

OCR COMPUTER SCIENCE J277

Website address	https://www.ocr.org.uk/qualifications/gcse/computer-science-j277-from-2020/
Provisional examination dates	Paper 1: J277/01 Computer Systems 50%: 24th May'22 Paper 2: J277/ 02 Computational thinking, algorithms and programming 50%: 6th June'22
GCSE grade type awarded	9-1
Revision books	<i>Paul Long Ultimate GCSE Guide</i>
Useful websites	<ul style="list-style-type: none">• https://quizlet.com/en-gb/content/ocr-gcse-computer-science-flashcards• https://www.youtube.com/c/craigndave/playlists?view=50&sort=dd&shelf_id=1• https://senecalearning.com/



1.1 Systems Architecture

<u>Confidence</u>	<u>Clarification</u>	✓
1.1.1 Architecture of the CPU		
☹️ 😐 😊	I can explain the purpose of the CPU	
☹️ 😐 😊	I can explain what actions occur at each stage of the fetch-execute cycle	
☹️ 😐 😊	I can explain the role/purpose of the (ALU) Arithmetic Logic Unit and what data it stores during the fetch-execute cycle	
☹️ 😐 😊	I can explain the role/purpose of the (CU) Control Unit and what it manages and controls during the fetch-execute cycle	
☹️ 😐 😊	I can explain the role/purpose of the Cache and what data it stores during the fetch-execute cycle	
☹️ 😐 😊	I can explain the role/purpose of the (MAR) Memory Address Register in the Von Neumann architecture and what addresses it stores during the fetch-execute cycle	
☹️ 😐 😊	I can explain the role/purpose of the (MDR) Memory Data Register in the Von Neumann architecture and what data it stores during the fetch-execute cycle	
☹️ 😐 😊	I can explain the role/purpose of the (PC) Program Counter in the Von Neumann architecture and what data/address it stores during the fetch-execute cycle	
☹️ 😐 😊	I can explain the role/purpose of the Accumulator in the Von Neumann architecture and what data it stores during the fetch-execute cycle	
☹️ 😐 😊	I understand the difference between storing an address and data	
1.1.2 CPU Performance		
☹️ 😐 😊	I can explain how the clock speed affects the CPU performance	
☹️ 😐 😊	I can explain how the cache size affects the CPU performance	
☹️ 😐 😊	I can explain how the number of cores affects the CPU performance	



1.1.3 Embedded Systems

☹️ 😐 😊	I can explain the purpose and characteristics of embedded systems	
☹️ 😐 😊	I can give a range of examples of different embedded systems	



1.2 Memory & Storage

<u>Clarification</u>	✓
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1.2.1 Primary storage (Memory)

I can explain why computers have primary storage	
I can explain why primary storage usually consists of ROM and RAM	
I can explain the difference and key characteristics of ROM and RAM	
I can explain the purpose of ROM in a computer system	
I can explain the purpose of RAM in a computer system	
I can explain why virtual memory may be needed in a system	
I can explain how virtual memory works and the transfer of data between RAM and the HDD	



<u>Clarification</u>	✓
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1.2.2 Secondary storage

I can explain why computers have secondary storage	
I understand what optical storage media is and how it works	
I can identify the advantages and disadvantages of optical storage media	
I can identify different types of optical storage devices	
I understand what magnetic storage media is and how it works	
I can identify the advantages and disadvantages of magnetic storage media	
I can identify different types of magnetic storage devices	

I understand what solid state storage media is and how it works	
I can identify the advantages and disadvantages of solid state storage media	
I can identify different types of solid state storage devices	
I can compare storage media and devices, identifying the most suitable for a given scenario	
I can compare storage media based on their capacity	
I can compare storage media based on their speed	
I can compare storage media based on their portability	
I can compare storage media based on their durability	
I can compare storage media based on their reliability	
I can compare storage media based on their cost	

1 0 0 1 1
0 0 1 1 1
1 1 0 1 0

<u>Confidence</u>	<u>Clarification</u>	✓
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1.2.3 Units

