GCSE MARKING SCHEME

SUMMER 2023

COMPUTER SCIENCE - UNIT 1
3500U10-1

INTRODUCTION

This marking scheme was used by WJEC for the 2023 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.

WJEC GCSE COMPUTER SCIENCE

UNIT 1 - UNDERSTANDING COMPUTER SCIENCE

SUMMER 2023 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 up to a maximum of four marks:** • A dual-core CPU will always process instructions twice as fast as a single-core CPU – **FALSE** • The ALU can perform comparisons on data e.g. an IF statement in a high-level language **– TRUE** • Overclocking is the process of setting a processor to run slower than its original design. **– FALSE** • Cache memory has a slower disk access speed than RAM **– FALSE**	4		1b		4
(b)	**Award one mark for each of the following up to a maximum of three marks:** Fetch: • The program counter (PC) holds the memory address of the next instruction to be fetched • The memory address in the PC is loaded into the Memory Address Register (MAR) • The instruction stored at the memory address is fetched from main memory • The instruction is loaded into the Current Instruction Register (CIR) • The PC is incremented to point to the next instruction. Decode: • The instruction stored in the CIR is decoded by the control unit • The control unit determines the type of instruction and identifies the operands required for the instruction. Execute: • Based on the decoded instruction, the necessary actions are performed • If the instruction involves data processing or calculations, the ALU (Arithmetic Logic Unit) carries out the required operations • The result is stored in a register or memory location as specified by the instruction.	3	1b			3
(c)	**Award one mark for each of the following up to a maximum of two marks:** • An embedded system performs a specific task • whereas a general-purpose computer is designed to carry out multiple tasks.	2	1b			2

Question	Answer	Marks	AO1	AO2	AO3	Total
2. (a)	**Award one mark for each of the following up to a maximum of two marks:** • Flash memory can be changed / ROM cannot be changed • This is advantageous as the BIOS can then be upgraded.	2		1b		2
(b)	**Award one mark for each of the following up to a maximum of two marks:** • Can store more **currently running** programs / data. • Faster transfer of data from one location of the hard disk to another • Fast start up and shutdown of the system • The load in the CPU is reduced • Processing is improved as more data and instructions can be passed to the CPU faster • Can run up-to-date versions of operating systems which require more RAM • Less use for virtual memory, speeding the computer up	2		1b		2
(c)	**Award one mark for each of the following up to a maximum of four marks:** Input (MAX two marks) • Mouse • Keyboard • Scanner • Microphone • Graphics tablet Accept any reasonable answer	2	1b			4
	Output (MAX two marks) • Printer • Monitor • Speaker Accept any reasonable answer	2	1b			

Question	Answer	Marks	AO1	AO2	AO3	Total
3. (a)	<table><tr><td>**P**</td><td>**Q**</td><td>**P.Q**</td><td>**$\overline{P}$**</td><td>**Z**</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td><td>1</td><td>1</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>1</td><td>0</td><td>1</td></tr></table> **Award one mark for each of the following columns up to a maximum of four marks:** • **P and Q** • **P.Q** • **$\overline{P}$** • **Z**	4		1b		4
(b)	**Award one mark for each simplification up to a maximum of four marks:** • $A.\overline{C} + C.A + C.B$ • $A.(\overline{C} + C) + C.B$ • $A.(1) + C.B$ • $A + C.B$ Accept other methods DO NOT accept truth table solutions where there is no final expression	4		1a		4
4. (a)	• A protocol that can be used when copying a file from one location to another via a network **– FTP** • The protocol that can be used to transfer multimedia web pages over the internet **– HTTP** • An email protocol that stores email messages on a mail server **– IMAP**	3		1b		3
(b) (i)	**Award one mark for each of the following:** TCP • TCP is a protocol that allows packets to be sent and received between computer systems. IP • IP is a protocol that sets out the format of packets and an addressing system.	2	1b			2

