Computer Science Department Curriculum Statement

Intent

In computer science we aim to inspire a fascination for computer programming and a curiosity about the technologies that surround and connect us. We want students to gain the specific skills needed to program, using a variety of programming languages and paradigms. But they also need the abstract thinking skills that allow complex problems to be decomposed and systematised into algorithms, efficiently and precisely expressed. Resilience, perseverance and clarity of thought are all part of the mindset of the effective programmer and our teaching focuses strongly on the growth mindset ethos. We also believe that coding is an enjoyable and creative process that can provide a satisfying hobby as well as a rewarding career.

Our curriculum emphasises the ethical and safe ways to use and develop computer technology, and introduces students to the ever widening variety of careers that these skills unlock. Our aim is to show that computer science touches every aspect of our lives and is now an essential skill for the modern workplace. Our schemes of work are sequenced to give all students the proper foundation for success at the Edexcel GCSE and then to study Computer Science Higher level as part of the IB diploma.

We supplement the formal curriculum with weekly after school clubs in game development and robotics, and take part in STEM and computer science competitions throughout the year. These are open to everyone, but are particularly focused on encouraging more girls and non-binary students to develop an interest in coding and computer technology, since they are traditionally under-represented. The department also has its own in-house humanoid robot development project. Each year, sixth form students upgrade the software and hardware capabilities of this robot to develop their own skills and better prepare themselves for computer science and engineering paths in further education.

Implementation

a) Content & Skills

The Key Stage 3 (KS3) computer curriculum is to introduce students to fundamental concepts in computing and digital literacy.

- Understanding how to design and use algorithms to solve problems.
- Students learn to write code in languages such as Python and JavaScript. They explore concepts like variables, loops, conditionals, and functions.
- How data is represented in computers using binary, hexadecimal, and other formats.
- Basics of how computers work, including hardware components, software, and the operating system.
- Creating and editing digital content such as images, audio, and video. This includes understanding different media formats and tools for editing.

KS3		
by the end of Y7	**by the end of Y8**	**by the end of Y9**
Understand **algorithm, sequence, selection, iteration, variables** Use these concepts in a block-based language. Know the basic data types Use **if** and **input** in Python programs. Name and explain the main parts of a PC Create a simple web page in **HTML** Understand how to research and verify information online	Use **for** loops, **range**, **lists**, **string manipulation** and **random** numbers in Python Use **turtle** graphics in Python to create simple games and simulations Create web pages using both **HTML** and **CSS** Convert 8-bit **binary**, denary and **hexadecimal** numbers Add 8-bit, positive binary numbers **Decompose** problems into codable algorithms	Use **while** loops and **functions** in Python Create web pages using **HTML**, **CSS** and **JavaScript** Understand how computers represent images and are used to create digital art Understand the impact of **AI** and machine learning on the job market Understand and defend against **digital threats** online Digital literacy skills using **iDEA**

The Key Stage 4 (KS4) computer science curriculum is to develop a deeper understanding of computational concepts, problem-solving skills, programming and how computers work .

- Develop their knowledge in computer science, digital media and information technology .
- Develop and apply their analytic, problem-solving, design, and computational thinking skills .
- Understand how changes in technology affect safety, including new ways to protect their online privacy and identity, and how to identify and report a range of concerns.

KS4 - Edexcel GCSE	
by the end of Y10	**by the end of Y11**
Programming skills in Python to include **2D arrays**, **search** and **sort**, and **file handling** Understand common network **topologies** and architecture Data representation of text, sound and graphics Fetch-Decode-Execute and the **von-Neumann** architecture Explain the function and operation of the OS Data security and how they work together to protect individuals and organisations **Data representation :** two's complement binary and bit-shifting	Python skills include robust programming strategies, **debugging** techniques and complex decomposition. Students will code at a level significantly above that required by the GCSE paper 2 exam Network **protocols** and traffic management on the internet **Environmental**, **legal** and **ethical** impacts of computing T**race** algorithms - truth table Sort and Search **algorithms**

IB Computer Science HL:

In the sixth form at BGS, we offer Computer Science at IB Higher Level only. This allows us to deliver a very ambitious curriculum in which students transition to a new coding language and programming paradigm. As part of this, students must develop a useful application, written in Java, for a real client. We aim for all software development work to be complete by the end of year 12 and the first year therefore focuses primarily on developing a deep and proficient understanding of Java programming. In year 13 the curriculum broadens to consider the wider theoretical aspects of OOP, the software development lifecycle and computer hardware. Paper 3 of the Higher exam covers a case study that changes each year (past topics have included, cryptocurrency, genetic algorithms and machine learning) and therefore the curriculum must adapt each year to deliver this content.

