GCSE MARKING SCHEME

SUMMER 2022

COMPUTER SCIENCE - COMPONENT 1
C500U10-1

INTRODUCTION

This marking scheme was used by WJEC for the 2022 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

EDUQAS GCSE COMPUTER SCIENCE – COMPONENT 1

SUMMER 2022 MARK SCHEME

Guidance for examiners

Positive marking

It should be remembered that learners are writing under examination conditions and credit should be given for what the learner writes, rather than adopting the approach of penalising him/her for any omissions. It should be possible for a very good response to achieve full marks and a very poor one to achieve zero marks. Marks should not be deducted for a less than perfect answer if it satisfies the criteria of the mark scheme.

For questions that are objective or points-based the mark scheme should be applied precisely. Marks should be awarded as indicated and no further subdivision made.

For band marked questions mark schemes are in two parts.

Part 1 is advice on the indicative content that suggests the range of computer science concepts, theory, issues and arguments which may be included in the learner's answers. These can be used to assess the quality of the learner's response.

Part 2 is an assessment grid advising bands and associated marks that should be given to responses which demonstrate the qualities needed in AO1, AO2 and AO3. Where a response is not credit worthy or not attempted it is indicated on the grid as mark band zero.

Banded mark schemes

Banded mark schemes are divided so that each band has a relevant descriptor. The descriptor for the band provides a description of the performance level for that band. Each band contains marks.

Examiners should first read and annotate a learner's answer to pick out the evidence that is being assessed in that question. Once the annotation is complete, the mark scheme can be applied.

This is done as a two stage process.

Stage 1 – Deciding on the band

When deciding on a band, the answer should be viewed holistically. Beginning at the lowest band, examiners should look at the learner's answer and check whether it matches the descriptor for that band. Examiners should look at the descriptor for that band and see if it matches the qualities shown in the learner's answer. If the descriptor at the lowest band is satisfied, examiners should move up to the next band and repeat this process for each band until the descriptor matches the answer.

If an answer covers different aspects of different bands within the mark scheme, a 'best fit' approach should be adopted to decide on the band and then the learner's response should be used to decide on the mark within the band. For instance if a response is mainly in band 2 but with a limited amount of band 3 content, the answer would be placed in band 2, but the mark awarded would be close to the top of band 2 as a result of the band 3 content. Examiners should not seek to mark candidates down as a result of small omissions in minor areas of an answer.

Stage 2 – Deciding on the mark

Once the band has been decided, examiners can then assign a mark. During standardising (marking conference), detailed advice from the Principal Examiner on the qualities of each mark band will be given. Examiners will then receive examples of answers in each mark band that have been awarded a mark by the Principal Examiner. Examiners should mark the examples and compare their marks with those of the Principal Examiner.

When marking, examiners can use these examples to decide whether a learner's response is of a superior, inferior or comparable standard to the example. Examiners are reminded of the need to revisit the answer as they apply the mark scheme in order to confirm that the band and the mark allocated is appropriate to the response provided.

Indicative content is also provided for banded mark schemes. Indicative content is not exhaustive, and any other valid points must be credited. In order to reach the highest bands of the mark scheme a learner need not cover all of the points mentioned in the indicative content but must meet the requirements of the highest mark band. Where a response is not creditworthy, that is contains nothing of any significance to the mark scheme, or where no response has been provided, no marks should be awarded.

Question	Answer	Marks	AO1	AO2	AO3	Total
1. (a)	**Award one mark for each of the following:** • Making a website unavailable to legitimate users by swamping them with fake requests - **Denial of service** • Self-replicating programs that enable remote control of the infected computer - **Worm** • Fake emails asking you to confirm personal details – **Phishing**	3	1a			3
(b) (i)	**Award one mark for the following:** • A hacker attempts to gain access to a systems by guessing the password • The program guesses the password by attempting all possible alphanumeric combinations.	2	1b			2
(ii)	**Award one mark for each of the following:** • A technique where users can inject SQL commands into an SQL statement, via web page input • Injected SQL commands can alter SQL statements • This can compromise the security of information held in a database.	2	1b			2

