GCSE MARKING SCHEME

SUMMER 2022

COMPUTER SCIENCE - UNIT 1
3500U10-1

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.

GCSE COMPUTER SCIENCE

UNIT 1 - UNDERSTANDING COMPUTER SCIENCE

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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.
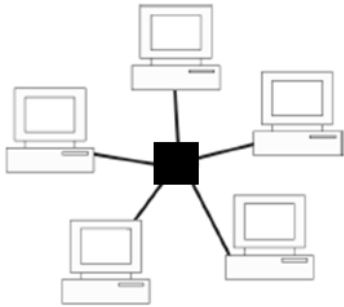
Q	Answer	Marks	AO1	AO2	AO3	Total
1.	Award one mark for each of the following: • Flash drive – Storage • Fingerprint scanner – Input • Hard disk drive – Storage • Monitor - Output	1 1 1 1	1a 1a 1a 1a			4
2.	Award one mark for each of the following rows: 	No	Unit		No	Unit
---	---	---	---	---
2	**nybbles**	**=**	1	byte
1024	**bytes**	**=**	1	kilobytes
1024	kilobytes	**=**	1	**megabyte**
1024	megabytes	**=**	1	**gigabyte**		1 1 1 1		1a 1a 1a 1a		4
3. (a)	Award one mark for each of the following rows: • A program that appears to perform a useful function but also provides a 'backdoor' that enables data to be stolen. - **Trojan** • Installed by opening attachments or downloading infected software and can be used to collect stored data without the user's knowledge - **Spyware** • Self-replicating program that identifies vulnerabilities in operating systems and enables remote control of the infected computer - **Worm**	3		1b		3
(b) (i)	Award one mark for each of the following: • Footprinting is the first step in the evaluation of the security of any computer system. • It involves gathering all available information about the computer system or network and the devices that are attached to it. • Footprinting should enable a penetration tester to discover how much detail a potential attacker could find out about a system • and allow an organisation to limit the technical information about its systems that is publicly available to a real attacker • by severely limiting the information given to the team performing the test. Accept ethical hacking (not twice)	2	1b			2

Q	Answer	Marks	AO1	AO2	AO3	Total
(ii)	Award one mark for each of the following: • 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. • The tests can be automated with software applications or they can be performed manually. • Penetration test strategies include; o Targeted testing, testing carried out by the organization'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.	2	1b			2

Q	Answer	Marks	AO1	AO2	AO3	Total
4. (a)	Award one mark for each of the following: Fetch the instruction • The fetch cycle takes the address required from main memory, • stores it in the (instruction) register • and moves the program counter on one • so that it points at the next instruction. Decode the instruction • The control unit checks the instruction in the (instruction) register. • The instruction is decoded to determine the action that needs to be carried out Execute the instruction • The actual actions that happen during the execution cycle depend on the instruction itself • such as reading values from registers and passing them to the ALU to perform mathematical or logic functions on them • and writing the result back to a register. • If the ALU is involved, it sends a condition signal back to the CU. • The result generated by the operation is stored in the main memory or sent to an output device. • Based on the feedback from the ALU, the PC may be updated to a different address from which the next instruction will be fetched.	4	1b			4
(b)	Award one mark for each of the following: • RISC processors can process a limited number of relatively simple instructions. • To carry out more complex commands the problem is broken down into a longer list of simpler instructions. • RISC processors run cooler • use less power • are cheaper to run	2	1b			2

Q	Answer	Marks	AO1	AO2	AO3	Total
(c) (i)	Award one mark for each of the following: • GPUs are specialised electronic circuits designed to rapidly manipulate and alter memory • GPUs efficiently manipulate computer graphics and carry out image processing. • A GPU is a microprocessor that performs the calculations needed to produce graphic images on screen. • Initially the CPU performed these calculations, ○ but as more complex applications were developed, such as 3D graphics and video quality animations, the GPU was introduced to offload those tasks from the CPU. • GPUs can be integrated within the circuitry of the motherboard or provided on a dedicated graphics card.	2	1b			2
(ii)	Award one mark for each of the following: • The motherboard is the main circuit board of a computer. • A motherboard provides connections between many of the components used by computer systems, • such as the CPU, memory, hard disc interface, expansion slots and other peripherals.	2	1b			2

Q	Answer	Marks	AO1	AO2	AO3	Total
5. (a)	OR	1		1a		1
(b) (i)	$R = \overline{P.Q}$	1		1b		1
(ii)	$Z = \overline{X \oplus Y}$	1		1b		1
(c)						3