☹️ 😐 😊	I can explain why data must be stored in binary format	
☹️ 😐 😊	I can explain how data needs to be converted into binary format to be processed by a computer	
☹️ 😐 😊	I can identify the different data units bit, nibble (4 bits), byte (8 bits), kilobyte (1,000 bytes or 1KB), megabyte (1,000 KB), Gigabyte (1,000 MB), Terabyte (1,000 GB), Petabyte (1,000 TB)	
☹️ 😐 😊	I can calculate the capacity of devices for different data units	
☹️ 😐 😊	I can calculate the require storage capacity for a given set of files	
☹️ 😐 😊	I can calculate the file sizes for sound files (file size = sample rate x duration(s) x bit depth)	
☹️ 😐 😊	I can calculate the file sizes for images (file size = colour depth x image height(px) x image width(px))	
☹️ 😐 😊	I can calculate the file sizes for text files (file size = bits per character x number of characters)	

1.2.4 Data Storage

Numbers



I can **convert positive denary whole numbers (0 – 255) to binary numbers** (up to and including 8 bits) and vice versa



I can **add two binary integers together** (up to and including 8 bits) and **explain overflow errors** which may occur



I can **convert positive denary whole numbers** into **2-digit hexadecimal numbers** (00 – FF) and vice versa



I can **convert binary integers** to their **hexadecimal** equivalents and vice versa



I understand the terms '**most significant bit**', and '**least significant bit**'.



I can carry out a **binary shift** and understand the effect (both left and right) on a number

Characters



I understand how binary codes are used to **represent characters**



I can explain what is meant by the term '**character set**'



I can explain the relationship between the **number of bits per character**, and the **number of characters** which can be represented, e.g. **ASCII and Unicode**



I can explain the **differences between and impact** of each character set



I understand how **character sets are logically ordered**, e.g. the code for 'B' will be one more than 'A'



I can perform a **binary shift** and understand the effect (both left and right) on a number



I know that the **binary representation of ASCII** in the exam will use 8 bits

Confidence

Clarification



1.2.4 Data Storage

Images



I understand how an image is **represented as a series of pixels**, represented in binary

☹️ 😐 😊	I can explain how each pixel has a specific colour , represented by a specific code	
☹️ 😐 😊	I can explain the effect on image size and quality when changing colour depth and resolution	
☹️ 😐 😊	I understand what additional information is stored in the metadata (e.g. height, width)	

Sound

☹️ 😐 😊	I understand how analogue sound can be sampled and stored in digital form (binary).	
☹️ 😐 😊	I understand that the sample rate is measured in Hertz (Hz)	
☹️ 😐 😊	I understand that the bit depth refers to the number of bits available to store each sample (e.g. 16-bit)	
☹️ 😐 😊	I understand that the duration refers to the number of seconds of audio the sound file contains.	
☹️ 😐 😊	I can explain the effect of sample rate, duration and bit depth on the playback quality and size of the sound file .	

1.2.5 Compression

☹️ 😐 😊	I understand the need for compression .	
☹️ 😐 😊	I can identify the advantages and disadvantages lossy and lossless compression .	
☹️ 😐 😊	I can explain the effects on the file for each type of compression.	
☹️ 😐 😊	I can identify common scenarios where compression may be needed.	

1.3 Computer networks, connections and protocols



<u>Confidence</u>	<u>Clarification</u>	✓
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1.3.1 Networks and topologies