Question	Answer	Marks	AO1	AO2	AO3	Total
(b) (ii)	**Award one mark for each of the following up to a maximum of three marks:** • Source address • The data • Information which enables the data to be reassembled into its original form / packet number / packet order • Other tracking information • Checksum / error checking **Not Destination Address**	3	1b			3
(c)	**Award one mark for each of the following up to a maximum of two marks:** Advantages (MAX one mark) • The connection is reliable • Once the connection is established, it is fast and generally error free. Disadvantages (MAX one mark) • It takes time to establish the connection. • Should anywhere on the route fail, the connection will be broken. • Interception / wiretapping collects all data being transmitted via circuit switching therefore less secure.	2	1b			2
(d)	**Award one mark for each of the following up to a maximum of six marks:** • The browser checks the local /cached host file to check if it already holds the IP address • If not, the local (ISP) DNS server is queried for the IP address • If the local DNS server does not hold the IP address then the query is passed to another DNS server at a higher level • This process is repeated until the IP address is resolved • The address is passed on to DNS severs lower in the hierarchy • When the full address has been resolved, the IP address is then passed to your browser • The browser then connects to the IP address of the server and downloads the web site.	6	1b			6

Question	Answer	Marks	AO1	AO2	AO3	Total
5.	**Award one mark for each correct lowest cost and each correct route up to a maximum of four marks:** <table><tr><th>Origin</th><th>Destination</th><th>Lowest Cost</th><th>Route</th></tr><tr><td>A</td><td>K</td><td>15</td><td>A>B>H>F>K</td></tr><tr><td>J</td><td>C</td><td>12</td><td>J>K>F>G>C</td></tr></table>	4		1a		4
6. (a) (i)	• 01011001_2	1		1a		1
(a) (ii)	• $7B_{16}$	1		1a		1
(a) (iii)	• 251_{10}	1		1a		1

(b)	**Award one mark for each of the following up to a maximum of four marks:**
	
	• An arithmetic shift involves moving the bits either left or right by a specified number of places.
	• When shifting to the right:
	  o the leftmost bit (MSB) is copied to fill in all the vacant positions (to maintain the sign bit)
	  o the rightmost bit (LSB) is lost
	• When shifting to the left:
	  o the leftmost bit (MSB) is lost
	  o the rightmost bit (LSB) is filled with a zero
		4	1b			4

(c)	00100101_2 $\underline{01111010_2}$ 1 1 $\underline{10011111_2}$	1 (carry) 1		1a 1a		2

Question	Answer	Marks	AO1	AO2	AO3	Total
7. (a)	**Indicative content**	4		1b		4

Indicative content

FIELD NAME	DATA TYPE	EXAMPLE DATA	VALIDATION CHECK
Product ID	String	FR01234	Format check
Product name	String	Cucumber	Presence check
Product type	Char	F	Look-up list
Weight	Real	3.54	Type check
Best before date	Date	03/06/21	Range check
Price	Real	0.70	Type check
Quantity in stock	Integer	3	Type check

- Award one mark for each <u>different</u> correct data type and one mark for each <u>different</u> correct validation check up to a maximum of four marks

Question	Answer	Marks	AO1	AO2	AO3	Total
(b) (i)	**Award one mark for each of the following up to a maximum of four marks:**	4		1b		4

Access Levels (MAX two marks)
- It is not desirable that every user should be able to access all the data on a computer system
- User access levels are one method used to allow certain users read and/or write access to data on a computer system
- For example, in a program used by Park Vale Groceries, an administrator, possibly the owner, will have read and write access to all data on the system
- Another staff member however, will only have access to their own personal data
- User access levels will define which users can change and view, view but not change, or not view stored data.

Password Protection (MAX two marks)
- Passwords are commonly used to prove a person's identity to a computer system, thus allowing them access to relevant data.
- Different programs may require a user to use different complexities of password, as well as different character lengths.
- An example of a simple password may be the user's town of birth, or the word 'password'.
- A more complex password may require the user to use a combination of upper and lower case alphanumeric characters.

Accept but not expect other types of software method.

