Computer Science KS5 – Statement of Intent

"Sometimes it is the people no one can imagine anything of who do the things no one can imagine." Alan Turing

AQA A-Level Computer Science is a Sixth Form option available for current Year 13 students and future Year 12 students. There are no Year 12 students studying the subject in 2021-22.

We align to the school vision of 'Living well together with dignity, faith and hope.' Students are taught to live well together by exploring cyber security issues, exploring laws and ethics behind Computer Science. Students are afforded dignity by the provision of a laptop free of charge. Students demonstrate faith as they develop their A-Level projects, overcoming syntax and logical errors to develop a fully functional programme.

SEND students are supported in understanding abstract concepts through visual demonstrations. For example, when teaching the properties of a CPU, teachers ask students to act out physical instructions using different timings to ensure students grasp the concept of 1 Hertz being 'one instruction per second'. Teachers provide students with support structures using pink pen in their books to demonstrate the personalised support available to students.

Pupil Premium students are provided with a free laptop to ensure that they do not fall behind their peers academically through lack of resources. These are used in Computer Science lessons and across the school for homework and to allow students to review taught content when completing tasks.

High Attaining students are challenged to merge multiple concepts together (e.g. selection and iteration in programming). Extended project work is available for students to achieve higher levels of work (e.g. the creation of a game).

Substantive Knowledge

Year 12

Students will cover each specification area for AS Computer Science:

1. Fundamentals of programming

2. Fundamentals of data structures

3. Systematic approach to problem solving

4. Theory of computation

5. Fundamentals of data representation

6. Fundamentals of computer systems

7. Fundamentals of computer organisation and architecture

8. Consequences of uses of computing

9. Fundamentals of communication and networking

Year 13

Students will cover each specification area for A-Level Computer Science:

10. Fundamentals of programming

11. Fundamentals of data structures

12. Fundamentals of algorithms

13. Theory of computation

14. Fundamentals of data representation

15. Fundamentals of computer systems

16. Fundamentals of computer organisation and architecture

17. Consequences of uses of computing

18. Fundamentals of communication and networking

19. Fundamentals of databases

20. Big Data

21. Fundamentals of functional programming

22. Systematic approach to problem solving

23. Non-exam assessment - the computing practical project

Disciplinary Knowledge

The course is divided into two strands, Programming and Theory, reflecting the structure of assessments.

Programming

Our chosen programming language is Python, owing to its prevalence of use across industry and academia. Furthermore, Python is one of the "easier" languages to learn when compared with other widely employed languages such as C/C++ and Java. Python's use of indentation rather than braces to indicate blocks of code encourages good practice that will be beneficial should students branch into other programming languages. Since Python is an interpreted language, it can easily be installed on student's home computers or even written within a browser.

Students will continue to develop their programming skills beyond GCSE level, introducing the object-oriented programming paradigm, developing an understanding of why it is used through practical experience. Students will gain experience of working with a range of data structures such as queues, stacks and trees, allowing them to select a structure appropriate to a given scenario. Students will implement standard algorithms such as those employed for searching and sorting as well as learning how to evaluate their time and memory efficiency.

Theory

Students will gain an appreciation of the importance of mathematics to the fundamentals of computing as they learn about number systems (N, 71, Q, 1W), number bases and the binary system. Students will gain experience of how different forms of data, such as characters and images are represented in computer systems. Students will encrypt data using a range of ciphers and will be given the opportunity codebreak using the National Cipher Challenge resources. Students will learn about the advantages and disadvantages of high-level and low level languages through the use of

the Little Man Computer. Students will learn how to construct truth tables though the drawing of logic gate circuits. Students will develop their knowledge of the hardware components of a computer and their respective roles. Students will learn the fundamentals of communication and networking, such as network topologies. This will culminate in an understanding of the structure of the internet, infrastructure, and protocols. Students will expand their understanding of databases and will be given the opportunity to implement and manage a database in using Python's SQLite package. Students will get an opportunity to work with big data through the use of Python's ML packages, gaining an appreciation that traditional data analysis methods are not appropriate.