

St Dominic's School

Curriculum Plan

What will pupils learn and when?



Subject	KS4 GCSE Computer Science	Year Group	Years 10 and 11
Subject Intent	In GCSE Computer Science, the intent is to build on knowledge and skills from the KS3 National Curriculum and introduce new concepts to develop learners' understanding of key topics relevant to the qualification. The topics are sequenced so that, throughout the school, all learners are learning similar topics at the same time. Each academic year begins with an element of online safety, an essential digital skill in the modern world, during the GCSE course, learners focus on cyber security and network security, what the threats are, and how we can defend against them; introducing potential careers in this lucrative environment. The autumn term also encompasses computer systems and computer networks, delving deeper into how these are designed and the factors that influence the type of network design or speed of a computer. The extensive programming units take learners from being complete novices to having the confidence to tackle any GCSE-level programming challenge. Essential programming theory is also interleaved into the practical elements of programming to provide tangible links between required knowledge and skills.		

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Year 10 Autumn 1	Computer Systems and Networks:	Why do people hack?	Tier 2 - Hacking - Security - Digital devices - Eavesdropping - Baiting - Trojan - Blagging - Zombie - Worm - Virus - Exploit Tier 3 - Cybersecurity - Network security - Planting the flag - Ethical hackers - Hacktivists - Social engineering - Keylogging - Tailgating - Pharming - Phishing - Shoulder surfing - Pretexting	This unit enables GCSE students to gain knowledge and understanding of the range of cybersecurity threats that impact the world, our organisations, and us as individuals. The pupils start by defining fundamental terms, such as cybersecurity and network security. They then progress to understanding different forms of attack, both non-automated and automated. Examining the different techniques used by social engineers (perpetrating non-automated attacks) enables the pupils to protect themselves against tactics such as blagging, phishing, and pharming. They also learn about automated cybercrime, including denial-of-service (DoS) attacks and SQL injection.
	Cybersecurity	What is social engineering and how is it used? What is the difference between automated and non-automated cybercrime? How can systems be protected with software? How can networks be designed to defend against cybercrime? Where is the danger? How can we be part of the solution?		The pupils then take this further by examining how organisations design and use networks and software to reduce the likelihood of a cyberattack, for example by using firewalls, MAC address filtering, automatic software upgrades, and modular testing. They also learn about the policy side of organisations, understanding how levels of access and network policies can protect an organisation.

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			• Quid pro quo • Malware • Data breach/data interception • Brute force attack • DoS • DDoS • SQL injection • Ransomware • Encryption • Caesar cipher • Encryption key • Asymmetric encryption • Input sanitisation • Code reviews • Modular testing • Spyware • Adware • Firewall • Antivirus software • Network policy • Archiving policy • Acceptable use policy • Backup policy • Disaster recovery policy • MAC address	Once they have understood the impact of cybercrime, they learn about how companies identify and reduce vulnerability through penetration testing. Lastly, the unit encourages pupils to be inspired to be part of the solution, as they find out about the potential for lucrative and fulfilling careers in cybersecurity.
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			• MAC address filtering • MAC address safe list • MAC address block list • Penetration testing (pen test) • Network forensics • Physical security • White box pen test • Grey box pen test • Black box pen test	
Year 10 Autumn 2	Computer Systems and Networks: Computer Systems	What are the differences between embedded and general-purpose systems? What's inside the CPU? How does the fetch-decode-execute cycle operate? How is main memory used? What is secondary storage? How do optical and magnetic storage devices work?	Tier 2 • Fetch • Decode • Execute • Magnetic • Optical • Cores Tier 3 • Embedded system • General purpose computer system • System software • Operating System • Utility software • Arithmetic logic unit • Bus	In this unit, pupils will gain an understanding and knowledge of how computer systems work. Starting with the building blocks of the microprocessor — logic gates — pupils will discover how a computer system works and executes instructions. The term 'note taking' is used throughout this unit, how this is applied is left to your judgement. Some computing teachers use exercise books or paper folders with pupils, some use files on the computer, and some use online note-taking software. You should adapt the lesson to your preferred way of working.