Question	Answer	Marks	AO1	AO2	AO3	Total

(b) (ii)	**Award one mark for each of the following up to a maximum of four marks:**
	
	Encryption
	   `10101010`
	• <u>`11110000 XOR`</u>
	• `01011010`
	
	Decryption
	   `01011010`
	• <u>`11110000 XOR`</u>
	• `10101010`
		1(method)
		1
		
		1(method)
		1
				1b
				1a
				
				1b
				1a
						4

8. (a)	A **LOADER** is a program which loads previously compiled code into memory.	1		1b		1
(b)	**TRACE** is a facility which displays the order in which the lines of a program are executed, and possibly the values of variables as the program is being run.	1		1b		1
(c)	**BREAK POINT** interrupts a program on a specific line of code, allowing the programmer to compare the values of variables against expected values.	1		1b		1
(d)	**MEMORY INSPECTOR** is a facility which will display the contents of a section of storage.	1		1b		1
9. (a) (i)	**Award one mark for each of the following up to a maximum of two marks:** Error • Line 11: `ouptut` Change • Line 11: `output`	2		1b		2
(a) (ii)	Award one mark for each of the following up to a maximum of two marks: Error • Line 10: `area = pi * radius - radius` Change • Line 10: `area = pi * radius * radius`	2		1b		2

Question	Answer	Marks	AO1	AO2	AO3	Total
9. (b)	**Award one mark for each of the following up to a maximum of two marks:** • It is similar to a natural human language, such as English • Some programmers prefer to use high-level programming languages, as they are easier to understand / learn / program • Identifiers can be long and meaningful • High-level programming languages also allow the use of powerful commands that perform quite complex task.	2	1b			2
(c)	**Award one mark for each of the following up to a maximum of two marks:** • lexical analysis, • symbol table construction, • syntax analysis, • semantic analysis, • code generation • optimisation.	2	1b			
10. (a)	**Award one mark for each of the following up to a maximum of two marks:** • It is illegal to access data without permission, e.g. looking at someone else's files • It is illegal to access computer systems without permission, e.g. hacking • It is illegal to alter data stored on a computer system without permission, e.g. writing a virus that deliberately deletes data.	2	1b			2

Question	Answer	Marks	AO1	AO2	AO3	Total

10. (b)	**Award one mark for each of the following up to a maximum of six marks:**
	
	• Shoulder surfing
	  ○ using direct observation to get information.
	• Keylogging
	  ○ Software that records keystrokes in order to get user IDs and passwords
	• Physical attack
	  ○ Breaking into a building or room in order to physically remove data held on a computer.
	• SQL injection
	  ○ a technique where malicious users can inject SQL commands into an SQL statement, via web page input.
	• Denial of service (DoS) attacks
	  ○ they do not attempt to break system security, they attempt to make your website and servers unavailable to legitimate users, by swamping a system with fake requests to exhaust server resources.
	• Distributed denial of service (DDoS) attacks
	  ○ launched from multiple connected devices that are distributed across the internet. These multi-person, multi-device attacks target the network infrastructure in an attempt to saturate it with huge volumes of traffic.
	• Dictionary attack
	  ○ This uses a simple file containing words found in a dictionary. This attack uses exactly the kind of words that many people use as their password.
	• Brute force attack
	  ○ Similar to the dictionary attack but able to detect non-dictionary words by working through all possible alphanumeric combinations from aaa1 to zzz10.
	• Guess
	  ○ A user-generated password is unlikely to be random. Passwords are likely to be based upon our interests, hobbies, pet names, family names etc. Educated guesses often work.
	• IP spoofing
	  ○ IP address spoofing involves an attacker changing the IP address of a legitimate host so that a visitor who types in the URL of a legitimate site is taken to a fraudulent or spoofed web page. The attacker can then use the hoax page to steal sensitive data, such as a credit card number, or install malware.
	• Social engineering
	  ○ tricking a user into giving out sensitive information such as a password, by posing as a legitimate system administrator.
		6	1b			6

