



GCE A LEVEL MARKING SCHEME

SUMMER 2023

**A LEVEL
COMPUTER SCIENCE - UNIT 4
1500U40-1**

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.

GCE A LEVEL COMPUTER SCIENCE - UNIT 4

SUMMER 2023 MARK SCHEME

Question		Mark	AO1	AO2	AO3	Total
1. (a)	<p>1 mark for example and 1 mark for description.</p> <p>Indicative content</p> <p>Examples</p> <ul style="list-style-type: none"> • dictating a letter, essay, coursework (any suitable document) (1) • recording findings / events whilst carrying out manual process / procedure (1) <p>Description</p> <ul style="list-style-type: none"> • because of poor typing skills / lack of speed (1) • as required due to injury/impairment or disability (1) • to avoid repetitive strain injury (1) • dictate notes whilst working on other tasks by hand, such as during surgery, an autopsy or whilst carrying out an experiment. (1) 	2	1b			6
(b)	<p>1 mark for example and 1 mark for description.</p> <p>Indicative content:</p> <p>Examples</p> <ul style="list-style-type: none"> • Giving commands to car entertainment / navigation system. • Giving commands to home heating and lighting control system / home digital assistant <p>Description</p> <ul style="list-style-type: none"> • Can reset radio channels whilst driving without need to look away / take hands off the controls (1) • Convenience / Can operate home control system from a remote location /change TV station without moving. 	2	1b			

Question		Mark	AO1	AO2	AO3	Total
(c)	<p>1 mark for example and 1 mark for description.</p> <p>Indicative content:</p> <p>Examples</p> <ul style="list-style-type: none"> • voice operated door entry system • voice authentication for on-line banking <p>Description</p> <ul style="list-style-type: none"> • No need to remember password or entry code • Improved security provided by unique voice print 	2	1b			

Question		Mark	AO1	AO2	AO3	Total
2. (a)	<p>1 mark for identifying task and 1 mark for correct reason</p> <p>Task 3 cannot be carried out in parallel with Task 2 (1) because it requires the result from Task 2 (1).</p>	2		2b		4
(b)	<p>80% of 16 hours = 12 hours 48 minutes (1) This time is shared between 8 processors Parallel running time = 1 hour 36 minutes (1)</p> <p>Accept Alternative solution using Amdahl's Law: $T_p = T_s (L + P/N)$ where T_p is parallel processing time, T_s is time using a single processor system, L is fraction of the processing which must be linear, P is fraction which can be run in parallel, and N is the number of processors.</p>	2		2b		

Question		Mark	AO1	AO2	AO3	Total
3.	<p>Indicative content</p> <p>(annotation not required)</p> <pre> loop IN {input weight} SUB R {subtract required minimum weight} JNG reject {if result is negative, package is underweight} OUT 1 {output code to allow package to pass} JMP loop {return to start of loop} reject OUT 2 {output code to deflect package into reject bin} JMP loop {return to start of loop} </pre> <p>1 mark for input of package weight 1 mark for label and JMP command creating a loop 1 mark for subtracting required weight from input 1 mark for output value 1 if weight acceptable 1 mark for output value 2 if package underweight 1 mark for correct repetition of loop in all cases</p>	6			3b	6