A	B	C	$B + C$	$A + (B + C)$
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	1	1
1	0	0	0	1
1	0	1	1	1
1	1	0	1	1
1	1	1	1	1

Award one mark for each of the following:

- Correct A, B and C columns — 1 — 1b
- Correct B + C column — 1 — 1b
- Correct $A + (B + C)$ column — 1 — 1b

Q	Answer	Marks	AO1	AO2	AO3	Total
6. (a) (i)	The **application** layer provides interfaces to the software to allow it to use the network.	1		1b		1
(ii)	The **transport** layer handles data-consistency functions, i.e. provides a reliable byte stream between two nodes on a network.	1		1b		1
(iii)	Addressing and routing is provided by the **network** layer.	1		1b		1
(iv)	The **data link** layer prepares data to be passed to the physical layer.	1		1b		1
(v)	The **physical** layer transmits the raw data.	1		1b		1
(b) (i)		1	1a			4
(ii)	• Good performance/fast network speed • Easy to set up • Possible to add more computer systems without taking the network down • Any non-centralised failure will have very little effect on the network • Minimal network collisions • Better security	2	1b			
(iii)	• Expensive to install – more cabling required • Extra hardware required, such as a hub / switch • Bottlenecking • Centralised failure (hub / switch **NOT** server) will take the network down	1	1b			

Q	Answer	Marks	AO1	AO2	AO3	Total

(c)	Award one mark for each of the following up to a maximum of five:
	
	Typical rules set out in these policies include
	• A list of unacceptable types of website that should not be visited
	
	And activities that are not allowed on the network, such as
	• Gambling
	• Installation of unauthorised software
	• Policies are documents written to outline the rules that users are required to follow while using a computer network.
	• Policy governing the behaviour of a user whilst connected to the network.
	• The policy may include some description of what may be called etiquette which includes such items of conduct as:
	  o creation and transmission of offensive, obscene, or indecent document or images
	  o creation and transmission of material which is designed to cause annoyance, inconvenience or anxiety
	  o creation of defamatory material
	  o creation and transmission that infringes copyright of another person
	  o Transmission of unsolicited commercial or advertising material and deliberate unauthorised access to other services accessible using the connection to the network.
	• Then there is the type of activity that uses the network to waste time of technical staff to troubleshoot a problem for which the user is the cause,
	  o corrupting or destroying other user's data
	  o violating the privacy of others online
	  o using the network in such a way that it denies the service to others
	  o continuing to use software or other system for which the user has already been warned about using,
	  o any other misuse of the network such as introduction of viruses.
	• Outline consequences of violating the policy.
	• Common actions that the company may take:
	  o if the activities are illegal the organization may involve appropriate authorities, such as the local police.
	  o Employers will at times withdraw the service from employees,
	• although a more common action is to terminate employment when violations may be hurting the employer in some way, or may compromise security.
		5	1b			5

Q	Answer	Marks	AO1	AO2	AO3	Total
7. (a)	Award one mark for each of the following:					2
(i)	6A	1		1a		
(ii)	10111001_2	1		1a		1
(iii)	Award one mark for the following: • Less error prone • Used as binary numbers can be quickly converted into hexadecimal numbers • They are more convenient for people to use.	1	1b			1
(b)	Award one mark for each of the following: 10101011_2 00110110_2 11100001_2 *011111*	1 1		1a 1a		2
(c)	Award one mark for the following: • Left: Multiply by 2 / double • Right: Divide by 2 / half	1 1	1b 1b			2
8. (a)	Award one mark for each of the following: • 0-255 • 256 colours	1 1		1b 1b		2
(b)	Award one mark for each of the following: • 600 x 500 = 300,000 bytes • 300,000 / 1024 = 292.97 KB (accept 300 KB)	1 1		1a 1a		2
9. (a)	Award one mark for each of the following: $A.\left(B + \overline{B}\right)$ $A.\left(1\right)$ A	1 1		1a 1a		2
(b)	Award one mark for each of the following: $A.\left(A + B\right) + B.\left(A + B\right)$ $A.A + A.B + B.A + B.B$ $A + A.B + A.B + B$ $A + A.B + B$ $A(1 + B) + B$ $A + B$	1 1 1 1 1		1a 1a 1a 1a 1a		5

