SCARBOROUGH UTC
Technical Excellence, Employable Graduates

# Long Term Plan Year 9 Computer Science

| Half Term | Unit Title | Key Knowledge/ Content to learn and retain | Essential Skills to acquire (subject & generic) | Link to intent and ethos | Anticipated misconceptions | Links to previous KS | Link to future KS | Opportunity for stretch and high prior attainers | SMSC & British Values | Cultural Capital | Career Link |
|---|---|---|---|---|---|---|---|---|---|---|---|
| One | 1. Introduction to Python<br><br>L1 Strings and variables<br><br>L2 Data types and arithmetic<br><br>L3 Selection<br><br>L4 Writing algorithms<br><br>L5 While Loops<br><br>L6 Searching | •Know what Python is and some of the applications it is used for<br><br>•Understand what a syntax error is and how to interpret an error message<br><br>•Know the rules for variable names and use variables in a program<br><br>•Understand the use and value of using comments<br><br>•Understand the importance of using correct data types: string, integer or float<br><br>•Understand how to use assignment statements correctly<br><br>•Identify different types of program errors: syntax errors, run-time errors and logic errors and how to fix them<br><br>•Compare alternative search algorithms for a given problem | •Run a simple Python program in Interactive mode using the input and print functions<br><br>•Write, save and run a program in Script mode<br><br>•Use the int, float and round functions<br><br>•Perform arithmetic using the BIDMAS rule<br><br>•Write a program involving input, calculation and output<br><br>•Use selection statements if, else and elif in a program<br><br>•Learn how to use different comparison operators<br><br>•Use indentation correctly to define a block of code<br><br>•Learn to write algorithms in pseudocode<br><br>•Use a while loop in a program<br><br>•Use an if statement within a while loop<br><br>•Use a function to generate a random number<br><br>•Use a linear search to find a number<br><br>•Write code to execute a binary search | Learners will develop knowledge and understanding of the practical elements of the course through computational methods directly linked to key knowledge:<br>-Abstraction<br>-Decomposition<br>-Algorithmic thinking<br><br>Working through a series of learning objectives, learners have the opportunity to improve their resilience through solving problems. | .The best way to learn this unit is by programming<br>• Practice coding small algorithms to help you understand how each programming technique<br>• Make sure loops have a START and END condition<br>• Check your > and < signs are the correct way around in loops and IF statements<br>• Many questions in the exam allow you to write your algorithms in short statements or bullet points – you may find this easy. | Learners should have had experience of at least one type of programming language which is textual such as Python, to solve a variety of computational problems. | Learners will know and be thoroughly prepared for KS4 through practice of solving problems to form a coded solution which leads to an understanding of how programs are created using further data structures. | Learners will have opportunities to learn A Level concepts such as:<br>-Data structures e.g. Queues, lists, hash tables, stacks, graphs through the essential A Level Algorithms guide<br><br>- Other programming languages such as assembly (low-level), Haskell (Functional), and C# (high-level) | Ethical discussions on open and closed source code and the impacts this has in the industry.<br><br>Ethical discussions on Ethical hacking by governments and well known hacking groups. | Learners will have the opportunity to discuss the origins of programming:<br><br>- GCHQ and Bletchley Park<br><br>-The history of programming from machine code to low level code, to high level code<br><br>- First computer programmer Ada Lovelace, daughter of Lord Byron the Poet | https://www.gchq-careers.co.uk/<br><br>https://www.mi5.gov.uk/careers<br><br>https://www.sis.gov.uk/explore-careers.html<br><br>https://www.yhrocu.org.uk/vacancies/<br><br>https://nationalcrimeagency.gov.uk/careers/vacancies |
