Computer Science Knowledge Sequencing KS3

By the end of key stage three we want all students of Computer Science to **know** and be able to **do** the following things:

Understand the risks & their responsibilities when using technology, be able to use a range of commonly used applications skilfully and creatively, understand some of the underlying principles of Computer Science, and be able to write simple code.

Prior Knowledge	Students will begin Year 7 with varying degrees of IT skills depending on their feeder school, but we expect most to possess basic IT skills and an awareness of E-Safety.
Future Knowledge	The KS3 curriculum is designed to prepare students for further study of Computer Science at GCSE level, develop core skills to support their wider studies and working life, and provide a basis for safe and responsible use of technology.

	Topic	Key Knowledge	Assessment Focus
Year 7	1	The aim of this unit is to develop students' knowledge of the school network and acceptable use policy and develop their knowledge g of E-Safety keywords and issues at an age-appropriate level.	Key rules and E-Safety keyword assessment.
	2	The aim of this unit is to develop students' knowledge of Microsoft Office skills and their ability to produce an attractive and effective presentation that is well suited to its audience and purpose, using a range of gathered resources and software tools appropriately.	Ability to gather, prepare, and use sources to produce an effective presentation following standard conventions.
	3	The aim of this unit is to develop students' knowledge of spreadsheets focusing on keywords and basic structure, formatting, formulae, and functions in Excel.	Understand the key vocabulary and be able to use basic formatting, formulae, and functions in a spreadsheet .
	4	The aim of this unit is to introduce students to knowledge surrounding website development using HTML & basic CSS by creating a website on a given topic: Endangered Animals	Understand the basic structure of HTML and be able to produce a simple webpage using standard tags and basic styling.
	5	The aim of this unit is to develop students' knowledge of bitmap images and to produce a range of graphics for use in their games	Know how to use a range software tools to produce digital artefacts for their game.
	6	The aim of this unit is to introduce students to knowledge of block-programming, developing a simple game using MIT scratch using the core programming principles of sequence, selection, and iteration.	Know how to produce a working game making use of basic sequencing, selection, and iteration.
	Topic	Key Knowledge	
Year 8	1	The aim of this unit is for students to research and develop an idea for a new local business and then use knowledge of traditional marketing techniques to promote it, using a range of core Office skills focusing on presenting information.	Know the role of house style and be able to produce high-quality, error-free documents using Desk Top Publishing and other supporting applications.
	2	The aim of this unit to further extend students' knowledge and skills in HTML and CSS to produce an online presence for their business from the previous unit.	Know how to use more complex HTML/CSS and be able to produce a website using standard tags and inline CSS styling.
	3	The aim of this unit is to Introduce students to knowledge of text-based programming and to further develop their understanding of basic programming constructs: sequence, selection, and iteration.	Know the basic programming constructs and be able to write simple programs using Microsoft Small Basic.
	4	The aim of this unit is to further develop students' knowledge of spreadsheets focusing on keywords and more advance formatting, formulae, and functions to analyse and present data.	Know the key vocabulary and be able to use more advanced formatting, formulae, and functions in Excel.
	5	The aim of this unit is to develop students' knowledge of primary and secondary research, know how to accurately reference sources, and be able to plan and carry out primary research, analysing and presenting their results using previously developed skills.	Know the difference between primary and secondary research, and be able to acknowledge secondary sources, design and distribute an online survey, and analyse/present their findings clearly and accurately.
	Topic	Key Knowledge	
Year 9	1	The aim of this unit is to Introduce students to knowledge of computational mathematics: number bases, binary/denary/hex conversion, and binary addition	Know about the use of number base systems (2,10, and 16) and be able to convert between decimal, binary, and hexadecimal numbers, and add binary numbers.
	2	The aim of this unit is to Introduce students to knowledge surrounding the concept of data encoding (text, images, and sound) and the role of encryption in the modern world.	Know the keywords, the factors that affect data encoding/quality, the role of encryption, and be able to apply simple ciphers.
	3	The aim of this unit is to Develop students' knowledge of the range of devices available, the main components inside a desktop PC and how to compare technical specifications. The unit also briefly introduces the role of system software and some of the threats to computer systems.	Know how to describe the role of key components and the factors that affect a system's performance.