Question	Answer	Marks	AO1	AO2	AO3	Total
2. (a)	**Award one mark for each of the following:** 	Component	Name	Purpose
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A	Arithmetic logic unit / ALU	Performs all the mathematical calculations / logical operations in the CPU.
B/C	Current instruction register / CIR	Stores the address in the main memory that is currently being read or written.
B/C	Memory data register / MDR	A temporary holding area for the instruction that has just been fetched from memory.		6	1a 1b			6
(b)	**Award one mark for each of the following:** • The fetch cycle takes the address required from memory / RAM • It stores the address in the current instruction register • The control unit authenticates the instruction in the current instruction register • The instruction is decoded to determine the action that needs to be carried out • The process is repeated • The program counter is incremented • The instruction is transferred to the MDR • The address of the instruction to be fetched is placed in the MAR.	4	1b			4
(c)	**Award one mark for each of the following:** • More cache memory improves the performance of the CPU • It is able to provide more instructions and data to the CPU • At a much faster rate than another system memory such as RAM.	2	1b			2
(d)	**Award one mark for each of the following up to a maximum of 2:** • Virtual memory is a section of memory created on the storage drive • It is created temporarily • It is created when a computer is running many processes at once and RAM is running low.	2	1b			2

Question	Answer	Marks	AO1	AO2	AO3	Total
3. (a)	**Award one mark for each of the following:** • They allow devices to communicate. • Using an agreed upon set of instructions / rules	2	1b			2
(b)	**Award one mark for each of the following:** • HTTPS: Transfer multimedia web pages over the internet **securely / encrypted** • FTP: Transfer files over the internet.	2	1b			2
(c)	**Award one mark for each of the following:** • Checksum • Source address.	2	1a			2
4. (a)	<table><tr><td>A</td><td>B</td><td>$\overline{A}$</td><td>$\overline{A} \oplus B$</td><td>$A \cdot (\overline{A} \oplus B)$</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td></tr></table> **Award one mark for each of the following:** • Correct A and B columns • Correct $\overline{A}$ column • Correct $\overline{A} \oplus B$ column • Correct $A \cdot (\overline{A} \oplus B)$ column	4		2a 2b		4
(b)	**Award one mark for the following:** • $A \cdot B$	1		2b		1

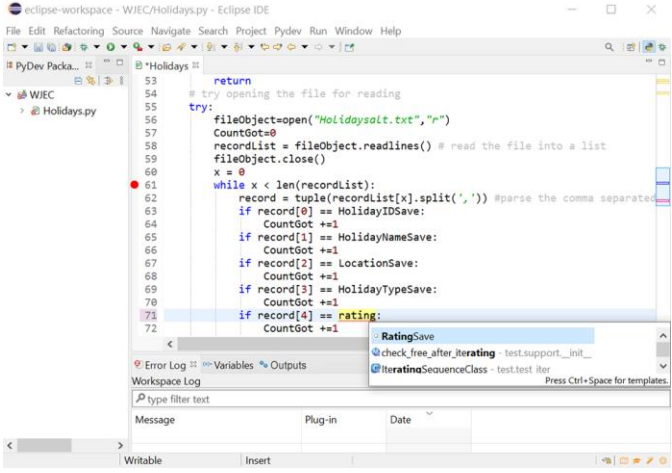| Question	Answer	Marks	AO1	AO2	AO3	Total
5. (a) (i)	**Award one mark for each of the following:** • **Overflow** errors occur when the execution of a set of instructions returns a value larger than its range.	1	1b			1
(ii)	**Award one mark for the following:** • **Underflow** is the condition in a computer program where the result of a calculation is smaller than the computer can actually represent in memory.	1	1b			1
(b)	**Award one mark for each of the following:** • 85_{10} • $0111\ 0101_2$ • BD_{16}	3		2a		3
(c)	**Award one mark for each of the following:** • $9_{10} = 01001_2$ • $-9_{10} = 10111_2$ • $21_{10} = 10101_2$ • Binary addition = 01100_2 **Must use 2s complementation and binary addition to gain more than 2 marks.**	4		2a		4
(d) (i)	**Award one mark for each of the following:** • $0001\ 0001_2$	1		2b		1
(ii)	**Award one mark for each of the following:** • 3 shifts left = multiply by 8 accept 2^3 • 4 shifts right = divide by 16 accept 2^{-4}	2		2b		2
6. (a)	**Award one mark for each simplification:** • $A + B \cdot \left(\overline{B} + C\right)$ • $A + B \cdot \overline{B} + B \cdot C$ • $A + B \cdot C$	3		2b		3
(b)	**Award one mark for each simplification:** • $\overline{X} + \overline{X} \cdot Y + \overline{Y}$ • $\overline{X} \cdot (1 + Y) + \overline{Y}$ • $\overline{X} + \overline{Y}$	3		2b		3