Question		Mark	AO1	AO2	AO3	Total
4.	<p>3 marks for explanation and 1 mark for example</p> <p>Explanation</p> <ul style="list-style-type: none"> • Batch processing is a system in which a series of repetitive processing operations are carried out together. • Processing is carried out without user intervention • may be carried out at times when a computer system is otherwise not in use, such as at weekends or during the night. <p>Example</p> <ul style="list-style-type: none"> • A valid example of batch processing, such as payroll or billing system. <p>3 marks for explanation and 1 mark for example.</p> <p>Explanation</p> <ul style="list-style-type: none"> • Real time transaction processing is a system in which transactions are processed immediately they occur. • Real time transaction processing can avoid multiple bookings • Real time transactions may be made simultaneously from different computer terminals (e.g. over the internet) • The file should be locked during update, to prevent corruption of a record by simultaneous changes by more than one user. <p>Example</p> <ul style="list-style-type: none"> • A valid real time transaction processing application e.g. booking an hotel room / airline seat. <p>Accept any other correct response.</p>	4	1b			8
	<p>3 marks for explanation and 1 mark for example.</p> <p>Explanation</p> <ul style="list-style-type: none"> • Real time transaction processing is a system in which transactions are processed immediately they occur. • Real time transaction processing can avoid multiple bookings • Real time transactions may be made simultaneously from different computer terminals (e.g. over the internet) • The file should be locked during update, to prevent corruption of a record by simultaneous changes by more than one user. <p>Example</p> <ul style="list-style-type: none"> • A valid real time transaction processing application e.g. booking an hotel room / airline seat. <p>Accept any other correct response.</p>	4	1b			

Question		Mark	AO1	AO2	AO3	Total
5. (a)	<p>1 mark for description, 1 mark for example</p> <p>Description sign and magnitude, has a sign bit (e.g. 0 positive, 1 negative) followed by the unsigned number value. Example e.g. 1000 0011 = -3</p> <p>1 mark for description, 1 mark for example</p> <p>Description two's complement format for a negative number comprises the negative value of the most significant bit followed by the positive value of all other bits as necessary to achieve the required negative number</p> <p>Example: e.g. 1111 1101 = -3</p>	4	1b			6
(b)	<p>1 mark for fixed point value, 1 mark for conversion</p> <p>mantissa 0.1 1001 0101 exponent 2^6 giving fixed point value 0110010.101 base-10 value =50.625</p>	2		2b		

Question		Mark	AO1	AO2	AO3	Total
6.	<p>3 marks for description, 1 mark for effects</p> <p>Description</p> <ul style="list-style-type: none"> • In an arithmetic shift, the sign bit of a two's complement number must remain the same. • For a right arithmetic shift, a binary 1 is inserted in the empty (second most significant bit) position for a negative number i.e. the empty position in the most significant bit is filled with a copy of the original MSB • For a left arithmetic shift the bit pattern moves one space to the left and a binary 0 is added in the position of the least significant bit. <p>Effects</p> <ul style="list-style-type: none"> • The effect of the right shift is to halve the negative value, the left shift doubles the negative value 	3	1b			4
		1	1b			

Question		Mark	AO1	AO2	AO3	Total
7.	<p>Award 1 mark for each point and 1 mark per expansion, up to a maximum of 6 marks:</p> <ul style="list-style-type: none"> • Many storage locations in the sequential access file will be left empty, (1) The direct access file takes up only one tenth / much less of the storage space (1) • Accessing a record in the direct access file will usually be quicker (1) as it will not be necessary to search from the start of the file (1) • In the sequential access file collisions cannot occur / Every record has its own unique storage location. (1) Collisions can occur in the direct access file if identification codes generate the same hash values. (1) • Collisions will have to be handled by separate overflow area (or progressive overflow). (1) This will reduce the speed advantage of using direct access (1) • If the number of products is increased, the direct access file may need to be reorganised with more memory locations and a new hash function. (1). The sequential access file allows for an increase in the number of products without reorganisation. (1) 	6		2b		6
8.	<p>1 mark for the name of each state and 1 mark for each description;</p> <ul style="list-style-type: none"> • Ready – The process is loaded into the main memory and waits to be allocated CPU time for its execution. Processes that are ready for execution by the CPU are maintained in a queue for ready processes. • Run – The process is chosen by CPU for execution and the instructions within the process are executed by any one of the available CPU cores. • Blocked or waiting – Whenever the process requests access to I/O it enters the blocked or wait state. The process continues to wait in the main memory. Once the I/O operation is completed the process goes to the ready state. 	6	1b			6

