



Year 12 Computer Science



What have students at St. Crispin's been taught to understand and be able to do?

Core Knowledge

Core Skills

Unit 1 - Structure and function of the processor

Students will recall their knowledge from GCSE's to dive deeper into the structure and function of the processor. Looking at specific topics such as components inside of the CPU, the fetch-decode-execute cycle; including its effects on registers, pipelining, Von Neumann and Harvard architecture.

Unit 2 - Types of processor, input, output and storage devices

Following on from unit 1 we start to look at the types of processors in which the students learn about the differences between and uses of CISC and RISC processors, GPUs and their uses and multicore and parallel systems. The students then look at how difference input, output and storage devices can be applied to different complex problems.

Unit 3 - System Software

After understanding hardware the students will now look at how system software plays a vital role in the modern day computer. We start to look at the need for operating systems, paging, segmentation and virtual memory. We progress onto Interrupts, the role of interrupts and Interrupt Service Routines (ISR), role within the Fetch-Decode-Execute Cycle and Virtual machines, any instance where software is used to take on the function of a machine, including executing intermediate code or running an operating system within another.

Unit 4 - Application generation

Building on different software the students will look at application generation, in this topic the students will learn about the nature of applications, justifying suitable applications for a specific purpose, stages of compilation (lexical analysis, syntax analysis, code generation and optimisation) and linkers and loaders and use of libraries.

A-Level specifications must require students to develop the following skills:

- take a systematic approach to problem solving
 - design, write and test programs to either a specification or to solve a problem
 - articulate how a program works, arguing for its correctness and efficiency using logical reasoning, test data, and user feedback
 - use abstraction effectively
 - apply computing-related mathematics
- In addition, A-Level specifications must require students to know and understand how to write specifications for a programming solution.



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Unit 5 - Software development

Understand the waterfall lifecycle, agile methodologies, extreme programming, the spiral model and rapid application development. Different test strategies, including black and white box testing and alpha and beta testing and test programs that solve problems using suitable test data and end user feedback, justify a test strategy for a given situation.

Unit 6 - Types of programming language

Need for and characteristics of a variety of programming paradigms.

Procedural languages:

- program flow
- variables and constants
- procedures and functions
- arithmetic, Boolean and assignment
- operators
- string handling
- file handling.

Assembly language (including following and writing simple programs with the Little Man Computer instruction set) and Object-oriented languages with an understanding of classes, objects, methods, attributes, inheritance, encapsulation and polymorphism.

Unit 7 - Compression, encryption and hashing

Building on from programming the students will have the chance to look at different compression, encryption and hashing methods these include lossy and lossless compression, run length encoding and dictionary coding for lossless compression, symmetric and asymmetric encryption and different uses of hashing.



Year 12 Computer Science continued



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Unit 8 - Databases

After understanding how encryption and hashing works, we progress onto databases and start to use this knowledge further students understanding. In databases the students will build on their GCSE knowledge to identify methods of capturing, selecting, managing and exchanging data, how to use normalization to 3NF, to write confidently in SQL, understanding the advantages and disadvantages of referential integrity and transaction processing, ACID (Atomicity, Consistency, Isolation, Durability), record locking and redundancy.

Unit 9 - Networks

From databases we start to look at how networks are created and the importance of protocols and standards. We recap on the internet structure:

- The TCP/IP Stack
- DNS
- Protocol layering
- LANs and WANs
- Packet and circuit switching.

With a deeper dive into network security and threats, use of firewalls, proxies and encryption.

Unit 10 - Web technologies

Students will be able to learn how to write in HTML, JavaScript and CSS.

They will also gain a deeper understanding of search engine indexing, pagerank algorithms, server and client side processing.



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Unit 11 - Data types

The students will use the skills and knowledge they learnt from data representation in GCSEs and develop their understanding on data types. This modules will cover the following:

- Primitive data types, integer, real/ floating point, character, string and Boolean
- Use of sign and magnitude and two's complement to represent negative numbers in binary
- Representation and normalisation of floating point numbers in binary
- Floating point arithmetic, positive and negative numbers, addition and subtraction
- Bitwise manipulation and masks: shifts, combining with AND, OR, and XOR.
- Positive and negative real numbers using normalised floating point representation.

Unit 12 - Boolean Algebra

- Define problems using boolean logic
- Manipulate Boolean expressions, including the use of Karnaugh maps to simplify Boolean expressions
- Use the following rules to derive or simplify statements in Boolean algebra: De Morgan's Laws, distribution, association, commutation, double negation
- Using logic gate diagrams and truth tables
- The logic associated with D type flip flops, half and full adders.



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Unit 13 – Moral and ethical issues

- The individual moral, social, ethical and cultural opportunities and risks of digital technology:
 - *Computers in the workforce
 - *Automated decision making
 - *Artificial intelligence
 - *Environmental effects
 - *Censorship and the Internet
 - *Monitor behavior
 - *Analyse personal information
 - *Piracy and offensive communications.
- Layout, colour paradigms and character sets.

How has learning been assessed?

Year 12 students have an official paper 1 and paper 2 mock exam near the end of the winter term and a series of assessments throughout the year to support their revision.

What is coming up in the following year?

Completing the rest of the A-Level curriculum but also putting all of this information into practice to start their programming projects.