GCE A LEVEL MARKING SCHEME

SUMMER 2019

A LEVEL (NEW)
COMPUTER SCIENCE - COMPONENT 2
A500U20-1

INTRODUCTION

This marking scheme was used by WJEC for the 2019 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.

Q	Answer	Mark	AO1	AO2	AO3	Total
1. (a)	**1 mark for each point up to a maximum of two:** • The program counter value is used to calculate the RAM address of the next program instruction. The address is transferred to the MAR. • The address is then sent out along the address bus. The program instruction returns along the data bus (and is stored in the CIR). • The program counter is updated.	1 1 1		2b		2
(b)	**1 mark for each point up to a maximum of 3:** • The program command is accessed in the CIR. • The data to be saved is transferred from general purpose register R to the MDR. • The address 02B6 where the data is to be saved is transferred to the MAR. • The address is then sent out on the address bus. • The data value is sent out along the data bus. • The program counter is updated. **(not given if stated in (a))**	1 1 1 1 1 1		2b		3

Q	Answer	Mark	AO1	AO2	AO3	Total
2. (a)	(i) The closest representation of 139.6_{10} possible is:					6
	1000 1011 . 100111	1		2a		
	In floating point format, this is: 0.1000 1011 1 x 2^8	1		2a		
	Using the specified format, mantissa 0.1000 1011 1 exponent 001000 (1 mark) **or** 0100 0101 11 0010 00 (1 mark) Note: either format is acceptable.	1		2a		
	(ii) The floating point number 0100 0101 11 0010 00 has a value of 139.5_{10}	1		2a		
	Absolute error = original value – rounded value = 139.6 – 139.5 = 0.1	1		2a		
	Relative error = absolute error / original value X 100% = $\frac{0.1}{139.6} \times 100\%$ = 0.07%	1		2a		
(b)	(i) Using two's complement with 8 bits:					4
	37_{10} = 0010 0101	1		2a		
	19_{10} = 0001 0011 -19_{10} = 1110 1101	1		2a		
	Adding: 0010 0101 <u>1110 1101</u> 0001 0010	1		2a		
	(ii) Left shift by 2 places, giving:			2a		
	0100 1000	1				

Q	Answer	Mark	AO1	AO2	AO3	Total
3.	**1 mark for a valid example of batch processing** **1 mark for a valid example of real time transaction processing** **1 mark** for each point, up to a **maximum of 4 marks**: **Group RTTP and Batch together** • Real time transaction processing involves direct updating of the master file immediately an event occurs. • Real time processing can avoid double booking (e.g. hotel rooms, theatre seats…) • Real time gives an accurate current view of the data (e.g. shop stock control, so staff are immediately aware if running low on stock) • Real time systems involve more complex algorithms – e.g. to reserve seats temporarily whilst the customer enters payment details, but free the seats again if payment not made. • Batch processing uses a transaction file to record events, then the master file is updated at the end of each period (day/week…) • Batch processing is a simpler/faster system to operate. Transactions can simply be stored in the order received, with all processing carried out later. • Batch processing can be carried out automatically at times when the computer system is not otherwise in use (e.g. at night).	6	1a			6