Question		Mark	AO1	AO2	AO3	Total
9. (a)	<p>1 mark per benefit to a maximum of 2 and 1 mark per drawback to a maximum of 2.</p> <p>Benefits</p> <ul style="list-style-type: none"> • High production rates / increased productivity • High levels of control / increased consistency / quality <p>Efficient use of materials / less waste.</p> <p>Drawbacks</p> <ul style="list-style-type: none"> • Worker displacement / redundancy • Capital cost • Lack of flexibility 	2	1b			8
(b)	<p>1 mark per description to a maximum of 2 and 1 mark per example to a maximum of 2.</p> <p>Description</p> <ul style="list-style-type: none"> • A safety related control system is a system where the main purpose is not to ensure safety, but where failure can be hazardous <p>or</p> <ul style="list-style-type: none"> • safety related systems do not have full responsibility for controlling hazards but would only be hazardous in conjunction with failure of other systems or human error. <p>Examples</p> <ul style="list-style-type: none"> • A suitable example of a safety related control system, e.g. timer on microwave oven, cruise control, traffic lights <p>Description</p> <ul style="list-style-type: none"> • A safety critical system is a control system where the main purpose is to ensure safety and where failure is likely to cause injury to persons or damage to property. <p>Example</p> <ul style="list-style-type: none"> • A suitable example of a safety critical control system, e.g. railway signalling, nuclear reactor controls, auto pilot, aircraft avionics. 	1	1b			
		1	1b			
		1	1b			
		1	1b			

Question		Mark	AO1	AO2	AO3	Total
10. (a)	SELECT Description, Price FROM Product 1 mark WHERE Price <300.00; 1 mark	2			3b	7
(b)	SELECT Customer, OrderDate FROM Order WHERE ProductID= (SELECT ProductID FROM Product WHERE Description='Cooker') ; 1 mark for SELECT ... FROM Order 1 mark for (SELECT ... FROM Product 1 mark for WHERE Description = 'Cooker') Accept but not expect solution using JOIN SELECT Customer, OrderDate FROM 1 mark (ORDER JOIN Product ON ProductID) 1 mark WHERE Description='Cooker' ; 1 mark	3			3b	
(c)	INSERT INTO Product VALUES 1 mark (288,'Refrigerator','Coolstore 2000',150.60); 1 mark Accept inclusion of field names Note: SQL requires single quotes around text fields. Numeric fields should not be enclosed in quotes.	2			3b	

Question		Mark	AO1	AO2	AO3	Total
11. (a)	<p>1 mark for each disadvantage and 1 mark for associated description to a maximum of 4 marks</p> <ul style="list-style-type: none"> Data redundancy. The company will need to repeat employee data for each project the employee is involved with. This will result in larger than necessary file size and slow down access. Data consistency – duplication of data and repeated input likely to give rise to errors in content, effecting the integrity of the Company’s data. 	2 2		2b 2b		9
(b)	<p>Indicative content:</p> <p>Project (ProjectCode [P], Title, Budget) ProjectTeam (ProjectTeamCode [P], ProjectCode [F], EmployeeNumber [F], HourlyRate) Employee [EmployeeNumber [P], Forename, Surname, DepartmentCode [F]] Department [DepartmentCode [P], DepartmentName, Head of Department]</p> <p>1 mark for four tables, including ProjectTeam linking Project and employee</p> <p>1 mark for Primary key in each table</p> <p>3 marks, 1 for each foreign key field, appropriately identified in ProjectTeam and Employee</p> <p>Ignore additional fields</p>	1 1 3		2b 2b 2b		

Question		Mark	AO1	AO2	AO3	Total
13. (a)	<p>Up to 4 marks for advantages of single and double key encryption. 1 mark for each point.</p> <p>Indicative content:</p> <ul style="list-style-type: none"> • Single key encryption - simpler and faster to encrypt and decrypt messages. • Double key – not necessary to send the key to the person encrypting the message, so security risk reduced. • Double key – the public key can remain in use for an extended period. Single key may need to be changed regularly for security. • Simpler to write the program for a single key system. • Double key encryption provides a means of independently verifying a digital signature. <p>2 marks for example uses.</p> <p>Indicative content:</p> <ul style="list-style-type: none"> • Double key – secure file transfer • Single key – encrypting personal files on a single computer. 	4	1b			9
(b)	<p>1 mark for each encrypted binary value, up to a maximum of 3 marks:</p> <ul style="list-style-type: none"> • 0010 1001 encrypted 'C' • 0110 1000 encrypted 'A' • 0010 1010 encrypted 'B' 	3		2b		

