Curriculum Progression Pathway

COMPUTER SCIENCE

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Why is the study of Computer Science important?

Computer Science is the study of the principles and use of computers. Its study will make you question how the systems that you use in a modern day society work and encourage you to explore the concepts behind the technology you use and develop skills to become a creator of technology yourself. From Year 7 you will have the exciting opportunity to develop and consolidate basic ICT skills that will allow you to access more complex Computer Science concepts. From there you will study the four cornerstones of Computational Thinking, these are crucial as they can be applied to any computer science context and will provide firm foundations for other topics within the subject. From this, key programming constructs can be learnt, allowing you to develop programming skills in more than one environment, this will help you to understand key similarities between different programming environments and develop key skills in problem solving and debugging. These skills will be further consolidated and mastered in text based programming languages throughout your study, applying the cornerstones of Computational Thinking in a wealth of scenarios to develop your problem solving skills. Computer Science theory is also explored, looking 'under the bonnet' of the computer systems that you use on a day-to-day basis. Key systems hardware are investigated, including how networks are formed, the inherent security risks that networked devices produce and how to mitigate against these risks. Computer Security is currently one of the biggest risks to national security, is relevant, interesting, and provides you with knowledge that can help you become a responsible e-citizen. Your study of Computer Science will encourage you to think deeply and help you more effectively to become a resilient problem solver that understands the technological world in which we live – a great life skill that all universities and employers will appreciate.

Across your study you will explore fundamental principles and concepts of Computer Science, including abstraction, decomposition, logic, algorithms, and data representation. You will analyse problems in computational terms through practical experience of solving such problems, including designing, writing and debugging programs. Furthermore, the subject will teach you to think creatively, innovatively, analytically, logically and critically and understand the impacts of digital technology to the individual and to wider society. Lessons will provide a wide range of opportunities for practical application of key concepts through a chosen programming language as well as plenty of opportunities for you to investigate how computers work. In addition, there will be opportunities for extended discussion about the ethical, moral and social implications of technology in society. Computer Science offers significant challenges, this is because it is a subject that encourages technological progress and breaking new ground, but this is what makes it exciting! Can you apply the concepts, knowledge and skills you have learnt in a creative way that others haven't thought of before? Can you identify an area of computer science that provides further technological development? Seems challenging – but you are going to love it! Computer Science will expand your mind!

Big Questions will be explored such as are the developments in artificial intelligence affecting job prospects and opportunity? Is technology creating a digital divide that further disadvantages people in developing countries? Can you create a program for a specific scenario to solve a problem? What opportunities and issues does the internet develop? All of these questions are key and can be explored by understanding key computer science concepts both through theory and practical application. I bet you can't wait to get started?

What skills will the study of Computer Science teach you?

You are a citizen in this world and you need to know how to solve problems using technology and the key concepts involved in the technology that we have become so dependent on. It will teach you to…

- Apply computational thinking techniques (abstraction, decomposition, pattern recognition, algorithms) in a range of scenarios to solve problems.
- Develop resilience by not being afraid of challenges when solving problems, but to break them down and keep trying.
- Be creative in a subject that may not be renowned for it – there is no limit to creativity when you create the solution.
- How to act responsibly online to ensure that you and others stay safe online.
- Identify the key programming constructs (sequence, selection, iteration) required to solve a problem.
- Apply the key programming constructs (sequence, selection, iteration) to any programming language.
- Work independently and part of a team to solve complex problems.
- Construct reasoned arguments to ethical, social and moral problems that have arisen due to technology and communicate these in an effective way.
- Identify links between different elements of computer science
- Evaluate different methods of representing data and decide on the most suitable method for presentation/storage

What will you know and understand from your study of Computer Science?