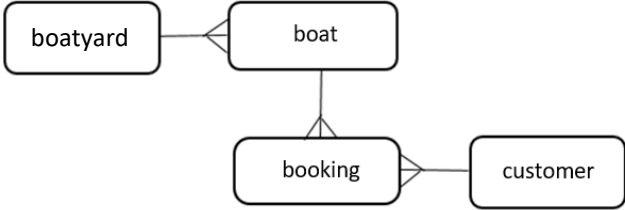| Q	Answer	Mark	AO1	AO2	AO3	Total
4.	**3 marks per network component**					9
	Switch **1 mark** for each point, up to a maximum of **3 marks**: • A **switch** is used to connect computers in a local area network. • The switch is programmed / maintains a table with the IP addresses/machine addresses of connected devices, so can send data to the required device. • When a packet of data is received by the switch, it is checked to determine the destination address.	3	1b			
	Router **1 mark** for each point, up to a maximum of **3 marks**: • A **router** is used to forward data packets between networks. • Routers control traffic on wide area networks such as the Internet. • The router determines the destination of a data packet from the IP address in the packet protocol, then selects an appropriate route for onwards transmission. • Routers may hold information about current transmission speeds to adjacent nodes, so that the fastest path for onward transmission can be selected.	3	1b			
	Multiplexor **1 mark** for each point, up to a maximum of **3 marks**: • A **multiplexor** allows multiple messages to be combined, so that they can be sent over a data link simultaneously, then separated again at the end of the link. • **Time division multiplexing** allocates small time slices alternately for data from each of the input message streams. • **Frequency division multiplexing** sends the different messages simultaneously, but using different transmission frequencies. • On a mainframe (multi-user) computer, a multiplexor allows input to the system from different terminals, then routes system output to the correct terminal. • On a wide area network (e.g. Internet), multiplexing may be used to combine messages for transmission over the very fast high-capacity backbone of the network.	3	1b			

Q	Answer	Mark	AO1	AO2	AO3	Total
5.	**Indicative Content** loop: IN input code from key pad SUB 02A0 subtract required door code JZE correct jump out of the loop if correct code entered JMP loop repeat the loop if code is not correct correct: OUT -1 send signal to unlock door **1 mark** for input of code from key pad (i.e. IN with no parameter) **1 mark** for: immediately subtracting required code from input value **1 mark** for: label and jump command for a loop **1 mark** for repeating loop if code input is incorrect **1 mark** for ending loop if input code is correct **1 mark** for output value of -1	 1 1 1 1 1 1			3b	6
6. (a)	1 mark for a valid use of robotics, and 1 mark for a corresponding example from manufacturing: **Indicative content:** - Accurate assembly, e.g. circuit boards. - Carrying out unhealthy or dangerous activities, e.g. car body welding or spray painting. - Repetitive operations, e.g. packing food items in boxes. - Warehouse functions, e.g. collecting selected items from shelves.	2	1.1b			6
(b)	1 mark for each valid point, up to 2 marks. **Indicative content:** - Lower prices due to reduced manufacturing costs. - Consistent quality due to accurate manufacturing. - Faster delivery times. - Quicker innovation for new products.	2	1.1b			

Q	Answer	Mark	AO1	AO2	AO3	Total
(c)	1 mark for each valid point, up to 2 marks **Indicative content:** • Need for retraining of the workforce to operate new technology • Cost of specialist technicians and programmers • Risk of breakdown of a complex system affecting production • Cost of adapting factory premises for automation / Initial setup costs • Risk of malicious damage by hackers • **NOT** losing jobs	2	1.1b			

Q	Answer	Mark	AO1	AO2	AO3	Total
7.	**1 mark** for each point, up to a **maximum of 7 marks**:					7
	• Processing is controlled by a **scheduler.**	1				
	• The currently active programs will be held in a job queue (**runnable** state).	1				
	• Each program will receive a slice of processing time when it reaches the front of the queue (**running** state).	1				
	• If a program requires slow input or output, it will temporarily leave the job queue (**blocked** state).	1				
	• Input/output will be handled by the **spooling system** while the processor continues to process other jobs.	1	1b			
	• The scheduler will **poll** the blocked jobs, to check when input/output is completed and the job can re-join the job queue.	1				
	• Efficiency can be improved by providing multiple job queues, so that users experience minimum delays.	1				
	• Description of a queue strategy, e.g. Smaller jobs enter a fast queue. Larger jobs are held in a main queue and only receive processor time when the fast queue is empty (analogy with the fast checkout queue in a supermarket for customers with few items).	1				
	• Polling to check the state of input / output devices	1				
	Additional credit can be given for detailed answers					