4	The aim of this unit is to build on students' prior coding knowledge (sequence, selection, iteration) and introduce them to Python.		Know the basic programming constructs and be able to write simple and more complex programs using Python.
5	The aim of this unit is to develop students' Office knowledge in preparation for future study/life and to increase their awareness of potential health issues related to technology use.		Know the risks posed by long-term IT use and know how to avoid/minimise them.
6	The aim of this unit is for students to gain knowledge of some of the threats to society and individuals from Cyber Crime and the laws that exists to protect us, and to reinforce the importance of E-Safety and responsible use of social media as they prepare for adult/professional life.		Know about some of the threats to business/society, know how to avoid/minimise them, and be aware of relevant legislation.

Opportunities for developing literacy skills and developing learner confidence and enjoyment in reading	Links to British Values	Links to Careers	Links to Other Personal Development

• Pupils discuss definition and etymology of key words in class. Subsequently pupils will record a glossary of words in their books for reference.
• Class teachers apply school literacy and marking policy to help support pupils.
• Suggested/Further reading in addition to lesson resource/reading tasks listed below:
 	
Programming:
 	
  o Computer Coding Python Projects for Kids – Carol Vorderman
  o Ada Lovelace cracks the code – Jestine Ware
  o Computational fairy tales - Jeremy Kubica
  o https://smallbasic-publicwebsite.azurewebsites.net/tutorials
  o https://www.computingatschool.org.uk/data/tft/01p2/03Handouts/0204Introducing_Small_Basic_Guide.pdf
  o Girls Who Code: Learn to Code and Change the World by Reshma Saujani
  o https://www.w3schools.com/Python/default.asp
 	
Office Apps:
 	
  o https://thenewstack.io/how-visicalcs-spreadsheets-changed-the-world/
  o https://edu.gcfglobal.org/en/subjects/office/
 	
Web Design
 	
  o https://www.w3schools.com/html/
  o https://html.com/
  o https://www.tutorialspoint.com/html/index.htm
 	
E-Safety & Cyber Crime
 	
  o Bullies, Cyberbullies and Frenemies by Michele Elliott
  o Amy (Internet Safety) - Mary Hooper
  o https://www.childline.org.uk/info-advice/bullying-abuse-safety/online-mobile-safety/staying-safe-online/
  o The Secret Life of Bletchley Park: The WWII Codebreaking Centre and the Men and Women Who Worked There
  o https://www.ncsc.gov.uk/section/information-for/individuals-families
	Mutual Respect:
	  • Behave appropriately, allowing all participants the opportunity to work effectively.
	  • Review each other's work thoughtfully and work collaboratively to share ideas and solve problems.
	
	Tolerance:
	  • Understand the role of women and other under-represented groups in the history of Computer Science
	  • Be supportive of peers with a different experience of technology to themselves.
	
	Rule of Law:
	  • Follow safe practice in the classroom and understand consequence if the rules are not followed.
	  • Have an awareness of the school's acceptable use and BYOD policies.
	  • Understand the role of legislation that governs our use of technology in the UK, including the Computer Misuse Act and Copyright, Designs and Patents Act.
		• Lesson resources present links to relevant careers for pupils' reference – GB4
		• Further/higher education and careers opportunities are signposted in lessons and classroom displays-GB7/8
		• Pupils are regularly supported and provided with guidance to enable further study of Computer Science.
		• Develop core Office and organisational skills to support further study and work in all areas of life
			Living in the wider world
			  • Understanding the risks associated with the online world and how to avoid/minimise them.
			
			Relationships:
			  • Promotion of women in STEM
			  • Recognition and celebration of Computer Scientists of different culture and members of the LGBTQIA+ community
			
			Health and wellbeing
			  • Managing study and revision time effectively and knowing how to effectively revise
			  • Recognising new challenges and the importance of problem-solving and resilience
			  • Knowing how to minimise health risks associated with the use of technology.