Question	Answer	Marks	AO1	AO2	AO3	Total
7.	**Indicative content** • declare markArray (1..999) as integer • numMarks is integer • maxMark is integer • numPrizes is integer • totalMarks is integer • • input numMarks • • for i = 1 to numMarks • • input markArray(i) • if markArray(i) > maxMark then • maxMark = markArray(i) • end if • • totalMarks = totalMarks + markArray(i) • next i • • output "Maximum Mark = ", maxMark • • for i = 1 to numMarks • if markArray(i) = maxMark then • numPrizes = numPrizes + 1 • end if • next i • • output "Number of Prizes = ", numPrizes • output "Mean Mark = ", totalMarks/numPrizes **Award one mark for each of the following:** • Declare markArray / variables for storing each mark • Declare / initialise variables • Input numMarks • Loop with correct terminating condition (numMarks) • Input marks • Correct determination of maxMark • Correct calculation of running total • Correct determination of number of prizes • Correct outputs maxMark and numPrizes • Correct output for mean mark.	10			3b	10

Question	Answer	Marks	AO1	AO2	AO3	Total
8. (a)	**Award one mark for each of the following:** • Sampling is a method of converting an analogue sound signal into a digital signal • At specific intervals (frequency) a measurement of the amplitude (bit depth) of the signal is taken / measures the level of sound many times per second.	2	1b			2
(b)	**Award one mark for each of the following:** • The amplitude of each sound sample is converted into the equivalent binary number • The whole collection of data (binary numbers) is then stored in a digital file.	2	1b			2
(c) (i)	**Award one mark for each of the following:** • $sound\ file\ size = 300 \times 2 \times 44,100 \times 16$ • $sound\ file\ size = 423,360,000\ bits$	2		2a		2
(ii)	**Award one mark for each of the following:** • $sound\ file\ size = \dfrac{423,360,000\ bits}{8} = 52,920,000\ bytes$ • $sound\ file\ size = \dfrac{52,920,000\ bytes}{1,024} = 51.68\ MB$ Accept answers using 1,000 divisor instead of 1,024.	2		2b		2
(d)	**Award one mark for each of the following:** • Artist • Title / Track Title • Product / Album Title • Track Number • Date Created / Year • Genre • Comments • Copyright • Software • Type • Duration • File size • Bit rate • Sampling rate • Channels • Volume.	2	1a			2

Question	Answer	Marks	AO1	AO2	AO3	Total
9. (a) (i)	**Award one mark for the following up to a maximum of two:** • Multitasking is the execution of multiple tasks / processes at the same time • New tasks can interrupt already started ones before they finish, instead of waiting for them to end • As a result, a computer executes segments of multiple tasks in an interleaved manner, while the tasks share common processing resources such as central processing units (CPUs) and main memory.	2	1b			2
(ii)	**Award one mark for the following up to a maximum of two:** • The OS manages the hard disk by ensuring that files and data can be stored and retrieved correctly • It maintaining a filing system such as FAT or NTFS • Ensure files are not overwritten • Organise files in a hierarchical directory structure.	2	1b			2

(b)	**Award one mark for the following up to a maximum of two marks per utility software maximum of 6 marks in total:**
	• Anti-virus
	  ○ Antivirus protection software is designed to prevent viruses, worms and Trojan horses from attacking a computer
	  ○ They remove any malicious software code that has already infected a computer.
	• Disk formatters
	  ○ Disk formatting is a process of configuring data storage device such as hard disk drive, solid-state drive, floppy disk, or USB flash drive for initial use
	  ○ However, what does formatting a hard drive do? Actually, the whole disk formatting process consists of three parts: low-level formatting, partitioning, and high-level formatting.
	• Clipboard manager
	  ○ A clipboard manager stores data copied to the clipboard in a way that permits extended use of the data, e.g. "copy and paste"
	• Disk partition editors
	  ○ Disk partition editors are designed to view, create, modify or delete disk partitions
	  ○ A disk partition is a logical segment of the storage space on a storage device.
	• System profiles
	  ○ System profiles are a record of personal, user-specific data associated with a named user's identity and desktop environment
	  ○ It contains many elements, such as settings, configuration items, connections and history.
		6	1b			6