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Q	Answer	Mark	AO1	AO2	AO3	Total
8. (a)	**1 mark** for each point, up to a **maximum of 4 marks**: • If records have a fixed length, the position of any record in the file can be calculated by multiplying the **record length in bytes** by the **record sequence number**. (There is no fast way of locating a variable length record with a particular sequence number.) • A fast **binary search** can be used to locate a fixed length record in a sequential file. • Variable length records can only be found using a slower **linear search** method. • Fixed length records can be quickly updated in-situ without affecting other records in the file. There should be empty space present in the record to allow for any increase in the size of the data (e.g. changing an address in a customer record). • If a variable length record is updated, the size of the record will change. The file will need to be rebuilt and the updated record inserted at the correct point in the sequence.	4	1b			4
(b)	**1 mark** for each point up to a maximum of 2. • Variable length records are preferred when the records in a file are of very different lengths. • So as to avoid wasting memory / storage / disk space. • Variable length records are suitable for situations where no searching or updating is necessary e.g. transaction files which will be used later to update a master file.	2	1b			2

Q	Answer	Mark	AO1	AO2	AO3	Total
9. (a)	SELECT Species, YearPlanted FROM FOREST_BLOCK; **1 mark for:** SELECT Species, YearPlanted **1 mark for:** FROM FOREST_BLOCK;	2			3b	
(b)	SELECT ActivityDescription, StartDate FROM ACTIVITY WHERE BlockID=(SELECT BlockID FROM FOREST_BLOCK WHERE Location = 'Little Sutton'); • **1 mark for:** SELECT ActivityDescription, StartDate • **1 mark for:** FROM ACTIVITY WHERE BlockID=(..) • **1 mark for:** SELECT BlockID FROM FOREST_BLOCK WHERE Location = 'Little Sutton' **Accepted not expected** SELECT ActivityDescription, StartDate FROM (FOREST_BLOCK JOIN ACTIVITY ON BlockID) WHERE Location = 'Little Sutton'; • **1 mark for:** SELECT ActivityDescription, StartDate • **1 mark for:** FROM (FOREST_BLOCK JOIN ACTIVITY ON BlockID). **Award the mark for joining the two tables in a query**. • **1 mark for:** WHERE Location = 'Little Sutton'	3			3b	
(c)	CREATE TABLE WORKER (WorkerID Integer PRIMARY KEY, Surname String(20), Initial Char, TractorQualified Boolean,); **1 mark for:** CREATE TABLE WORKER **1 mark for:** WorkerID field, including PRIMARY KEY. **1 mark for:** all three correct other fields. Surname: accept any suitable length for the string. Initial: accept string field of length(1).	3			3b	
(d)	INSERT INTO WORKER VALUES ('5221', 'Smith', 'M', 'FALSE');	1			3b	
	INSERT INTO WORKER VALUES ('8312', ' Singh ', 'G', 'TRUE');	1			3b	

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Q	Answer	Mark	AO1	AO2	AO3	Total
10. (a)	 **1 mark** for each of the three 1 : n relationships.	3		2b		3
(b)	Tables should be similar to: BOATYARD (BoatyardID **[P]**, Location, Phone…) BOAT(BoatID **[P]**, BoatName, Berths, BoatyardID **[F]** …) BOOKING (BookingID **[P]**, Date, BoatID **[F]**, CustomerID **[F]**, …) CUSTOMER (CustomerID **[P]**, CustomerName…) **1 mark** for 4 suitable tables **1 mark** for 4 primary keys clearly identified **1 mark** for **each** of 3 correct foreign keys clearly identified	5		2b		5

Q	Answer	Mark	AO1	AO2	AO3	Total
11.	**1 mark** for concept that interrupts are signals to the operating system / CPU requesting attention.	1	1b			7
	1 mark for concept that the operating system / CPU will suspend the current program(s) in order to deal with the interrupt (then resume the program(s) from the point reached).	1	1b			
	2 marks for two examples of a hardware interrupts. Indicative content: • Mouse click or mouse move • Keyboard key press • Printer ready for further data • Printer out of paper/ink… • Disk drive data transfer completed • Power failure	2	1a			
	2 marks for two examples of a software interrupts: Indicative content • Mathematical error in program, such as 'division by zero'. • File handling error in program such as file not 'found'. • Execution of program completed. • User termination of program by CTRL/ALT/DEL or ESC.	2	1b			
	1 mark for the concept that interrupts may have different priorities.	1	1b			