☹️ 😐 😊	I can explain the difference between a LAN (Local Area Network) and WAN (Wide Area Network)	
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☹️ 😐 😊	I understand the different factors that can affect the performance of a network, e.g. the numbers of devices connected and the bandwidth	
☹️ 😐 😊	I can explain the different roles of computers in a client-server and a peer-to-peer network	
☹️ 😐 😊	I can identify the hardware needed to connect stand-alone computers into a Local Area Network including wireless access points, routers, switches, NIC (Network Interface Controller/Card) and Transmission media.	
☹️ 😐 😊	I can explain the tasks performed by each piece of network hardware.	
☹️ 😐 😊	I understand the concept of the Internet as a network of computer networks.	
☹️ 😐 😊	I understand a Domain Name Service (DNS) is made up of multiple Domain Name Servers	
☹️ 😐 😊	I can explain the role of the DNS (Domain Name Server) in the conversion of a URL to an IP address.	
☹️ 😐 😊	I understand the concept of servers providing services (e.g. Web Server -> Web pages, File Server -> files storage/retrieval)	
☹️ 😐 😊	I understand the concept of Hosting and clients requesting/using services from a server	
☹️ 😐 😊	I understand what is meant by 'The Cloud' and remote service provision (e.g. storage, software, processing)	
☹️ 😐 😊	I can explain the advantages and disadvantages of 'The Cloud' .	
☹️ 😐 😊	I can explain the advantages and disadvantages of the Star and Mesh topologies	
☹️ 😐 😊	I can apply my understanding of networks to a given scenario	

1.3.2 Wired and wireless networks, protocols and layers

☹️ 😐 😊	I can compare the benefits and drawbacks of wired (Ethernet) and wireless (Wi-Fi, Bluetooth) connections	
☹️ 😐 😊	I am able to recommend one or more connections for a given scenario	
☹️ 😐 😊	I understand the principle of encryption to secure data across network connections	

☹️ 😐 😊	I understand IP addressing and the format of an IP address (IPv4 and IPv6) for communication over the Internet	
☹️ 😐 😊	I understand that MAC addresses are assigned to a devices for use within a network	
☹️ 😐 😊	I understand the principle of a standard to provide rules for areas of computing	
☹️ 😐 😊	I can explain how standards allow hardware/software to interact across different manufacturers/producers	
☹️ 😐 😊	I can explain the principle of a (communication) protocol as a set of rules for transferring data	
☹️ 😐 😊	I understand that different types of protocols are used for different purposes	
☹️ 😐 😊	I can explain the basic principle of the TCP/IP (Transmission Control Protocol/Internet Protocol) including its purpose and key features	
☹️ 😐 😊	I can explain the basic principle of the HTTP (Hypertext Transfer Protocol) including its purpose and key features	
☹️ 😐 😊	I can explain the basic principle of the HTTPS (Hypertext Transfer Protocol Secure) including its purpose and key features	
☹️ 😐 😊	I can explain the basic principle of the FTP (File Transfer Protocol) including its purpose and key features	
☹️ 😐 😊	I can explain the basic principle of the POP (Post Office Protocol) including its purpose and key features	
☹️ 😐 😊	I can explain the basic principle of the IMAP (Internet Message Access Protocol) including its purpose and key features	
☹️ 😐 😊	I can explain the basic principle of the SMTP (Simple Mail Transfer Protocol) including its purpose and key features	
☹️ 😐 😊	I understand the concept of layers and can explain the benefits of using layers e.g. the 4-layer TCP/IP model	

1.4 Network Security

<u>Confidence</u>	<u>Clarification</u>	✓
1.4.1 Threats to computer systems and networks		
☹️ 😐 😊	I can explain how Malware is used, its purpose and the threats posed to devices/systems	

☹️ 😐 😊	I can explain how Social engineering (e.g. phishing, people as a 'weak point') is used, its purpose and the threats posed to devices/systems	
☹️ 😐 😊	I can explain how a Brute-force attack is used, its purpose and the threats posed to devices/systems	
☹️ 😐 😊	I can explain how a Denial of service attack is used, its purpose and the threats posed to devices/systems	
☹️ 😐 😊	I can explain how a Data interception and theft is used, its purpose and the threats posed to devices/systems	
☹️ 😐 😊	I can explain the concept of how SQL injection is used, its purpose and the threats posed to devices/systems	

