.					
			I can give examples of graphical, command-line and natural-language interfaces which are used in the real world.					
			I can outline the benefits and disadvantages of graphical, command-line and natural-language interfaces.					
			I can explain how an operating system provides an interface to the end-user of a computer system.					
	Utility Software	Explain the purpose and functionality of a range of utility software.	I can explain what utility software is.					
			I can list each of the typical tasks utility software is responsible for performing.					
			I can explain each of the typical tasks utility software is responsible for performing.					
Principles of Programming	**Levels of Computer Languages**	Describe the characteristics and purpose of high-level and low-level languages.	I can explain the difference between low and high-level programming languages.					
			I can give examples of low and high-level programming languages.					
			I can outline the benefits and disadvantages of low and high-level programming languages.					
		Identify and describe situations that require the use of a high-level or a low-level language.	I can identify situations which require the use of a high or low-level programming language.					
			I can describe why certain situations require the use of a high or low-level programming language.					
Software Engineering	**Software Tools**	Explain the role of Integrated Development Environment (IDE) tools in developing and debugging programs.	I can explain what is meant by an Integrated Development Environment.					
			I can outline each of the common tools found in an Integrated Development Environment.					
			I can explain the difference between a linker and a loader.					

				I can explain how to debug programs within an Integrated Development Environment.					
Programming Constructs	**Compilers, Interpreters and Assemblers**	Describe the purpose and give examples of the use of compilers, interpreters and assemblers.	I can explain what a translator is.						
			I can describe the purpose of compilers, interpreters and assemblers.						
			I can explain how compilers, interpreters and assemblers work.						
		Explain the principal stages involved in the compilation process: lexical analysis, symbol table construction, syntax analysis, semantic analysis, code generation and optimisation.	I can list each of the different stages involved in the compilation process.						
			I can explain each of the different stages involved in the compilation process.						
			I can list each of the different stages of the compilation process in order.						
		Describe and give examples of programming errors.	I can explain what syntax, runtime / execution, logical, linking, rounding and truncation errors are.						
			I can give examples of different types of programming errors.						
			I can explain how to avoid a range of different programming errors.						
Security and Data Management	**Data Security**	Describe the dangers that can arise from the use of computers to store personal data.	I can explain the difference between accidental and malicious damage.						
			I can outline the dangers of using personal computers to store personal data.						
			I can explain the dangers which can arise from discarded components.						
	Data Management	Describe methods that protect the security of data including access levels, suitable passwords for access and encryption techniques.	I can explain how user access levels work.						
			I can explain with examples the difference between a strong and a weak password.						
			I can explain how the XOR logical operator can be used to encrypt data.						
		Explain the need for file backups and generations of files.	I can explain the purpose of backups.						
			I can explain how the grandfather-father-son backup methods work.						
		Explain the need for archiving files	I can explain the difference between backups and archived data.						

			I can outline reasons as to why files might be archived.				
Compression		Explain how lossy and lossless data compression algorithms are used.	I can explain what data compression is.				
			I can outline different reasons as to why files might need to be compressed.				
			I can explain the difference between lossy and lossless compression techniques.				
			I can outline the advantages and disadvantages of lossy and lossless compression techniques.				
			I can identify situations which require the use of either lossy or lossless file compression techniques.				
		Calculate compression ratios.	I can calculate compression ratios based on before and after file sizes.				
			I can use ratios to calculate the size of files following compression.				
			I can use data to calculate the compression ratio required to store data.				
Network Security		Recognise the importance of network security and describe the dangers that can arise from the use of networks.	I can explain the importance of network security.				
			I can explain how the following security techniques work: anti-virus, firewall, two-factor authentication, access levels and passwords work.				
			I can describe each of the risks which arise from network use.				
		Explain the purpose and typical contents of an acceptable use policy and disaster recovery policy.	I can explain the purpose of an acceptable use policy.				
			I can outline the typical contents of an acceptable use policy.				
			I can explain the purpose of a disaster recovery policy.				
			I can outline the typical contents of a disaster recovery policy.				
Cyber Security		Describe the characteristics and explain the methods of protection against	I can explain what malware is.				
			I can describe each of the following types of malware: viruses, worms and key loggers.				

		malware, including viruses, worms and key loggers.	I can explain the methods of protection which can be used against different types of malware attacks.				
		Describe the different forms of attack based on technical weaknesses and/or user behaviour.	I can describe how the following technical weaknesses work: SQL injection, DoS attack, password-based attack and IP address spoofing.				
			I can explain what social engineering is.				
			I can describe how social engineering can be used to perform a cyber-attack.				
			I can explain what phishing is.				
			I can describe how phishing attacks work.				
		Describe methods of identifying vulnerabilities.	I can describe how footprinting works.				
			I can explain how penetration testing works.				
		Explain different ways of protecting software systems during design, creation, testing and use.	I can explain what the term "secure by design" means.				
			I can explain different ways in which software systems can be protected during design.				
			I can explain how software systems can be protected in creation.				
			I can explain how testing can be used to protect software systems.				
			I can explain different ways to protect software systems during their use.				
		Describe the role of Internet cookies.	I can explain what an Internet cookie is.				
			I can explain the purpose of Internet cookies.				
			I can explain why Internet cookies can be a security risk.				
Impact of Digital Technology	Ethical	Describe the ethical impacts of digital technology, including issues of privacy and cybersecurity.	I can explain what is meant by the term "digital divide".				
			I can consider the environmental impact technology has upon society.				
			I can explain how technology can have a good and bad impact on working conditions.				
			I can consider the implications of the privacy of private data.				

			I can explain the difference between black hat, white hat and grey hat hacking.					
			I can explain the growing importance of cybersecurity in light of increasing cyberattacks.					
		Explain the importance of conforming to professional standards, including formal and informal codes of ethical behaviour.	I can explain the difference between a formal and informal code of ethics.					
			I can outline what a formal code of ethics might contain.					
	Legislation	Explain how relevant current legislation impacts on security, privacy, data protection and freedom of information.	I can explain what the data protection act is.					
			I can outline each of the main sections of the data protection act.					
			I can explain what the computer misuse act is.					
			I can explain the copyright act is.					
			I can explain what the Regulation of Investigatory Act is.					
			I can explain what the Freedom of Information Act is.					
	Environmental Issues	Describe the environmental impacts of digital technology on wider society.	I can consider the impact technology can have upon a person's health.					
			I can consider the environmental impact society's increased dependence on technology can have.					
			I can explain the impact cloud computing is having on the environment.					
			I can consider the environmental impact ageing technology can have.					
			I can provide suggestions as to how we can protect the environment from technology use.					