

# Computer Science

## Preparing students for tomorrow, bit by bit

The Computing department will help to create, share, and apply knowledge in all branches of Computer Science and ICT. We will educate students to be successful, ethical, and effective problem-solvers with a passion to innovate and create, rather than just passive consumers and users of technology. We will develop an understanding and appreciation of all aspects of digital products, from how they work to how they look. We will foster curiosity and encourage exploration to create students who can contribute positively to the well-being of our society and who are prepared to tackle the complex 21st Century challenges facing the world.

Summary focus areas:

- Innovate, create, develop
- Solving 21st Century problems
- Active developers not passive consumers

Autumn		Spring		Summer
Data Representation	Fundamentals of Algorithms	Fundamentals of Networks	C# Programming	Exam Revision & Preparation
Relational Databases	C# Programming	Cyber Security	Exam Revision & Preparation	
	Computer Systems	Ethical, Legal & Environmental Impacts		

Homework for Computing is set weekly to support and extend the students' studies from their lessons. Work may be a mixture of practical, computer-based tasks and paper-based written work or design tasks. Activities set as homework may be:

- Preparatory work or research ahead of a new topic or concept being discussed in lessons.
- Extension work that allows the student to explore a topic in more depth or in other contexts.
- Application work that allows students to practise skills or demonstrate abilities.

Students are expected to spend around an hour on a homework activity each week and work is marked promptly to help students to identify and understand their weaknesses to make incremental improvements over the course of the year.

Unit	Duration (lessons)	Learning Objectives/Outcomes
Data Representation	6	<ul style="list-style-type: none"> <li>Understand how binary can be used to represent decimal numbers, text, images and sound</li> <li>Convert between Binary, Hexadecimal and Decimal numbers</li> <li>Understand and distinguish between units of data (bit, byte, kilobyte etc)</li> <li>Be able to distinguish between lossy and lossless compression methods and how they work</li> <li>Discuss the advantages, disadvantages and potential uses of lossy and lossless compression</li> <li>Be able to apply compression methods to data</li> </ul>
Relational Databases	7	<ul style="list-style-type: none"> <li>Revisit key database terminology <ul style="list-style-type: none"> <li>Tables, Rows and Fields</li> <li>Primary Keys and Foreign Keys</li> </ul> </li> <li>Revisit and use Structured Query Language (SQL) in exam question scenarios <ul style="list-style-type: none"> <li>SELECT...FROM...WHERE</li> <li>ORDER BY...ASC/DESC</li> <li>INSERT INTO... VALUES...</li> <li>UPDATE...SET...WHERE</li> <li>DELETE... FROM... WHERE</li> </ul> </li> </ul>
Fundamentals of Algorithms	6	<ul style="list-style-type: none"> <li>Revisit what an algorithm is and how/why computers use them</li> <li>Revisit the Binary Search and compare it with the Linear Search algorithm in an exam question scenario</li> <li>Be able to explain and model the Bubble Sort algorithm</li> <li>Be able to compare the benefits of the Bubble Sort and Merge Sort algorithms</li> </ul>
C# Programming	6	<ul style="list-style-type: none"> <li>Be able to use loops and logic independently</li> <li>Be able to read from and write to files</li> <li>Be able to generate and use random numbers</li> <li>Be able to use string operations to use substrings and combine strings using concatenation.</li> <li>Be able to solve simple problems using code</li> </ul>
Computer Systems	5	<ul style="list-style-type: none"> <li>Revisit and define the Von Neumann architecture</li> <li>Identify different roles played by computers including Embedded Systems</li> <li>Revisit the role and operation of main memory and the</li> </ul>

		<p>major components of a central processing unit (CPU)</p> <ul style="list-style-type: none"> <li>• Revisit and explain the factors that affect the performance of a CPU: <ul style="list-style-type: none"> <li>○ clock speed</li> <li>○ number of processor cores</li> <li>○ cache size</li> <li>○ cache type</li> </ul> </li> <li>• Revisit and explain the Fetch-Decode-Execute cycle</li> <li>• Recap the differences between main memory, secondary storage, RAM and ROM</li> <li>• Understand different types of secondary storage and their advantages/disadvantages including solid state, optical and magnetic storage</li> <li>• Explain the term 'cloud storage' and discuss its advantages and disadvantages</li> </ul>
Fundamentals of Networks	4	<ul style="list-style-type: none"> <li>• Revisit what a computer network is and the advantages and disadvantages of using a computer network</li> <li>• Revisit and describe/explain LAN/PAN/WAN networks</li> <li>• Be able to describe and compare the bus, ring and star networking topologies in an exam question scenario.</li> <li>• Revisit and explain the different hardware needed as part of a network system and the role each piece of hardware plays</li> <li>• Recap common networking protocols and their role in communication between different devices</li> <li>• Explain 4 different layers of the TCP/IP protocol stack</li> </ul>
Cyber Security	4	<ul style="list-style-type: none"> <li>• Define the term cyber security and be able to describe its main purposes</li> <li>• Understand and be able to explain cyber security threats: <ul style="list-style-type: none"> <li>○ social engineering techniques</li> <li>○ malicious code</li> <li>○ weak and default passwords</li> <li>○ misconfigured access rights</li> <li>○ removable media</li> <li>○ unpatched and/or outdated software</li> </ul> </li> <li>• Revisit what penetration testing is and what it is used for</li> <li>• Revisit and define the term social engineering <ul style="list-style-type: none"> <li>○ Describe malware and answer exam-style questions about how to protect against viruses, Trojan horses, spyware and adware</li> </ul> </li> <li>• Revise and explain common security measures such as biometric measures, password systems, CAPTCHA, 2FA</li> </ul>