Q	Answer	Marks	AO1	AO2	AO3	Total
10. (a) (i)	Award one mark for each of the following: • Arrays can only store one data type Example of array use	1		1a		3
(ii)	Total nights booked out per month Jan Feb Mar Apr Room 1| 12 23 3 … Room 2| 15 28 … Room 3| 23 16 … • Suitable labels and array structure • Suitable data and data type	1 1		1b 1b		
(b)	Award one mark for each of the following: • Suitable validation check type for field x 3 • Suitable validation check rule x 3 Example Booking ID Format Check – RM00000 Paid Type Check - Boolean	3 3		1b 1b		6
(c) (i)	Award one mark for each of the following: • Hacking o gain unauthorised access to data/to a computer system. • Malicious damage o when a person intentionally sets out to corrupt or delete electronic files, data or software programs. • Accidental damage o when a person unintentionally corrupts or deletes electronic files, data or software programs.	4	1b			4

Q	Answer	Marks	AO1	AO2	AO3	Total
(c) (ii)	Award one mark for each of the following: • A backup is a copy of data that can be used if the original data is lost. • Backups of all data should be made regularly as the older the backed up data becomes, the less likely it is to match any current data stored on a computer system. • A typical backup policy would require that three different backups be kept at any given time • with one of these being stored off-site. • The oldest backup copy would be named the grandfather, the second oldest backup being named the father and the most recent backup being called the son. • When a new backup is made, the oldest backup, the grandfather is overwritten and becomes the son backup, with the original son becoming the father and the father becoming the grandfather. • This backup policy is called the grandfather-father-son method.	4	1b			4
(iii)	Award one mark for each of the following: • When the data stored is no longer in regular use • But may be required sometime in the future • It is held for security, legal or historical reasons. • The process of archiving data frees up resources on the main computer system • The process of archiving data allows faster access to data that is in use.	2	1b			2

Q	Answer	Marks	AO1	AO2	AO3	Total
11.	Award one mark for each of the following: • input is misspelt as imput Line 5 **– Syntax** • First is written with a capital F, but should be a small f Line 7 **– Syntax** • missing quote mark - it should be "The sum is" **– Syntax** • FirstNumber – secondNumber – it should be + **– Logical**	3 x 2		1b		6
12.	Award one mark for each of the following: • The increase in delivery lorries on the road has caused increased congestion and increases in carbon emissions. • Computer Science is supposed to lead to a paperless society but more and more paper seems to be consumed affecting rainforests and influencing global warming. • Old computer equipment needs to be disposed of correctly which is expensive. Dumping old computers etc on landfill sites can cause pollution of toxic substances into the water supply and lead to health problems. • Computer equipment generates heat so many organisations install air conditioning systems leading to increased carbon emissions. • Many computers are left on standby, wasting electricity unnecessarily and increasing carbon emissions. • Global assembly lines • Increased mining for rare earth elements • Working from home has led to a decrease in pollution **Accept any suitable answer**	3	1b			3

Q	Answer	Marks	AO1	AO2	AO3	Total
13.	**Indicative content** Lexical analysis • Comments and unneeded spaces are removed. • Keywords, constants and identifiers are replaced by 'tokens'. • A symbol table is created which holds the addresses of variables, labels and subroutines. Syntax analysis • Tokens are checked to see if they match the spelling and grammar expected, using standard language definitions. • This is done by parsing each token to determine if it uses the correct syntax for the programming language. • If syntax errors are found, error messages are produced. Semantic analysis • Variables are checked to ensure that they have been properly declared and used. • Variables are checked to ensure that they are of the correct data type, e.g. real values are not being assigned to integers. • Operations are checked to ensure that they are legal for the type of variable being used, e.g. you would not try to store the result of a division operation as an integer. Code generation • Machine code is generated. • Code optimisation may be employed to make it more efficient/faster/less resource intense.	9	1b			9

Q		Answer	Marks	AO1	AO2	AO3	Total
	Band	**AO1.1b** **(Max 9 marks)**					
	3	**7-9 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 seven to nine relevant detailed points from the indicative content • addressed the question appropriately discussing principal stages in the compilation process. • used appropriate technical terminology referring to the indicative content accurately.					
	2	**4-6 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 six points from the indicative content. • addressed the question, discussing the principal stages in the compilation process. • 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. • used limited technical terminology referring to the indicative content					
	0	**0 marks** Response not credit worthy or not attempted.					
			100	**52**	**48**	**0**	**100**