1.4.2 Identifying and preventing vulnerabilities

☹️ 😐 😊	I understand how to limit/prevent threats posed and remove vulnerabilities through use of Penetration testing	
☹️ 😐 😊	I understand how to limit/prevent threats posed and remove vulnerabilities through use of Anti-malware software	
☹️ 😐 😊	I understand how to limit/prevent threats posed and remove vulnerabilities through use of Firewalls	
☹️ 😐 😊	I understand how to limit/prevent threats posed and remove vulnerabilities through use of User access levels	
☹️ 😐 😊	I understand how to limit/prevent threats posed and remove vulnerabilities through use of Passwords	
☹️ 😐 😊	I understand how to limit/prevent threats posed and remove vulnerabilities through use of Encryption	
☹️ 😐 😊	I understand how to limit/prevent threats posed and remove vulnerabilities through use of Physical security	

1.5 Systems Software



<u>Confidence</u>	<u>Clarification</u>	✓
1.5.1 Operating systems		
☹️ 😐 😊	I can explain the purpose of the operating system	

☹️ 😐 😊	I can identify the different types and features of a user interface	
☹️ 😐 😊	I can explain how the operating system performs memory management , e.g. the transfer of data between memory, and how this allows for multitasking	
☹️ 😐 😊	I understand that data is transferred between devices and the processor, and that this process needs to be managed	
☹️ 😐 😊	I can explain how peripherals are managed and the need for device drivers	
☹️ 😐 😊	I can explain user management functions , e.g. allocation of an account, access rights, security, etc.	
☹️ 😐 😊	I can explain file management , and the key features, e.g. naming, allocating to folders, moving files, saving, etc.	

1.5.2 Utility software

☹️ 😐 😊	I understand that computers often come with utility software , and how this performs housekeeping tasks	
☹️ 😐 😊	I can explain the purpose of encryption software and why it is required	
☹️ 😐 😊	I can explain the purpose of defragmentation software and why it is required	
☹️ 😐 😊	I can explain the purpose of data compression software and why it is required	

1.6 Ethical, legal, cultural and environmental concerns



<u>Confidence</u>	<u>Clarification</u>	✓
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1.6.1 Ethical, legal, cultural and environmental impact

☹️ 😐 😊	I understand that technology introduces ethical, legal, cultural, environmental and privacy issues .	
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☹️ 😐 😊	I can discuss, using a variety of digital technology examples, ethical issues and the impact of technology on wider society	
☹️ 😐 😊	I can discuss, using a variety of digital technology examples, privacy issues and the impact of technology on wider society	
☹️ 😐 😊	I can discuss, using a variety of digital technology examples, cultural issues and the impact of technology on wider society	
☹️ 😐 😊	I can discuss, using a variety of digital technology examples, environmental issues and the impact of technology on wider society	
☹️ 😐 😊	I can discuss, using a variety of digital technology examples, legal issues and the impact of technology on wider society	
☹️ 😐 😊	I can explain the purpose of The Data Protection Act 2018 and the specific actions it allows or prohibits	
☹️ 😐 😊	I can explain the purpose of the Computer Misuse Act 1998 and the specific actions it allows or prohibits	
☹️ 😐 😊	I can explain the purpose of the Copyright Designs and Patents Act 1988 and the specific actions it allows or prohibits	
☹️ 😐 😊	I can explain the need to license software and the purpose of a software license	
☹️ 😐 😊	I can explain the features of open source software (providing access to the source code and the ability to change the software)	
☹️ 😐 😊	I can explain the features of proprietary software (no access to the source code, purchased commonly as off-the-shelf)	
☹️ 😐 😊	I can recommend a type of license for a given scenario including benefits and drawbacks	







2.1 Algorithms
























<u>Confidence</u>	<u>Clarification</u>	✓
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2.1.1 Computational Thinking

























☹️ 😐 😊	I understand how the principle of Abstraction and how it can be used to define and refine problems	
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  	I understand how the principle of Decomposition and how it can be used to define and refine problems	
  	I understand how the principle of Algorithmic Thinking and how it can be used to define and refine problems	