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		For what purpose would we choose different storage solutions? What factors limit a CPU's performance? How are logic gates used to address real-world problems?	• Control unit • Cache • Registers • Clock • FDE cycle • RAM • ROM • Secondary storage • Main memory • Solid state • Cloud storage • Logic gates • Boolean expression • Truth table • Assembly language	Ideally, pupils would have prior knowledge of the binary number system and programming in a high-level language.
Year 10 Spring 1	Media: HTML Website Design	What is HTML? How do you add images and links to a website? What features make a good website? Why is CSS needed in addition to HTML? What is the purpose of DIV tags?	Tier 2 • Pages • Images • Accessibility • Navigation • Design • Tags • Chevrons • Classes • Source Tier 3	In this unit learners will gain an understanding of how websites are displayed within a browser using HTML and CSS. Starting with an introduction to how websites are requested and delivered to our computer via the internet and the World Wide Web, learners will go on to study how to create the structure of a website using HTML and change the styling using CSS. This unit covers multiple aspects of the National Curriculum Computing programmes of study. Ideally, students will have some prior basic knowledge of how the internet works.

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			• HTML • CSS • DIV • Pixels	
Year 10 Spring 2	Data and Information: Data Representations	What is representation? How does the base-2 number system operate? How do you add binary numbers? How do you subtract binary numbers? In which situations are binary shifts used? What are overflow and underflow errors? Why are where are hexadecimal notation used? How Is ASCII used to represent characters? Why is Unicode needed?	Tier 2 • Representation • Addition • Subtraction • Multiplication • Decimal • Compression • Resolution Tier 3 • Denary • Binary • Hexadecimal • Overflow error • Underflow error • ASCII • Unicode • Sample rate • Sample size	Data can be represented in many different forms. You can see this happening throughout time, for example, in the use of cave paintings and clay tablets, through to the use of Morse code. Data and instructions in a computer are formed using a series of 1s and 0s. In this unit, learners will discover how numbers, letters, images, and sound are represented with 1s and 0s. They will also learn about the factors that impact on the quality of those representations, such as bit depth. Finally, learners will be introduced to the concept of compression and discover how to perform run length encoding and Huffman coding as forms of lossless compression.

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		Why does analogue sound data need to be converted into binary digits? What effect does sample rate, duration and resolution have on playback quality and size of sound files? Why does data need to be compressed?		
Year 10 Summer 1	Programming: Sequencing and Selection	How do computers and humans interpret instructions differently? What benefits do subroutines give programmers? Why are variable used? For what purposes are different data types required? How can validation checks improve the robustness of programs? How is nested selection used in programs?	Tier 2 • Instructions • Translator • Interpreter • Sequence • Declaration • Initialisation • Assignment • Variables • BIDMAS • Add, subtract, multiply, power, integer division • Selection Tier 3 • Compiler	This extensive programming unit takes pupils from being complete novices to having the confidence to tackle any GCSE-level programming challenge. Essential programming theory is also interleaved into the practical elements of programming to provide tangible links between required knowledge and skills. The latest pedagogical research has been used to ensure that pupils are appropriately scaffolded and challenged as they move through the lessons. pupils that have already programmed with a text-based language might advance through the earlier lessons at a faster rate than planned. Explorer tasks have been provided to help stretch pupils that need a further challenge.

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			• IDE • Subroutines • Logic error • Syntax error • Value error • Validation checks • Real division • MOD • Boolean • Real / float • String • Nested selection • Machine code	
Year 10 Summer 2	Programming: Iteration and Subroutines	What is iteration? How can a while loop improve programming? What is the difference between a for loop and a while loop? Why do we need validation checks? What is the purpose of pseudocode?	Tier 2 • Executed • Parameters • Functions • Variables • Structured • Constant Tier 3 • Iteration • Trace table • While loop • For loop • Validation checks	This extensive programming unit takes pupils from being complete novices to having the confidence to tackle any GCSE-level programming challenge. Essential programming theory is also interleaved into the practical elements of programming to provide tangible links between required knowledge and skills. The latest pedagogical research has been used to ensure that pupils are appropriately scaffolded and challenged as they move through the lessons. pupils that have already programmed with a text-based language might advance through the earlier

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		What is the difference between a function and a procedure? What are advantages of the structured approach to programming? What is iterative testing?	• Pseudocode • Subroutine • Truth table • XOR operator	lessons at a faster rate than planned. Explorer tasks have been provided to help stretch pupils that need a further challenge.
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Year 11 Autumn 1	Computer Systems and Networks: Impact of Technology	How does technology impact us? What are the consequences for misusing technology? What is a stakeholder? Should hacking be illegal? What would life be like without mobile phones? Should the government be listening to us? Is technology good for the environment?	Tier 2 • Privacy • Legal • Ethical • Impact • Environmental • Cultural • Legislation • Stakeholder • Copyright • Downtime • Social media Tier 3 • Creative commons • Freedom of Information Act • Computer Misuse Act • Digital divide • Artificial intelligence	This unit has been designed to enable GCSE students to gain knowledge and understanding of the impact of technology on individuals, organisations, and the planet. Through a range of real-world examples, they will learn how to identify the specific type of impact, ie legal, cultural, privacy, environmental, and ethical. They will then progress to identifying stakeholders who are impacted by technology, and learn how these impacts are experienced, negated, or adapted to. Throughout the unit, learners will be encouraged to discuss their views and make use of sample long-form answers as either cloze or comprehension exercises, to further develop their rhetorical skills. Lastly, they will complete an assessment and identify which of the technologies that they have studied they believe to have had the most negative or positive effect on our society as a whole.