Extra-Curricular and Co-Curricular Opportunities	Links with other subjects in the curriculum
Cyber/Game related competitions when available + wider STEM activities.	Mathematics: Averages, charts/graphs, number bases, conversion, Business studies: marketing and data handling/interpretation English and MFL: etymology of words Arts: house style, colour theory

Computer Science Knowledge Sequencing KS4

By the end of Key Stage 4 we want all students of GCSE Computer Science to **know** and be able to **do** the following things:

- *Know the risks & their responsibilities when using technology.*
- *Know some of the underlying principles of Computer Science including the Von Neumann architectures, the role of primary/secondary storage, computer networks.*
- *Know and understand the taught algorithms.*
- *Know how to write robust programs using data structures, decomposition, database connectivity, and simple GUIs.*

The OCR J277 specification can be found [here](#).

Prior Knowledge	Students will have studied a range of supporting topics as part of the Key Stage 3 Curriculum, including: core office skills, computational mathematics, hardware and software components, and basic Python programming.
Future Knowledge	The GCSE Computer Science course provides a solid foundation for further study of the subject at A-Level and focuses on knowledge and skills applicable in all STEM subjects, including problem-solving, thinking logically, and data analysis.

	Term	Key Knowledge	Assessment Focus
Year 10	1	1.2.3: The units of data storage, how data needs to be converted into a binary format to be processed by a computer, data capacity and calculation of data capacity requirements. 1.2.4: How to convert positive denary whole numbers to binary numbers, add two binary integers together, explain overflow errors which may occur, how to convert positive denary whole numbers into 2-digit hexadecimal numbers and vice versa, how to convert binary integers to their hexadecimal equivalents and vice versa, binary shifts. 1.2.5: The role of compression and lossy vs. lossless 2.4.1: Boolean logic including truth tables and simple circuits	GCSE exam questions covering the studied topics.
	2	2.1.1: Principles of computational thinking 2.1.2 and 2.2.1: Designing, refining and correcting algorithms, including the use of IPO, pseudocode, flowcharts, ERL, and trace tables	GCSE exam questions covering the studied topics.
	3	2.1.3: Searching and sorting algorithms: Abstraction, decomposition, and logical thinking. 2.3.1: defensive design and maintainability 2.3.2: The purpose of testing, types of testing, and selection of test data.	GCSE exam questions covering the studied topics.
	4	2.2.3: More advanced programming techniques including: file handling, SQL databases, data structures, the use of sub-routines, and simple GUIs. 2.5.1: High/Low level languages and the role of translators 2.5.2: the IDE, including error diagnostics, and debugging tools	GCSE exam questions covering the studied topics.
	5	This term is used to practice and further develop students' knowledge of algorithm design, programming, and testing in preparation for their independent programming project.	Programming skills
	6	During this term students complete their independent programming project to further embed their core programming skills. Towards the end of the term we also recap all key topics	Programming project and GCSE exam questions covering all topics studied to date.
	Term	Key Knowledge	
Year 11	1	1.2.1: The Von Neumann Fetch-Decode-Execute cycle, the main components within a CPU, and the key performance indicators. 1.2.2: Differences between primary and secondary storage, the different types within each category, their role, and the key performance indicators	GCSE exam questions covering the studied topics.
	2	The first half of the term is used to prepare/revise for mocks and recap prior learning. 1.5.1 and 1.5.2: The role of System software and utility software	GCSE exam questions covering the studied topics.
	3	1.3.1: The different types of networks, the hardware needed to connect to them, network architectures and topologies, cloud computing, and the role of DNS. 1.3.2: Network protocols, IP/MAC addressing, and wired/wireless connection.	GCSE exam questions covering the studied topics.