| Two | 2. Python Next Steps<br><br>L1 The basics<br>L2 For loops<br>L3 Lists<br>L4 Functions<br>L5 Functions returning values | •Recall different data types<br>•Make a choice about which loop to use, and why<br><br>•Understand why using a list can be more efficient than using single variables<br><br>•Understand what a procedure is<br><br>•Understand why procedures are useful | •Read and understand an existing Python program<br>•Use the int(), float() and str() functions to convert data types<br>•Write an if-else statement<br>•Use a **while** loop to repeat a section of code<br>•Use a **for** loop to repeat a section of code<br>•Be able to store and update values in a list<br>•Be able to append data to a list<br>•Be able to use a **for()** loop to step through a list<br>•Be able to define and call a procedure<br>•Be able to use parameters in a procedure<br>•Define a function which calculates a | Learners will develop knowledge and understanding of the practical elements of the course through computational methods directly linked to key knowledge:<br>-Abstraction<br>-Decomposition<br>-Algorithmic thinking<br><br>Working through a series of learning objectives, learners have the opportunity to improve their resilience through solving problems | .The best way to learn this unit is by programming<br>• Practice coding small algorithms to help you understand how each programming technique<br>• Make sure loops have a START and END condition<br>• Check your > and < signs are the correct way around in loops and IF statements<br>• Many questions in the exam allow you to write your algorithms in short statements or bullet points – you may find this easy. | Learners should have had experience of at least one type of programming language which is textual such as Python, to solve a variety of computational problems. | Learners will know and be thoroughly prepared for KS4 through practice of solving problems to form a coded solution which leads to an understanding of how programs are created using further data structures. | Learners will have opportunities to learn A Level concepts such as:<br>-Data structures e.g. Queues, lists, hash tables, stacks, graphs through the essential A Level Algorithms guide<br><br>- Other programming languages such as assembly (low-level), Haskell (Functional), and C# (high-level) | Ethical discussions on open and closed source code and the impacts this has in the industry.<br><br>Ethical discussions on Ethical hacking by governments and well known hacking groups. | Learners will have the opportunity to discuss the origins of programming:<br><br>- GCHQ and Bletchley Park<br><br>-The history of programming from machine code to low level code, to high level code<br><br>- First computer programmer Ada Lovelace, daughter of Lord Byron the Poet | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | value and passes it back to the calling module<br>•Call a function which calculates a value<br>• Assign the return value to a variable in the calling module | | | | | | | | |
| Three | 3.Understanding Computers<br><br>L1 Elements of a computer<br>L2 The CPU<br>L3 understanding binary<br>L4 Binary addition<br>L5 Storage devices<br>L6 Convergence and new technologies | •Distinguish between hardware and software<br>•Identify Input, Output and Storage devices<br>•Name at least five pieces of software<br>•Suggest appropriate input and output devices for a given scenario<br>•Explain what RAM and ROM are used for<br>•Distinguish between main memory and permanent storage devices<br>•Name the three stages in the Fetch Execute Cycle<br>•Define Hz, MHz and GHz and state how these relate to the speed of the processor<br>•Understand why all data is represented in binary in a computer<br>•Define a Bit, Byte, Kb, Mb and Gb<br>•Identify a binary number as odd or even<br>•Understand the effect of adding an extra zero to a binary number<br>•State the typical capacities, strengths and weaknesses of different storage devices | •Draw an abstract diagram of the main components of a computer: input, processor, output and storage<br>•Convert integers to binary numbers<br>•Convert binary numbers to integers<br>•Show how characters can be represented using ASCII<br>•Add two binary numbers (each no more than eight binary digits)<br>•Review the history and development of communication<br>•Discuss the different ways and applications in which modern technology is used<br>•Discuss future uses of technology and the pace of change (Moore's Law) | Learners will develop knowledge and understanding of technical content in this unit through computational approaches by using essential skills they will be able to logically think about how a CPU processes data, how data is stored in different memory and storage components whilst concurrently thinking how all these components function together. | • When comparing CPU speeds, learners need to think about clock speed, cache size and number of cores. Just because one is larger/faster does not mean it is faster<br>• Embedded systems are usually pre-programmed and stored in ROM.