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Year 11 Autumn 2	Computer Systems and Networks: Networks	What is a computer network? What would you use a PAN for? What is a network topology? When would you use wired or wireless networks? How do you calculate the transmission time of a file over a network? What is the Internet? What is 'the cloud' and what is it used for? What is a protocol and what purpose do they have? Why is it important to protect your network?	Tier 2 • Network • Wired / wireless • Range • Browser • Cloud Tier 3 • Peer-to-peer • Client-server • PAN, LAN, WAN • Network hardware (WAP, router, switch, hub, NIC, bridge) • MAC address • Topology (bus, ring, mesh, star) • Bandwidth • Latency • Transmission rate • IP address • DNS • Network protocols (Ethernet, WiFi, HTTP, HTTPS, FTP, POP, SMTP, IMAP) • Network security • Social engineering	Computer networks have become an integral part of our daily lives. This unit allows pupils to explore how a computer network works from the hardware required to the protocols used for communication. It also allows them to explore simulations of networks using Packet Tracer software. Packet Tracer is free for schools to use and is used in universities to train network engineers.
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			Malicious software	
Year 11 Spring 1	Media: Algorithms	What is computational thinking? How can algorithms be represented? How can trace tables help recognise errors in an algorithm? How does a linear search algorithm operate? How does a binary search algorithm operate? In which situations would you use the different search algorithms? How does a bubble sort algorithm operate? How does an insertion sort algorithm operate? How does a merge sort algorithm operate? How do the sorting algorithms compare?	Tier 2 - Decomposition - Abstraction - Flow charts Tier 3 - Computational thinking - Abstraction - Trace table - Linear search - Binary search - Bubble sort - Insertion sort - Merge sort	The main focus of this unit is on searching and sorting algorithms, though other topics are covered, such as computational thinking, flow charts, and tracing algorithms. Learners will have opportunities to analyse, interpret, modify, and implement a range of algorithms. Each lesson that introduces a new searching or sorting algorithm uses numbers hidden under cups to help learners visualise how the algorithm works step by step. This is so that learners can better understand how a computer executes these algorithms, as a computer cannot 'see' all of the items in a list at once as a human can, but instead is only able to compare two values at a time. There are also written instructions alongside each of these steps that together represent the algorithm in structured English; coded solutions are provided in a subsequent lesson.

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				There are many crossovers with the KS4 Programming units, the lessons that involve tracing code (Lesson 3), coding linear search and binary search (Lesson 6) and coding bubble sort and insertion sort (Lesson 9) require learners to be familiar with programming concepts such as selection, iteration, and lists. However, the lessons on computational thinking, representing algorithms, and introducing the searching and sorting algorithms can be taught without any prior programming experience.
Year 11 Spring 2	Data and Information: Databases and SQL	What is the difference between a flat file database and a relational database? What is the purpose of different data types? What is the function of SQL? How can SQL be used to modify a database?	Tier 2 • Table • Record • Field • Insert • Update • Delete Tier 3 • Flat-file database • Relational database • Primary key • Foreign key	This unit introduces learners to the world of databases and SQL. Learners explore the key terms used in a database and learn why relational databases are used to eliminate the redundancy and inconsistencies that can occur in a flat file database. Next, they explore increasingly challenging SQL commands where they retrieve, update, and delete data in a relational database.
Year 11 Summer 1	Programming:	What is the function of string operators?	Tier 2 • Operators	This extensive programming unit takes pupils from being complete novices to

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	Strings, Lists, Dictionaries and Datafiles	When would a substring be used? What is the difference between a list and an array? Why would you need to create text files with Python?	• Program • List • Function • Dictionary Tier 3 • For loop • Substring • ASCII • Array • Append • Pseudocode	having the confidence to tackle any GCSE-level programming challenge. Essential programming theory is also interleaved into the practical elements of programming to provide tangible links between required knowledge and skills. The latest pedagogical research has been used to ensure that pupils are appropriately scaffolded and challenged as they move through the lessons. pupils that have already programmed with a text-based language might advance through the earlier lessons at a faster rate than planned. Explorer tasks have been provided to help stretch pupils that need a further challenge.
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