4	1.4.1 and 1.4.2: The threats to computer networks/systems and how to minimise/prevent them. 1.6.1: Knowledge of the cultural, ethical, and environmental issues related to technology and the legislation that exists to protect use		GCSE exam questions covering the studied topics.
5	This term is used to recap taught content and work on examination technique in preparation for terminal examinations.		Examination technique
6	Examinations		

Opportunities for developing literacy skills and developing learner confidence and enjoyment in reading	Links to British Values	Links to Careers	Links to Other Personal Development

• Pupils discuss definition and etymology of key words in class. Subsequently pupils will record a glossary of words in their books for reference.
• Class teachers apply school literacy and marking policy to help support pupils.
• Suggested/Further reading in addition to lesson resource/reading tasks listed below:
 	
Programming:
 	
   o Computer Coding Python Projects for Kids – Carol Vorderman
   o Ada Lovelace cracks the code – Jestine Ware
   o Computational fairy tales - Jeremy Kubica
   o Once upon an algorithm - Martin Erwig, 2017
   o https://smallbasic-publicwebsite.azurewebsites.net/tutorials
   o https://www.computingatschool.org.uk/data/tft/01p2/03Handouts/0204Introducing_Small_Basic_Guide.pdf
   o Girls Who Code: Learn to Code and Change the World by Reshma Saujani
   o https://www.w3schools.com/Python/default.asp
 	
Office Apps:
 	
   o https://thenewstack.io/how-visicalcs-spreadsheets-changed-the-world/
   o https://edu.gcfglobal.org/en/subjects/office/
 	
E-Safety & Cyber Crime
 	
   o Bullies, Cyberbullies and Frenemies by Michele Elliott
   o Amy (Internet Safety) - Mary Hooper
   o The Teen's Guide to social media … and Mobile Devices: 21 Tips to Wise Posting in an Insecure World   Jonathan McKee
   o The new Turing omnibus: 66 excursions in computer science - AK Dewdney, 2003
   o https://www.childline.org.uk/info-advice/bullying-abuse-safety/online-mobile-safety/staying-safe-online/
   o The Secret Life of Bletchley Park: The WWII Codebreaking Centre and the Men and Women Who Worked There
   o https://www.ncsc.gov.uk/section/information-for/individuals-families
	Mutual Respect:
	• Behave appropriately, allowing all participants the opportunity to work effectively.
	• Review each other's work thoughtfully and work collaboratively to share ideas and solve problems.
	
	Tolerance:
	• Understand the role of women and other under-represented groups in the history of Computer Science
	• Be supportive of peers with a different experience of technology to themselves.
	
	Rule of Law:
	• Follow safe practice in the classroom and understand consequence if the rules are not followed.
	• Have an awareness of the school's acceptable use and BYOD policies.
	• Understand the role of legislation that governs our use of technology in the UK, including the Computer Misuse Act, DPA, and Copyright, Designs and Patents Act.
		• Lesson resources present links to relevant careers for pupils' reference – GB4
		• Further/higher education and careers opportunities are signposted in lessons and classroom displays-GB7/8
		• Pupils are regularly supported and provided with guidance to enable further study of Computer Science.
		• Develop core Office and organisational skills to support further study and work in all areas of life
			Living in the wider world
			• Understanding the risks associated with the online world and how to avoid/minimise them.
			
			Relationships:
			• Promotion of women in STEM
			• Recognition and celebration of Computer Scientists of different culture and members of the LGBTQIA+ community
			
			Health and wellbeing
			• Managing study and revision time effectively and knowing how to effectively revise
			• Recognising new challenges and the importance of problem-solving and resilience
			• Knowing how to minimise health risks associated with the use of technology.

Extra-Curricular and Co-Curricular Opportunities	Links with other subjects in the curriculum
Cyber related competitions when available and lunch-time coding/support in CO1	Mathematics: Averages, charts/graphs, number bases, conversion, Science and Business studies: data handling/interpretation English and MFL: etymology of words

Computer Science Knowledge Sequencing KS5

By the end of GCSE, we want all students of Computer Science to **know** and be able to **do** the following things:

- *Know the risks & their responsibilities when using technology.*
- *Know some of the underlying principles of Computer Science including the Von Neumann and Harvard architectures, the operation of primary/secondary storage, computer networking, encryption/hashing, Boolean algebra.*
- *Know the taught algorithms, including Big O notation.*
- *Know how to write robust and modular/OO programs using classes/objects, data structures, database connectivity, 3rd party libraries, and more complex GUIs.*

The OCR H446 specification can be found here.