KS5 - IB Higher Level	
by the end of Y12	**by the end of Y13**
Object Oriented Programming paradigm Coding in Java to a sufficiently high standard to allow students to complete the coding of their independent IA project GUI programming using the Swing library Abstract Data Types: **linked lists**, **stacks**, **queues**, **trees** **OSI 7 layer model** Understand and use **selection sort** Write and trace **recursive** functions Analyse **logic gates** and truth tables	Test, document and deliver the **IA project** to the client Understand the specific benefits to the developer of **abstraction**, **encapsulation**, **inheritance** and **polymorphism** Use **UML** notation to describe a project class structure Specific understanding and familiarity of the IB **Case Study** topic, which changes each year. Understand the hardware architecture of the computer Explain the Fetch-Decode-Execute cycle and the **von-Neumann** architecture Identify the functions and operation of the OS

b) Learning environment

There are three fully equipped computer suites at BGS. All computer science lessons at all key stages are taught in one of these rooms, as well as being booked out to other subjects as required. The displays and decorations in the computer rooms are designed to promote a calming and inclusive atmosphere that allows students to reach the mental "flow state" required for effective programming, even during busy lessons. One of the computer rooms is generally available at break and lunchtimes for students to use for work connected with any subject.

Homework is used to reinforce and practice concepts, skills and knowledge learned in class. Much of computer programming involves procedural memory and yet we are also aware that not all students have the same access to desktop or laptop computers at home. Homework is set with this in mind and at KS3 often focuses on short fragments of code that can be

completed effectively without extensive support at home. At KS4, weekly homework uses exam-style questions to embed knowledge and check understanding of the higher-order concepts. In the sixth form, students generally have much better access to computers and are given longer form coding challenges to reinforce their understanding of Java and OOP.

c) Assessment & Feedback

Assessment for KS3 is based on in-class assignments and homework. Students receive verbal feedback during coding lessons and self-evaluate their progress at the end of each one, based on how far they progressed through the graduated series of challenges. Pupils will be given annual summative assessment and three formative assessment projects each year.

At KS4 and KS5, homework is assessed weekly and there are mock examinations twice a year. A weekly after-school code clinic allows students struggling with specific coding problems to receive one-to-one feedback and guidance.

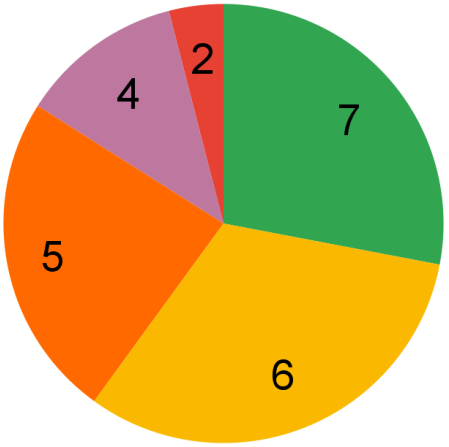
Apart from regular homeworks, and coding projects, assessment at KS4 and KS5 is supplemented by formal mock exams held biannually.

d) Monitoring

The progress of all students is tracked via a centralised spreadsheet, which records all assessment data and any specific concerns or SEN issues. Departmental staff liaise daily to discuss misconceptions that have arisen during lessons and to refine the schemes of work to address any gaps. Staff regularly observe each other's lessons and exam marking is cross-moderated to ensure consistency. Report grades are also compared to identify any causes for concern.

Impact

In 2024 our IB Higher results showed outstanding results. In a cohort of 25 students, the average point score (APS) was 5.64. These results are well above the national average and all students achieved or exceeded their predicted grade. Destinations for this cohort were also very encouraging with 9 students going on to study computing or engineering at Russell Group universities.

2024 IB Higher results (25 candidates)	
• 28% grade 7 • 60% 7 - 6 • 84% 7-5 • 96% 7-4	

At GCSE, results were equally impressive with **37%** of the class gaining a grade 9. This was higher than the percentage of students that gained grades 9 - 7 nationally (34%).

2024 GCSE results (52 candidates)	
• 37% grade 9 • 87% 9 - 7 • 98% 7 - 6 • 100% 9 - 5