Year 13 Computer Science

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

Core Knowledge

Unit 1 – Thinking abstractly

- The nature of abstraction
- The need for abstraction
- The differences between an abstraction and reality

Devise an abstract model for a variety of situations.

Unit 2 – Thinking ahead

- Identify the inputs and outputs for a given situation
- Determine the preconditions for devising a solution to a problem
- The nature, benefits and drawbacks of caching
- The need for reusable program components.

Unit 3 – Thinking Procedurally

- Identify the components of a problem
- Identify the components of a solution to a problem
- Determine the order of the steps needed to solve a problem
- Identify sub-procedures necessary to solve a problem.

Unit 4 – Thinking Logically

- Identify the points in a solution where a decision has to be taken
- Determine the logical conditions that affect the outcome of a decision
- Determine how decisions affect flow through a program.

Unit 5 – Thinking Concurrently

- Determine the parts of a problem that can be tackled at the same time
- Outline the benefits and trade offs that might result from concurrent processing in a particular situation.

Core Skills

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.

Year 13 Computer Science continued

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Unit 6 – Programming Techniques

- Recursion, how it can be used and compares to an iterative approach
- Modularity, functions and procedures, parameter
- passing by value and by reference
- Use of object oriented techniques.

Unit 7 – Computational methods

- Features that make a problem solvable by computational methods
- Problem recognition
- Use of divide and conquer
- Use of abstraction.

Students should apply their knowledge of:

- backtracking
- data mining
- heuristics
- performance modelling
- pipelining
- visualisation to solve problems.

Unit 8 – Algorithms

- The suitability of different algorithms for a given task and data set, in terms of execution time and space
- Standard algorithms (bubble sort, insertion sort, binary search and linear search)
- Standard algorithms (quick sort, Dijkstra's shortest path algorithm, A* algorithm, binary search)
- Representing, adding data to and removing data
- from queues and stacks
- Measures and methods to determine the efficiency of different algorithms, Big O notation (constant, linear, polynomial, exponential and logarithmic complexity)
- Algorithms for the main data structures, (stacks, queues, trees, linked lists, depth-first (post-order) and breadth-first traversal of trees).

Year 13 Computer Science continued

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

Unit 9 – Programming project (20%)

Learners will be expected to analyse, design, develop, test, evaluate and document a program written in a suitable programming language. The underlying approach to the project is to apply the principles of computational thinking to a practical coding problem. Learners are expected to apply appropriate principles from an agile development approach to the project development.

While the project assessment criteria are organised into specific categories, it is anticipated the final report will document the agile development process and elements for each of the assessment categories will appear throughout the report.

How has learning been assessed?

Year 13 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, with a final exam in the summer term.