		and automatic software updates
Ethical, Legal & Environmental Impacts	4	<ul style="list-style-type: none"> <li>• Revisit and define/discuss ethical concerns in computing such as public safety and data security, and legal concerns such as hacking, data leaks, copyright and blackmail.</li> <li>• Understand, define and discuss environmental concerns such as energy consumption (including cryptocurrencies) and pollution and precious metals</li> <li>• Discuss the emerging impact of wearable technology and cybernetic implants and the emerging impact of autonomous vehicles in exam style scenarios.</li> </ul>
C# Programming	6	<ul style="list-style-type: none"> <li>• Be able to use loops and logic independently</li> <li>• Be able to read from and write to files</li> <li>• Be able to solve problems independently using code</li> </ul>
Exam Revision & Preparation	6+	<ul style="list-style-type: none"> <li>• Develop examination technique to deal with coding questions, extended writing questions, common mistakes, and discuss students' concerns and clear up any misconceptions.</li> </ul>

Unit	Duration (lessons)	Learning Objectives/Outcomes
Java programming & NEA project	5	<ul style="list-style-type: none"> <li>• Completion of the 20-hour programming project started in Y10</li> </ul>
Logic, binary and data representation revision	12	<ul style="list-style-type: none"> <li>• Understand the basic logical operations – <i>and</i>, <i>or</i>, <i>not</i></li> <li>• Be able to interpret and create logic circuit diagrams</li> <li>• Be able to construct truth tables for given logical constructs</li> <li>• Be able to count in binary and hexadecimal and convert numbers between counting systems</li> <li>• Understand how binary can be used to represent text, images and sound</li> <li>• Explore binary representation systems and concepts such as: <ul style="list-style-type: none"> <li>○ ASCII</li> <li>○ Unicode</li> <li>○ Bitmap images</li> <li>○ Colour depth and resolution</li> </ul> </li> <li>• Sound sampling, rates and resolutions</li> <li>• Understand the measurement of data storage</li> <li>• Be able to apply the Run Length Encoding and Huffman</li> </ul>

		Coding compression techniques
Digital security	12	<ul style="list-style-type: none"> <li>• Be able to define the term cyber security and be able to describe its main purposes</li> <li>• Understand and be able to explain the following cyber security threats: <ul style="list-style-type: none"> <li>○ social engineering techniques</li> <li>○ malicious code</li> <li>○ weak and default passwords</li> <li>○ misconfigured access rights</li> <li>○ removable media</li> <li>○ unpatched and/or outdated software</li> </ul> </li> <li>• Explain what penetration testing is and what it is used for</li> <li>• Define and describe the term social engineering</li> <li>• Describe malware and how it can be protected against</li> <li>• Understand and explain common security measures: <ul style="list-style-type: none"> <li>○ biometric measures</li> <li>○ password systems</li> <li>○ CAPTCHA (or similar)</li> <li>○ two-factor authentication</li> <li>○ automatic software updates</li> </ul> </li> </ul>
Computer systems and architectures revision	6	<ul style="list-style-type: none"> <li>• Explain the Von Neumann architecture</li> <li>• Explain the role and operation of main memory and the major components of a central processing unit (CPU)</li> <li>• Understand and explain the factors that affect the performance of a CPU: <ul style="list-style-type: none"> <li>○ clock speed</li> <li>○ number of processor cores</li> <li>○ cache size</li> <li>○ cache type</li> </ul> </li> <li>• Understand and explain the Fetch-Execute cycle</li> <li>• Understand the differences between main memory, secondary storage, RAM and ROM</li> <li>• Understand different types of secondary storage and their advantages/disadvantages</li> <li>• Explain the operation of solid state, optical and magnetic storage</li> <li>• Explain the term 'cloud storage' and discuss its advantages and disadvantages</li> <li>• Understand the term 'embedded system'</li> </ul>
Computer networks	6	<ul style="list-style-type: none"> <li>• Understand what a computer network is</li> <li>• Be able to discuss the advantages and disadvantages of</li> </ul>

revision		<p>using a computer network</p> <ul style="list-style-type: none"> <li>• Be able to describe and explain the bus and star networking topologies</li> <li>• Be able to discuss the advantages and disadvantages of each of these topologies</li> <li>• Be able to explain the different hardware needed as part of a network system and the role each piece of hardware plays</li> <li>• Understand common networking protocols and their role in communication between different devices</li> <li>• Explain the different layers of the TCP/IP protocol stack</li> </ul>
Writing pseudo-code algorithms	12	<ul style="list-style-type: none"> <li>• Be able to express simple algorithms in pseudo-code</li> <li>• Be able to understand and interpret pseudo-code algorithms to determine their function</li> <li>• Be able to complete trace tables for given algorithms to determine the likely output</li> <li>• Be able to detect and correct errors in simple algorithms</li> <li>• Be able to evaluate the efficiency of algorithms</li> <li>• Understand the algorithms for Bubble Sort and Merge Sort</li> <li>• Understand the algorithms for Linear Search and Binary Search</li> </ul>