Question	Answer	Marks	AO1	AO2	AO3	Total
10. (c)	**Award one mark for each of the following up to a maximum of four marks:** • Footprinting o Footprinting is the first step in the evaluation of the security of any computer system. o It involves gathering all available information about the computer system or network and the devices that are attached to it. o Footprinting should enable a penetration tester to discover how much detail a potential attacker could find out about a system o and allow an organisation to limit the technical information about its systems that is publicly available. • Ethical hacking o Ethical hacking is carried out with the permission of the system owner to cover all computer attack techniques. o An ethical hacker attempts to bypass system security and search for any weak points that could be exploited by malicious hackers. o This information is then used by the system owner to improve system security. • Penetration testing o Penetration testing is a sub set of ethical hacking that deals with the process of testing a computer system, or network to find vulnerabilities that an attacker could exploit. o The tests can be automated with software applications or they can be performed manually. o Penetration test strategies include; o Targeted testing, testing carried out by the organisation's IT team and the penetration testing team working together. o External testing, to find out if an outside attacker can get in and how far they can get in once they have gained access. o Internal testing, to estimate how much damage a dissatisfied employee could cause. o Blind testing, to simulate the actions and procedures of a real attacker by severely limiting the information given to the team performing the test.	4	1b			4

Question	Answer	Marks	AO1	AO2	AO3	Total
11.	**Indicative content** Utility software - File indexing - An indexed file is a computer file with an index that allows easy random access to any record given its file key - File conversion - Convert a sound file from WAV to MP3 - Defragmentation - 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. - Compression - Software reduces file sizes using less space - Task management - Can see how much disk % a given program is using, can shut it down if dominating. - Disk scanning and repair - Fixes problems on disk - Anti-virus software - Scan for viruses which could be causing issues with the disc access speed / damaging data - Backup - Data backup is the process of creating copies of important files or information to protect against loss, damage or accidental deletion. - Firewall - Software or hardware that protects a network or system from unauthorised access Resources - Managing peripherals such as input and output devices - Communicates with and sends data output to a printer/monitor/other valid output device. - Communicates with and receives data input to a keyboard/mouse/other valid input device. - Managing printing using spooling - Data is stored on a hard disk/in memory/stored in a queue. - Document is printed when printer is free/in correct order. - Benefit of spooling – user can carry on working/log off when waiting for job to print.	10	1b			10

13

Question	Answer	Marks	AO1	AO2	AO3	Total
	• Managing backing store o Ensures data is stored and can be retrieved correctly from any disk drive. o Creates and maintains filing system such as file allocation table (FAT) or new technology file systems (NTFS). o Organises files in a hierarchical directory structure. • Managing RAM o Ensures that programs/data do not corrupt each other. o Ensures that all programs and data, including itself, are stored in correct memory locations. • Managing processes o Ensures that different processes can utilise the CPU and do not interfere with each other or crash. o On a multi-tasking O/S, ensures that all tasks appear to run simultaneously. • Managing security o Allows creation and deletion of user accounts. o Allows users to logon and change passwords.					

Question		Answer	Marks	AO1	AO2	AO3	Total
	Band	**AO1.1b** **(Max 10 marks)**					
	3	**8-10 marks** The candidate has: • shown clear understanding of the requirements of the question and a clear knowledge of the indicative content. Clear knowledge is defined as a response that provides eight to ten relevant detailed points from the indicative content • addressed the question appropriately discussing utility software **and** operating system resources. • used appropriate technical terminology referring to the indicative content accurately.					
	2	**4-7 marks** The candidate has: • shown adequate understanding of the requirements of the question and a satisfactory knowledge of the indicative content. Satisfactory knowledge is defined as a response that provides four to eight points from the indicative content. • addressed the question by discussing utility software **and/or** operating system resources. • used appropriate technical terminology referring to the indicative content.					
	1	**1-3 marks** The candidate has: • attempted to address the question but has demonstrated superficial knowledge of the indicative content. Superficial knowledge is defined as a response that provides one to three points from the indicative content • addressed the question by discussing **only** utility software **or** operating system resources. • used limited technical terminology referring to the indicative content					
	0	**0 marks** Response not credit worthy or not attempted.					
			100	**52**	**48**	**0**	**100**

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