Question		Mark	AO1	AO2	AO3	Total
14. (a)	<p>2 marks for hardware required, e.g.</p> <ul style="list-style-type: none"> • wireless network card, • wireless access point / wireless router. 	2	1b			6
(b)	<p>Up to 2 marks for stating suitable wireless communication protocols: e.g.</p> <ul style="list-style-type: none"> • Bluetooth • WiFi • WAP • WPA • WEP • 802.11 	2	1b			
(c)	<p>1 mark for explanation and 1 mark for expansion</p> <p>Lack of security arising from ease of interception of transmitted data.</p>	2	1b			

Question		Mark	AO1	AO2	AO3	Total
15.	<p>Points which may be given credit include:</p> <ul style="list-style-type: none"> • Opportunity for health professionals to provide information to the general public, e.g. website recommending healthy eating / warn of dangers, e.g. drug misuse, alcohol misuse. • Opportunities for specialist charities to support particular patient groups, e.g. diabetes or cancer patients. • Opportunity for members of the public to obtain medical information based on symptoms of an illness. • Risk of incorrect self-diagnosis and unnecessary worry. • There may be no quality control on a web site's content, so incorrect health advice may be offered. • Doctors may find that patients have checked on-line and demand the latest / most expensive treatment. • Patients may seek 'second opinions' from web sites rather than accept the opinions of health professionals. • Internet searches made for particular diseases can provide information on developing epidemics, e.g. locations/numbers of searches for influenza. • Searches made by members of the public for particular health information may lead to a breach of privacy, e.g. a search engine provider keeping a record if a person accesses web sites about mental illness. <p>Aspects of an on-line medical or health expert system:</p> <ul style="list-style-type: none"> • Can store more knowledge than one person. • Can be kept up to date. • Helps to give a more accurate decision. • Available 24/7. • Lower cost than employing NHS staff, e.g. in a call centre. • Allows access to an expert where not available locally. • A good expert system explains its decision / gives probabilities so that a user can decide whether to accept the decision or not • Allows employees to learn from the system 	9		2b		9

Band	Q15 Max 9 marks
3	<p style="text-align: center;">7-9 marks</p> <p>The candidate has:</p> <ul style="list-style-type: none"> • written an extended response that has a sustained line of reasoning which is coherent, relevant, and logically structured • shown clear understanding of the requirements of the question and a clear knowledge of the topics as specified in the indicative content. • addressed the question appropriately with minimal repetition and no irrelevant material • has presented a balanced discussion and justified their answer with examples • effectively drawn together different areas of knowledge, skills and understanding from all relevant areas across the course of study • used appropriate technical terminology confidently and accurately.
2	<p style="text-align: center;">4-6 marks</p> <p>The candidate has:</p> <ul style="list-style-type: none"> • written a response that has an adequate line of reasoning with elements of coherence, relevance, and logical structure • shown adequate understanding of the requirements of the question and a satisfactory knowledge of the topics as specified in the indicative content. • presented a discussion with limited examples • drawn together different areas of knowledge, skills and understanding from a number of areas across the course of study • used appropriate technical terminology.
1	<p style="text-align: center;">1-3 marks</p> <p>The candidate has:</p> <ul style="list-style-type: none"> • written a response that that lacks sufficient reasoning and structure • produced a discussion which is not well developed • attempted to address the question but has demonstrated superficial knowledge of the topics specified in the indicative content. • used limited technical terminology.
0	Response not credit worthy or not attempted.