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**Years 9 to 11 Computer Science**

Our Computer Science curriculum intends to train excellent Computer scientists. This means that they will be able to:

Develop and apply their analytic, problem-solving, design, and computational thinking skills

Students will be taught and understand the following topics

* Fundamentals of algorithms
* Programming
* Fundamentals of data representation
* Computer systems
* Fundamentals of computer networks
* Fundamentals of cyber security
* Ethical, legal and environmental impacts of digital technology on wider society, including issues of privacy

The curriculum teaches the fundamental ideas which are the building blocks of scientific understanding, and we sequence these in the best order so that students can see how these fundamental ideas link together.

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Students have been issued with a classwork and homework pack which contains the PLC, Exam Question Grid and Past Exam Paper Selection

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| **Topic** | **Key ideas** | **Why they are learning it and in what order.** | **What students often get wrong** |
| Fundamentals of algorithms | Students are taught Representing algorithms, Efficiency of algorithms, Searching algorithms, Sorting algorithms | Students learn first what an algorithm is and this is need sequenced through in the order of the key ideas. It is important that students learn first than an algorithm is a set of step by step instructions. From a fully represented algorithm a computer program can then be implemented | Definition of Algorithm, Abstraction and Decomposition  Students need to practice tracing variables with trace tables |
| Programming | Data types, Programming concepts, Arithmetic operations in a programming language, Relational operations in a programming language, Boolean operations in a programming language, Data structures, Input/output and file handling, String handling operations in a programming language, Random number generation in a programming language, Subroutines (procedures and functions), Structured programming, Robust and secure programming  Classification of programming languages | Once students understand the concept of algorithm they can then think about this being implemented. This then comes on programming. Programming is built upon each other as building blocks. The first part teaching the core concepts, then getting on to more sophisticated concepts such as subroutines and arrays | Students need to ensure they understand  Array and Array indexing  MOD/DIV  Types of Programming Languages and then the classifications of Programming Languages |
| Fundamentals of data representation | Number bases, converting between number bases, Units of information, Binary arithmetic, Character encoding, representing images, Representing sound, Data compression, | Now students have understood how instructions are taken and then developed into a represented algorithm and then implemented into a computer program. Students then go on to learn how a computer system represents data. This is introduced at the end of the programming section when machine code is discussed in the programming language representation | Students need to be clear on the left and right binary shift  Students need to also be clear on the calculations involved in representing sound |
| Computer systems | Hardware and software, Boolean logic, Software classification, Systems architecture, | In the previous section students discuss Binary and how a computer system represents data. This can now be explored to see how the Binary is used in terms of logic. And what parts of a computer system do what in terms of processing | Students need to be clear on the difference between the logic gates and the associated truth tables  Students need to be clear on the taught systems architecture |
| Fundamentals of computer networks | Understanding what a network is, the types of topologies, wired and wireless, networks and protocols which are associated | In the previous section students discuss hardware. Students will be taught in this section how we can connect hardware together and what additional hardware is needed and what rules/protocols are needed | Students need to pay particular attention to the 4 Layer Model and associated rules/protocols |
| Fundamentals of cyber security | Cyber security threats, Social engineering, Malicious code, Methods to detect and prevent cyber security threats, | In the previous section students learnt that devices can be connected. In learning this they discover that devices become more vulnerable when connected together. In this section they need discover how they can be kept safe | Students need to be clear on the different types of malware are and how to protect against them |
| Ethical, legal and environmental impacts of digital technology on wider society, including issues of privacy | cyber security, mobile technologies, wireless, networking, cloud, storage, theft of computer code, issues around copyright of algorithms, cracking, hacking, wearable technologies, computer-based implants | Throughout this whole unit students have learnt about various areas of computer science. At this point the students are positioned to be able to think about the different technologies which exist and are able to discuss the ethical, legal and environmental issues and then impacts from there | Students need to be clear on the terms ethical, legal, environmental, impact, issue and privacy. Sometimes students are unable to answer questions as they do not understand the command words being used |