<br>• Virtual memory refers to space on a secondary storage device to store temporary data (e.g. to cope when RAM is full)<br>•Avoid general statements like "Flash memory is better". Most questions will ask to compare different storage devices and why one is better or worse than another<br>• Remember that the scenario in storage questions will affect how to compare storage devices | Learners should understand the hardware and software components that make up a computer system, and how they communicate with one another and with other systems.<br><br>Understand how instructions are stored and executed within a computer system | Learners will know and be thoroughly prepared for KS4 through practical tasks such as identifying computer components within a computer system. | Learners are encouraged to learn how the CPU fetches, decodes and executes through simulation software 'The Little Man Computer'. This enables learners to develop an understanding of how the CPU works visually and at a much deeper level whilst introducing learners to assembly programming language. | Learners will have opportunities to think and discuss how memory has evolved in computer systems over time.<br><br>Influential people involved from 16th century to present day.<br><br>Computer component manufacturers leading in processor architecture.<br><br>How government agencies (GCHQ, Police, NHS, and Council) store data, what kind of data, is this moral?<br><br>The laws surrounding data; private and public data and copyright.<br><br>Impacts on storage space and how this impacts on the environment and society. | Learners will have the opportunity to think and discuss the topic on 'Big Data' ; issues relating to how enormous amounts of data is stored which in turn relates to mainframe computers and quantum computers. Further concerning issues are discussed such as misinformation (information warfare), and social media and the impacts this has on society | IT Service Manager<br><br>Service Desk Analyst<br><br>IT Technician<br><br>NHS IT Roles<br><br>Police IT Roles |
| Four | 4. Computer Networks<br><br>L1 The Internet<br>L2 Connectivity<br>L3 Topologies<br>L4 Client-server networks<br>L5 Encryption | •Learn what the Internet and World Wide Web are<br>•Understand how packet switching works<br>•Compare different types of cable, and the relative speeds of data transmission<br>•Understand the difference between LANs and WANs<br>•Contrast a client-server network with a peer-to-peer network<br>•Understand what is meant by cloud computing<br>•unauthorised people can break ciphers and read encrypted data | •Learn what a protocol is and why one is needed for data communication<br>•Learn what the Domain Name Server (DNS) does<br>•Calculate time taken to download files of different sizes at different bandwidths<br>•Be able to give examples of each type of network<br>Draw three different network topologies<br>•To learn some classical encryption techniques | Learners will develop knowledge and understanding of different types of networks, topologies, and how they are connected computational methods such as thinking ahead and thinking logically. | Virtual networks are created by software and wireless technology.<br><br>Be clear on the differences between network cable types<br><br>Be clear on the differences between topologies<br><br>Be clear on the two types of encryption; Asynchronous and synchronus | Learners should have some knowledge of the Internet and IP addresses. | This unit will prepare learners to study these topics in depth at KS4 such as;<br>-network protocols<br>-network layers<br>-encryption techniques | Learners are encouraged to learn and explore network simulation software to be able to:<br><br>- visually design many types of networks and topologies using CISCO packet tracer to simulate how data packets transmit over a network and the implementation of protocols. This in turn enhances higher level thinking of how VLANs/subnets are created.<br><br>-Enigma machine simulator to encrypt messages | Learners will have opportunities to explore legislation surrounding the Internet in the UK and globally.<br><br>-Internet services in other countries – why do certain countries limit access to the internet and what impact does this have on society; is this moral?<br><br>-What impact does the Internet have on society regarding social media? | Learners will have the opportunity to think and discuss issues surrounding the Internet:<br><br>- Who owns the Internet?