- How computers processes data, the architecture of a CPU (von Neumann) and the characteristics that affect the performance of computer systems
- Different types of computer system and how embedded systems are used in society
- Methods of storage within a computer system, including primary and secondary storage
- How to calculate storage requirements for a range of different types of file
- The suitability of different storage devices based on capacity, cost, speed, portability, durability and reliability
- Different types of networks and factors that affect the performance of networks
- Hardware required to create a network and the different responsibilities of the different type of hardware
- How the internet is used for access to the WWW and online storage
- How the TCP/IP (the rules used to send data across a network) stack works, the different protocols related to each layer and their roles
- Threats to network and system security and how to prevent/overcome these problems
- Different types of software (operating systems and utility software) and their roles within a computer system
- Ethical, cultural and environmental issues that have arisen due to technology
- Different legislation that relates to computers and technology
- Different searching and sorting algorithms and how they are used
- The key programming constructs (sequence, selection and iteration) and how these can be written in a text based programming language
- The use of file handling in a programming language
- How SQL (structured query language) can be used to query and interrogate data
- The use of data types, arithmetic, Boolean and string manipulation when creating programs
- Different defensive design considerations for creating robust programs and how to implement these in programming
- How to generate test plans for a range of different scenarios
- Applying computational logic to generate truth tables for logic circuits.
- How translators are used to deal with different types of programming language
- How data is represented in computers, including binary, hexadecimal, characters, images and sound
- How compression is used in computer systems.

- How to select and combine multiple applications to achieve challenging goals, including collecting and analysing data and meeting the needs of a given scenario

How does your study of Computer Science support your study in other subjects?

Study of any subject in our curriculum takes full advantage of links with other subject areas- we term these as interdisciplinary links and we make the most of them because we know that deep learning requires the transference of knowledge and skills from one topic of learning to another. Once you can transfer your learning across topics and subject areas then you are really mastering what you know and how to apply your understanding and skills.

Computer Science touches on so many other subjects such as mathematics as you develop skills in problems solving, including decomposition (breaking down problems), abstraction (removing unnecessary detail from a problem) and pattern recognition. All of these skills will support your teaching in Mathematics as these are very important in being able to solve mathematics problems in a range of contexts. There are also links with Science as binary logic can be applied to electrical circuits in Physics and much of the technology from Computer Science can be mapped back to core principles of Science. For example, how sensors are used to monitor motion, force and/or pressure. You will learn methods of thinking and research that are widely applicable to other subject areas helping your thinking in all subjects.

How can you deepen your understanding of Computer Science?

The Computer Science department offers lots of great opportunities for you to really engage with this fabulous subject. In Year 7 & 8 we engage with an external program called iDEA (Inspiring Digital Enterprise Award). This is an online program that students can complete in addition to their lessons to develop digital and enterprise skills. It is an initiative from the Duke of York and is the digital equivalent of the Duke of Edinburgh programme. Across Year 7 to 11, students engage in the Bebras Challenge. This is a national competition run by Oxford University that assesses Computational Thinking skills. Students have to the opportunity to take part in this competition and if they are in the 10% nationally, they will be invited to Oxford university to take part in a new challenge.

Why not attend the enrichment for the iDEA programme to complete your bronze award, see if you can complete all the badges, develop your digital literacy and enterprise skills and compete against other students in the trust.

Get involved! Become a Computer Scientist!

How are you assessed in Computer Science?

Throughout the 5 years Computer Science course you are assessed using the following assessment objectives which ensure that you can cumulatively build your subject understanding in preparation for future GCSE study. There are 6 assessment points each year that we term Praising Stars©. We assess how students at their current stage of study are on track to reach their end of stage targets which are formulated on aspirational expectation from their KS2 starting points. We make an informed prediction from our holistic assessments based on our subject mapping of expectation across the Computer Science curriculum.

Key Assessment Objectives

AO1: Demonstrate knowledge and understanding of the key concepts and principles of Computer Science.

A02: Apply knowledge and understanding of key concepts and principles of Computer Science.

A03: Analyse problems in computational terms:

- to make reasoned judgements
- to design, program, evaluate and refine solutions.