Question	Answer	Marks	AO1	AO2	AO3	Total

	• Archivers
	   ○ Archivers are used to collect multiple data files together into a single file for easier portability and storage, or simply to compress files to use less storage space.
	• Backup software
	   ○ At periodic intervals, a backup of the entire hard drive or of selected files and folders can be performed
	   ○ Backup programs can also be set up to back up files automatically right after they have been updated and saved.
	• Cryptographic utilities
	   ○ Cryptography is the process of converting ordinary data into unintelligible data and vice-versa
	   ○ It is a method of storing and transmitting data in a particular form so that only those for whom it is intended can read and process it.
	• Disk checkers
	   ○ A disk checker is a utility program which can scan a hard disk to find files or areas that are corrupted in some way, or were not correctly saved, and eliminate them for a more efficiently operating hard drive.
	• Data recovery
	   ○ Data recovery is a process of retrieving inaccessible, lost, corrupted, damaged or formatted data.
	• Disk compression
	   ○ Compression is the process of making a file size smaller
	   ○ This may be advantageous as it allows more data to be stored on the disk, and files may also be transferred more quickly
	   ○ There are two primary methods that are used to compress files stored on a computer system; these are lossy and lossless.
	• Revision control
	   ○ In software engineering, version control (also known as revision control, source control, or source code management) is a class of systems responsible for managing changes to computer programs, documents, large web sites, or other collections of information. Version control is a component of software configuration management.[1]
	• Disk defragmenters
	   ○ Defragmentation is the process where files are physically re-arranged on disk so that they are no longer fragmented, and the parts of each file are stored together.					

Question	Answer	Marks	AO1	AO2	AO3	Total

	• File managers
	    o A file manager provides a user interface to manage files and folders
	    o The most common operations performed on files or groups of files include creating, opening (e.g. viewing, playing, editing or printing), renaming, copying, moving, deleting and searching for files, as well as modifying file attributes, properties and file permissions.
	    o Folders and files may be displayed in a hierarchical tree based on their directory structure.
	 • Task manager
	    o A systems monitor program used to provide information about the processes and applications running on a computer.
	
	Award MAX 3 marks for naming only.					

10.	**Award one mark for each of the following:** • Uses divide and conquer by dividing the list into separate elements • Pairs of elements are then compared and placed into order and combined • The pairs are then compared, starting with the first number in each pair • If the left hand number is smaller than the right hand number, it is placed in order • The process is then repeated until the list is recompiled as a whole.	5	1b			5

Question	Answer	Marks	AO1	AO2	AO3	Total
11. (a)	**Award one mark for each correctly labelled tool:** • Editor • Line numbering • Automatic formatting • Spell checker • Indentation • Automatic word completion • Break point • Variable watch • Output • Error diagnostics / debugger 	5		2a		5
(b)	**Award one mark for each of the following:** • Editor: Allows a programmer to enter, format and edit code • Automatic formatting: Correctly indents code • Spell checker: checks variable names and command mnemonics for spelling • Automatic colour coding: Changes key words, literals and annotation to different colours • Automatic line numbering: Line numbers and syntax errors It is a simple matter for a program to count the newlines in a source file and display an automatically generated line number as the location of the error • Break point: Interrupts a program on a specific line of code • Error diagnostics / debugger: Used when a program fails to compile or to run. Error messages are displayed to help the programmer debug • Variable watch: Displays the current value of any variable • Threading: Displays all the different tasks that are running simultaneously • Output window: Displays all the values output by the program.	2	1b			2

Question		Answer	Marks	AO1	AO2	AO3	Total
12. (a) (i)		Variables are checked during the **semantic analysis** stage to ensure that they are of the correct data type.	1	1a			1
	(ii)	During the **lexical analysis** stage, keywords, constants and identifiers are replaced by 'tokens'.	1	1a			1
	(iii)	Tokens are checked to see if they match the spelling and grammar expected, using standard language definitions during the **syntax analysis** stage.	1	1a			1
	(iv)	**Code optimisation** may be employed to make programs less resource intense.	1	1a			1
(b) (i)		**Award one mark for each of the following up to a maximum of two:** • convert high-level language programs into executable code, • one line at a time • each instruction generates several low-level instructions.	2	1b			2
	(ii)	**Award one mark for each of the following:** • converts low-level language programs into executable code • each mnemonic is replaced with the corresponding machine code.	2	1b			2