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Q	Answer	Mark	AO1	AO2	AO3	Total
12.(a)	**1 mark** for each valid point, up to a **maximum of 5 marks**. Indicative content: • An expert system uses an inference engine, knowledge base of facts and rules for decision making. • Facts and rules should be produced by a specialist with relevant expertise, using the best available information. • The user is asked a series of questions. Subsequent questions may vary according to the answers given. • Question sequences should be designed so as to gather the necessary information needed for decision making for all valid sets of input values. • The user interface should be user-friendly, with adequate help and error trapping during data entry. • The system should generate results on screen or on paper in a format which is clearly understandable to the user. • The system should list its results in order of suitability, or indicate a relative value or score for each. • The system should explain its reasoning in reaching its decisions, so that the accuracy of the results can be evaluated.	5	1b			9
(b)	**1 mark** for each valid point, up to a **maximum of 4 marks**. **Indicative content:** • The expert system allows more students to receive advice than is possible with interviews alone. • Students may investigate career/course options using the expert system as preparation before an interview, to make best use of interview time. • The expert system can be regularly updated with the latest career/course information. • Students may feel more comfortable using an expert system rather than consulting a careers advisor in person, e.g. if they were very uncertain about choice of career and didn't feel ready to discuss this yet. • The expert system can be made available at any time of the day, and from any location by internet. • Staff costs will be lower than if additional careers advisors are employed.	4		2b		

Q	Answer	Mark	AO1	AO2	AO3	Total
13.	**Marks in the range 0-11 should be awarded according to the criteria listed in the table below.** **Indicative content** • The hotel should consider physical security. Keep the computer in a locked area when staff are not present. CCTV might be used to monitor the reception area. • Individual members of staff should have user names and passwords. • Access to the network by different users should be recorded in a log file. • Staff should receive training and sign a code of conduct regarding computer use and confidentiality of data. • Staff may be given different levels of access to the computer system, according to their job roles. • Some staff may have read-only access to booking data. • Sensitive data such as bank account details should be held on the computer system in encrypted format. • All client data transmitted by e-mail should be sent in an encrypted format. • If the hotel accepts bookings and payments from its web site, then customers should be able to submit their data through a secure encrypted system. • The hotel should introduce an efficient backup system, with copies of data made daily. Backup data should be stored off-site, either on a portable storage device or using the 'cloud'. • A transaction file should be kept, to help in restoring data in the event of loss. • The hotel must implement improved security in order to conform with the Data Protection Act.	11		2b		11

Max 11 Marks

8-11 Marks

The candidate has:
- 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. Clear knowledge is defined as a response that makes eight to eleven points in the area signalled in the indicative content.
- addressed the question appropriately with minimal repetition and no irrelevant material.
- has presented a balanced argument and justified their arguments.
- effectively drawn together different areas of knowledge, skills and understanding from all relevant areas across the course of study.
- used appropriate technical terminology referring to the indicative content confidently and accurately.

4-7 Marks

The candidate has:
- 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.
- Satisfactory knowledge is defined as a response that makes four to seven points in the area signalled in the indicative content.
- presented an argument with limited justification.
- drawn together different areas of knowledge, skills and understanding from at least two areas across the course of study used appropriate technical terminology referring to the indicative content.

1-3 Marks

The candidate has:
- written a response that that lacks sufficient reasoning and structure
- produced a discussion which is not well developed, and the justification is weak
- attempted to address the question but has demonstrated superficial knowledge of the topic specified in the indicative content. Superficial knowledge is defined as a response that makes one to three points in the indicative content.
- used limited technical terminology referring to the indicative content.

0 Marks

Response not credit worthy or not attempted.