2.1.2 Designing, creating and refining algorithms

  	I can identify the inputs , processes , and outputs for a problem	
  	I produce simple structure diagrams to show the structure of a problem, the subsections and their links to other subsections	
  	I can complete, write or refine an algorithm using pseudocode	
  	I can complete, write or refine an algorithm using flowcharts	
  	I can complete, write or refine an algorithm using OCR reference language or Python	
  	I can identify syntax/logic errors in code and suggest fixes	
  	I can create and use trace tables to follow an algorithm	

2.1.3 Searching and sorting algorithms




  	I understand the main steps of a binary search algorithm	
  	I understand the pre-requisites of a binary search algorithm	
  	I can apply a binary search algorithm to a data set	
  	I can identify a binary search algorithm if given the code or pseudocode for it	
  	I understand the main steps of a linear search algorithm	
  	I can apply a linear search algorithm to a data set	
  	I can identify a binary search algorithm if given the code or pseudocode for it	
  	I understand the main steps of a bubble sort algorithm	

☹️ 😐 😊	I can apply a bubble sort algorithm to a data set	
☹️ 😐 😊	I can identify a bubble sort algorithm if given the code or pseudocode for it	
☹️ 😐 😊	I understand the main steps of a merge sort algorithm	
☹️ 😐 😊	I can apply a merge sort algorithm to a data set	
☹️ 😐 😊	I can identify a merge sort algorithm if given the code or pseudocode for it	
☹️ 😐 😊	I understand the main steps of a insertion sort algorithm	
☹️ 😐 😊	I can apply a insertion sort algorithm to a data set	
☹️ 😐 😊	I can identify a insertion sort algorithm if given the code or pseudocode for it	
























2.2 Programming fundamentals




























<u>Confidence</u>	<u>Clarification</u>	✓
2.2.1 Programming fundamentals		
☹️ 😐 😊	I understand and can use variables and constants in the Python high-level programming language	
☹️ 😐 😊	I understand and can use inputs and outputs in the Python high-level programming language	
☹️ 😐 😊	I understand and can use the comparison operators (== Equal to, != Not equal to, < Less than, <= Less than or equal to, > Greater than, >= Greater than or equal to)	
☹️ 😐 😊	I understand and can use the arithmetic operators (+ Addition, - Subtraction, * Multiplication, / Division, MOD Modulus, DIV Quotient, ^ Exponentiation (to the power))	
☹️ 😐 😊	I understand the use of the three programming constructs (sequence, selection, and iteration) and how they're used to control the flow of a program	
☹️ 😐 😊	I am able to identify sequence in code or pseudocode	
☹️ 😐 😊	I am able to identify selection in code or pseudocode	
☹️ 😐 😊	I am able to identify iteration (count and condition controlled loops) in code or pseudocode	

  	I understand and can use the Boolean operators AND, OR and NOT	
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2.2.2 Data types

  	I understand and can use Integer numbers in the Python high-level programming language	
  	I understand and can use Real numbers in the Python high-level programming language	
  	I understand and can use Boolean values in the Python high-level programming language	
  	I understand and can use Characters and Strings in the Python high-level programming language	
  	I understand and can use Casting in the Python high-level programming language	
  	I am able to choose suitable data types for data in a given scenario	
  	I understand that data types may be temporarily changed through casting , and where this may be useful	

2.2.3 Additional programming techniques

  	I understand and can use basic string manipulation (Concatenation and Slicing) in the Python high-level programming language	
  	I understand and can use basic file handling operations (Open, Read, Write, and Close) in the Python high-level programming language	
  	I understand the use of records to store data	
  	I understand the use of arrays as fixed length or static structures when solving problems, including both one-dimensional (1D) and two-dimensional arrays (2D)	
  	I understand the use of 2D arrays to emulate database tables of a collection of fields, and records.	
  	I understand the use of SQL to search for data in a database	
  	I understand and can write SQL statements using SELECT, FROM and WHERE	
  	I understand how to use sub programs (functions and procedures) to produce structured code and where to use them effectively	
  	I can use local variables/constants within functions and procedures	