<br><br>-Origins of the Internet<br><br>-Difference between the Internet and the World Wide Web<br><br>-Sir Tim Berners Lee founder of WWW<br><br>-Future trends of the Internet and IoT | IT Service Manager<br><br>Service Desk Analyst<br><br>IT Technician<br><br>NHS IT Roles<br><br>Police IT Roles |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Five | 5. Computer Crime and Cyber Security<br><br>L1 Email scams<br>L2 Computer misuse<br>L3 Protecting personal data<br>L4 Copyright<br>L5 Health and safety | •Identify common types of computer crime<br>•Look at examples of computer crime on the Internet<br>•Learn about different types of email scam<br>•Learn about the Computer Misuse Act – which makes certain activities illegal<br>•Understand what is meant by hacking<br>•Understand what is meant by malware<br>•Be aware of who might hold personal data about you<br>•Be aware of the possibility of identity theft<br>•Know how to minimise the chance of identity theft | •Recognise the signs of fraudulent emails<br>•Look at examples of computer misuse<br>•Learn ways to protect yourself from malware and hacking<br>•Discuss the need for various organisations to hold data about you | Learners will develop knowledge and understanding through computational methods such as thinking procedurally when explaining the process of how different forms of attack function and thinking ahead when explaining different preventative measures to keep computer systems secure. | •Encryption does not stop data theft. Encryption protects the data from being read as easily<br>•It's incorrect to assume that a computer system or network is 100% secure or risk free even with preventative measures in place. | Learners should know some methods of computer crime and the impacts on the individual and businesses. | Learners will develop an understanding of linked topics such as systems software; It is paramount that network and computer security is everyone's responsibility and knowing how to keep your devices free from potential risk of threat with the use of specialised softwares and utility softwares. | Learners are encouraged to research and explore common exploits and hacks in society, e.g. WannaCry ransomware attack<br><br>Why do exploits happen?<br><br>What are the reasons for illegal hacking?<br><br>Are there different types of hackers?<br><br>What are the impacts of hacking?<br><br>What is cyberwarfare? | Learners will have opportunities to discuss encryption:<br><br>-Why is data encrypted?<br><br>- Rule of law; legislation<br><br>-Ethical hacking and democracy | Learners will have the opportunity to discuss wider issues surrounding encryption and number systems:<br>-Origin of GCHQ and encryption during WWII and the works of Alan Turing<br>-Original and well known encryption ciphers, e.g. Caesar cipher and the Pig Pen Cipher | Cyber Security Apprenticeship<br><br>Cyber security Analyst<br><br>Ethical Hacker<br><br>Penetration Tester<br><br>BAE Systems |
| Six | 6. Control Systems with Flowol<br><br>L1 Flowcharts<br>L2 Sequencing<br>L3 Sensors<br>L4 Actuators | •Identify control flowchart symbols and understand how they are used to describe systems<br>•Understand why a control system might fail and explain the impact this can have on safety<br>•Identify common types of **sensors** used in control systems<br>•Understand how the use of subroutines can make programs more efficient<br>•Understand what **actuators** are used for in control systems<br>•Understand what a **variable** is and explain how **variables** can be used to control systems | •Develop a control flowchart solution for a simple problem<br>•Develop a control solution for a system that uses two flowcharts operating in sequence<br>•Use decision symbols in a flowchart<br>•Develop a control solution for a system that uses multiple sensors<br>•Develop a control solution for a system that includes a **subroutine**<br>•Develop a control solution for a system that uses **variables** | Learners will develop knowledge and understanding of control systems through computational methods such as thinking logically and procedurally;<br><br>- to follow the logic using a flow diagram | Sensors work together in a control system; a sensor monitors conditions and signals when changes occur whereas an actuator receives a signal and performs an action often in the movement of a mechanical machine. | Learners should have knowledge of how computers work;<br><br>Input, process and output. | This unit provides the fundamentals of algorithms and programming whilst providing technical content on control systems that directly links to Boolean algebra and Systems Engineering. | Learners will have the opportunity to create their own control systems through practical activities using Flowol software.<br><br>This will enhance learners knowledge and skills in programming techniques such as ;<br>-sequence<br>-selection<br>-Iteration | Learners will have the opportunity to discuss the ethics and laws surrounding PLC (Programmable Logic Controllers) Systems | Learners will have the opportunity to discuss PLC (Programmable Logic Controllers) Systems and how it is related to assembly programming language. | Electrical Engineer<br><br>Software Engineer |