Prior Knowledge	All students should possess the required mathematical skills, and most/all will have studied Computer Science at GCSE level giving them a foundation in the required knowledge and programming skills.
Future Knowledge	The A-Level Computer Science course provides a solid foundation for further study of the subject, and related STEM subjects, at degree/apprenticeships.

	Term	Key Knowledge	Assessment Focus
Year 12	1	**KSHS:** 1.4.1 and 1.4.3: Students develop their knowledge of computational mathematics, focusing on normalised binary form floating point numbers, learn the taught circuits, and how to use Karnaugh maps to simplify Boolean Expressions. **CGS:** 2.1: Students gain knowledge of the main computational methods and are introduced to Java as the course language, including the fundamentals of OO methodology	A-Level exam questions covering the studied topics
	2	**KSHS:** 1.1 , 1.1.3, 1.2.4c: Students gain knowledge of processor architecture, including Von Neumann and Harvard, the Fetch-Decode-Execute Cycle, and the role of GPUs/concurrent processing models. They will also study the role of RAM/ROM/Peripherals and learn how to write simple programs using assembler/LMC. **CGS:** 2.1 and 2.2: Students extend their knowledge of computational methods and continue to extend their knowledge of Java /Object-Oriented programming, including the cores concepts: encapsulation, polymorphism, and inheritance	A-Level exam questions covering the studied topics
	3	**KSHS:** 1.3.1 and 1.3.4: Students know how to create websites using HTML, CSS, and JavaScript, the role of DNS, the TCP/IP stack, PageRank/indexing algorithms, asymmetric encryption, hashing, and common compression algorithms. **CGS:** 2.1: Students continue to further develop their knowledge of OO programming and use of computational thinking and are introduced to the first data structures of the course: Queues and Stacks	A-Level exam questions covering the studied topics
	4	**KSHS:** 1.5: Students investigate and expand their knowledge of social, ethical, cultural, and legal issues related to technology and learn about the legislation that exists to protect the public and organisations: DPA, CDP, and CM. 1.2.1 and 1.2.2: Students know about the role of application software, system software, and the role of the O/S including: processor scheduling algorithms and memory management techniques. **CGS:** Students know about recursive algorithms, scope, and common IDE features focusing on testing/debugging.	A-Level exam questions covering the studied topics
	5	**KSHS:** 1.3.3: Students will extend their knowledge of networking, focusing on network hardware, standards/topologies, and packet-switching. **CGS:**	A-Level exam questions covering the studied topics

		2.3.1: Students know about search/sort algorithms and are introduced to the data structures and their common operations: arrays, lists, queues, and stacks	
	6	**KSHS:** 1.3.2: Students will know about relational database design and the use of SQL to create and interrogate databases. 1.2.3: Students will know about project lifecycles, including waterfall, RAD, and XP. **CGS:** 3: Students will focus on their NEA, agreeing a project with their supervising teacher and starting their analysis.	A-Level exam questions covering the studied topics. NEA Mark Scheme: Analysis
Year 13	Term	**Key Knowledge: During Terms 1-4 lesson time at both sites is divided between NEA work and recap/additional theory work**	
	1	**KSHS:** 1.4.1 and 1.4.3: Recap Year 12 content and know how to perform bitwise manipulation and algebraic simplification of Boolean statements. 1.1, 1.1.3, 1.2.4c: Recap Year 12 content and know about CISC/RISC architectures, pipelining, and addressing modes in assembler. **CGS:** 2.3.1: Students will know about linked list, tree, and graph data structures and the common operations including Big O notation and traversals.	A-Level exam questions covering the studied topics. NEA Mark Scheme: Analysis and Design
	2	**KSHS:** 1.2.2: Students will know about the role and type of translators, the stages of compilation, and use of linkers/loaders. 1.3.1.: Recap Year 12 content and know about client-side versus server-side processing. **CGS:** 2.3.1: Students will know about linked list, tree, and graph data structures and the common operations including Dijkstra, A* and the role of heuristics.	A-Level exam questions covering the studied topics. NEA Mark Scheme: Development and Testing
	3	**KSHS:** 1.2.1: Recap Year 12 content and know about ISR handling and the use of virtual machines. 1.3.2: Recap Year 12 and know how to normalise to 3NF and apply ACID to database transactions. 1.2.3: Recap Year 12 content **CGS:** 3: Recapping Year 12 content in preparation for mocks and on their NEA, applying the taught skills to their project.	A-Level exam questions covering the studied topics. NEA Mark Scheme: Development and Testing
	4	**KSHS:** 1.3.3: Recap Year 12 content and know about client-server/peer-to-peer architecture, network threats, and network security. 1.5.1: Recap Year 12 content and know about the Regulation of Investigatory Powers Act. **CGS:** 3: Students focus on their NEA, applying the taught knowledge to their project.	A-Level exam questions covering the studied topics. NEA Mark Scheme: Testing and Evaluation
	5	This term is used to recap taught content and work on examination technique in preparation for terminal examinations.	Examination technique
	6	Examinations	