☹️ 😐 😊	I can use global variables/constants within functions and procedures	
☹️ 😐 😊	I can use arrays (passing and returning) within functions and procedures	
☹️ 😐 😊	I can create and use random numbers in a program	



2.3 Producing robust programs

<u>Confidence</u>	<u>Clarification</u>	✓
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2.3.1 Defensive design

☹️ 😐 😊	I understand the issues a programmer should consider to ensure that a program caters for all likely input values and anticipate misuse	
☹️ 😐 😊	I understand how to deal with invalid data in a program	
☹️ 😐 😊	I understand the authentication is required to confirm the identity of a user	
☹️ 😐 😊	I am able to design and create python code to provide simple authentication of a user (e.g. username and password)	
☹️ 😐 😊	I understand why commenting code is useful and can apply this appropriately	
☹️ 😐 😊	I understand the benefits of using sub programs to improve maintainability	
☹️ 😐 😊	I understand the benefits of using naming conventions for variables and constants to improve maintainability	
☹️ 😐 😊	I understand the benefits of indentation in program code to improve maintainability	

2.3.2 Testing

☹️ 😐 😊	I understand the purpose of testing	
☹️ 😐 😊	I can explain the difference between Iterative (testing modules of a program during development) and Final/terminal testing (testing the program at the end of production)	
☹️ 😐 😊	I can identify Syntax errors as errors which break the grammatical rules of the programming language and stop it from being run/translated	
☹️ 😐 😊	I can identify Logic errors as errors which produce unexpected output	

☹️ 😐 😊	I can identify Normal test data as data which should be accepted by a program without causing errors	
☹️ 😐 😊	I can identify Boundary test data as data which should be accepted by a program without causing errors	
☹️ 😐 😊	I can identify Invalid test data as data of the correct data type which should be rejected by the computer system	
☹️ 😐 😊	I can identify Erroneous test data as data of the incorrect data type which should be rejected by the computer system	
☹️ 😐 😊	I am able to identify suitable test data for a given scenario	
☹️ 😐 😊	I am able to create and complete a test plan	
☹️ 😐 😊	I am able to use test results to refine algorithms	



2.4 Boolean logic

<u>Confidence</u>	<u>Clarification</u>	✓
2.4.1 Boolean logic		
☹️ 😐 😊	I can identify the logic gate symbols for AND, OR and NOT	
☹️ 😐 😊	I understand how each logic gate works and can complete truth tables for them	
☹️ 😐 😊	I can complete simple logic gate diagrams using the operators AND, OR and NOT	
☹️ 😐 😊	I can combine Boolean operators using AND, OR and NOT	
☹️ 😐 😊	I can create, complete or edit logic diagrams for given scenarios	
☹️ 😐 😊	I can create, complete or edit truth tables for given scenarios	
☹️ 😐 😊	I can apply logical operators in truth tables to solve problems	
☹️ 😐 😊	I am able to use test results to refine algorithms	

2.5 Programming languages and IDE's

```
ooo
user@user /c
$ -
```

<u>Confidence</u>	<u>Clarification</u>	✓
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2.5.1 Languages

☹️ 😐 😊	I can explain the differences between High and Low level programming languages	
☹️ 😐 😊	I can explain the purpose of Translators	
☹️ 😐 😊	I can explain the differences, benefits and drawbacks of using a Compiler or an Interpreter	

2.5.2 The Integrated Development Environment (IDE)

☹️ 😐 😊	I can identify the tools that an IDE provides	
☹️ 😐 😊	I can explain how Editors can be used to help a programmer develop a program	
☹️ 😐 😊	I can explain how Error diagnostics can be used to help a programmer develop a program	
☹️ 😐 😊	I can explain how a Run-time environment can be used to help a programmer develop a program	
☹️ 😐 😊	I can explain how Translators can be used to help a programmer develop a program	
☹️ 😐 😊	I have practical experience of using a range of these tools within an IDE	