How can Computer Science support your future?

Of course we offer the study of GCSE Computer Science and we encourage your continued study in this fantastic subject. Yet we know that choice and personal interest are important aspects of worthy study. Whether you have continued your study of Computer Science into GCSE or not you will have gained access to this enriching subject and its study will have taught you to think differently and deeply.

Computer Science is offered at most prestigious universities either as a single honours or a joint honours subject studied alongside other disciplines e.g. Computer Systems Engineering, Computer Games Design, Computer Science & Artificial Intelligence, Mathematics & Computer Science and Computer Forensics. The very fact that you have been able to study Computer Science e.g. computational thinking will help your future application be they for colleges, universities, apprenticeships or employment.

Careers that the study of Computer Science supports include:

- Secondary School Teacher
- Database administrator
- Software Developer
- Web Application Developer
- Computer Systems Analyst
- Mobile App Developers
- Information Security Analyst
- Computer Network Architect
- Software Tester
- Network Manager

CURRICULUM PROGRESSION PATHWAY FOR COMPUTER SCIENCE AT OUTWOOD ACADEMY HAYDOCK

	Year 7	Year 8	Year 9	Year 10	Year 11
Autumn 1	**The Outwood Welcome** **Topic Question:** How can we use Google Workspace safely and responsibly to improve our computing skills? (4 lessons)	**Data Representation** **Topic Question:** What is Binary, Denary and Hexadecimal? How can I represent different types of data using binary? (7 lessons)	**Python Part 2** **Topic Question:** How can I use the Python programming language to solve real world problems? (8 lessons)	**Python Programming** How can I use the Python Programming language to solve real world Problems? **Programming Fundamentals** Can you apply all cornerstones of computational thinking to solve a problem?	**Networking** How is data sent across a network? **System Security** How can I keep networks secure?

Autumn 2	**ICT Unit - Charlie and the Chocolate Factory (Docs and Slides)** **Topic Question:** How can ICT be used to plan and present an idea? (6 lessons)	**Python: Part 1a** **Topic Question:** How can I use the Python programming language to solve real world problems? (5 lessons)	Bebras Challenge (1 lesson) **CT Database** **Topic Question:** What are the components of a database? (6 lessons)	**Data Representation** How is data represented in Binary?	**Environmental, Ethical & Cultural** Issues in Computer Science What are the ethics and laws that need to be considered when using computers?
Spring 1	**Computational Thinking** **Topic Question:** How does computational thinking help us to solve problems? (6 lessons)	**ICT Unit: People in Technology** **Topic Question:** Who are the people who influenced the history of Computing? (6 lessons)	**Digital Forensics** **Topic Question:** How can digital artefacts be explored and analysed to reveal information about a person? (7 lessons)	**Advance Programming** How do we create robust programs?	**Revisiting Key Concepts** Recap and Recall of topics based on mock exam analysis.
Spring 2	**Block Based Programming (MicroBit)** **Topic Question:** How can Micro:bit be used to program images, text and functions? (6 lessons)	**Python: Part 1b** **Topic Question:** How can I use the Python programming language to solve real world problems? (5 lessons)	**Computer Hardware and Networking** **Topic Question:** How can I determine what hardware I need to build a school network? (6 lessons)	**Algorithms** How do we search and sort data?	**Exam Preparation**
Summer 1	**ICT Unit - Music Festival (Sheets and Docs)** Topic Question: How can IT software be used to manage a large project? (6 lessons)	Media Project (8 lessons)	**AI & Data Science** **Topic Question:** How can data science and artificial intelligence be used to solve real-world problems? (3 lessons)	**Programming Project** **System Architecture & Memory** How does the CPU and memory work together in a computer?	
Summer 2	**Text based Programming (Small Basic)** **Topic Question:** How do I use text based programming languages to		Sonic Pi (5 lessons)	**Programming Project 2**	

	solve problems? (4 lessons)				