Opportunities for developing literacy skills and developing learner confidence and enjoyment in reading	**Links to British Values**	**Links to Careers**	**Links to Other Personal Development**

- Pupils discuss definition and etymology of key words in class. Subsequently pupils will record a glossary of words in their books for reference.
- Class teachers apply school literacy and marking policy to help support pupils.
- Students are also encouraged to stay abreast of the latest tech news and current affairs.
- Suggested/Further reading in addition to lesson resource/reading tasks listed below:

  - Crashing Computers (Totally) - Michael Coleman
  - Once upon an algorithm - Martin Erwig, 2017
  - Nine Algorithms that Changed the Future: The Ingenious Ideas that Drive Today's Computers John MacCormick
  - But How Do it Know? – The Basic Principles of Computers for Everyone   J Clark Scott
  - Hackers: Heroes of the Computer Revolution - Stephen Levy
  - Algorithms to live by: the computer science of human decisions. London: Christian, B. and Griffiths, T. (2016)
  - Blown to bits: your life, liberty, and happiness after the digital explosion. Ledeen, K., Lewis, H.R., Abelson, H. and Lewis, H. (2008. 2nd edition 2019).
  - https://www.w3schools.com/Python/default.asp
  - https://www.w3schools.com/java/
  - https://www.tutorialspoint.com/java/index.htm
  - https://www.w3schools.com/html/
  - https://www.tutorialspoint.com/html/index.htm

Tech news & current affairs
- https://www.bbc.co.uk/news/technology
- https://www.cnet.com/news/
- https://www.wired.co.uk/

Mutual Respect:
- Behave appropriately, allowing all participants the opportunity to work effectively.
- Review each other's work thoughtfully and work collaboratively to share ideas and solve problems.

Tolerance:
- Understand the role of women and other under-represented groups in the history of Computer Science
- Be supportive of peers with a different experience of technology to themselves.

Rule of Law:
- Follow safe practice in the classroom and understand consequence if the rules are not followed.
- Have an awareness of the school's acceptable use and BYOD policies.
- Understand the role of legislation that governs our use of technology in the UK, including the Computer Misuse Act, DPA, Copyright, Designs and Patents Act, and RIPA.

- Lesson resources present links to relevant careers for pupils' reference – GB4
- Further/higher education and careers opportunities are signposted in lessons and classroom displays-GB7/8
- Pupils are regularly supported and provided with guidance to enable further study of Computer Science.
- Develop core Office and organisational skills to support further study and work in all areas of life

Living in the wider world
- Understanding the risks associated with the online world and how to avoid/minimise them.

Relationships:
- Promotion of women in STEM
- Recognition and celebration of Computer Scientists of different culture and members of the LGBTQIA+ community

Health and wellbeing
- Managing study and revision time effectively and knowing how to effectively revise
- Recognising new challenges and the importance of problem-solving and resilience
- Knowing how to minimise health risks associated with the use of technology.

Extra-Curricular and Co-Curricular Opportunities

Cyber related competitions when available and lunch-time coding/support in CO1

Links with other subjects in the curriculum

Mathematics: Averages, charts/graphs, number bases, conversion, standard form, exponential/logarithms
Science and Business studies: data handling/interpretation
English and MFL: etymology of words