GCE A LEVEL MARKING SCHEME

SUMMER 2024

A LEVEL
COMPUTER SCIENCE - COMPONENT 2
A500U20-1

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

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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.

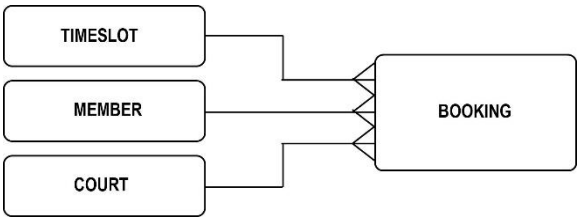
When marking, examiners can use these examples to decide whether a learner's response is of a superior, inferior or comparable standard to the example. Examiners are reminded of the need to revisit the answer as they apply the mark scheme in order to confirm that the band and the mark allocated is appropriate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

Question	Answer	Mark	AO1	AO2	AO3	Total
1 (a)	**1 mark** for each correct statement to a maximum of **2 marks.** The Program Counter (PC) will hold the address of the next instruction to be fetched from main memory. (1). As soon as the address is read the Program Counter (PC) increments / PC = PC + 1. (1) / updates (1) to hold the address of the next instruction to be executed. (1).	2	1b			8
1 (b).	**1 mark** for identifying a register**, 1 mark** for stating the role of the register in the fetch-execute cycle, to a maximum of **6 marks**. Indicative content **Current Instruction Register (CIR)**. Holds the instructions that is currently being processed / executed. **Memory Address Register (MAR**). Holds the address found of the current instruction that is to be fetched from memory. / Holds the memory address to which data is to be transferred. **Memory Data Register (MDR) / Memory Buffer Register (MBR).** Holds the contents found at the address held in the MAR./ Holds data that is to be transferred to RAM. **Accumulator**. Acts as temporary storage location which holds an intermediate value in arithmetic and logical operations. / Holds intermediate results which overwrite results of previous steps in a calculation.	6	1b			

Question	Answer	Mark	AO1	AO2	AO3	Total
2 (a).	**1 mark** for method of obtaining the binary fraction 5.75 = 101.11 $_2$. **1 mark** for Mantissa = 0101 1100 00 $_2$. **1 mark** for exponent = 0000 11_2 5.75 = | 0101 1100 00 | 0000 11	3		2a		10
2 (b)(i)	Given result: 5.25 x 24.50 = 128.625 **1 mark** for Method 1: Multiply then round: 1 absolute error = 0.375 **1 mark** for: Method 2: Multiply then truncate: 146 absolute error = 0.625	2				
2 (b)(ii)	**1 mark** for each of the following up to a maximum of **2 marks**. Rounding is always at least as accurate as truncating (1) and will often be more accurate. (1) Concept that greatest overall accuracy is achieved by completing all stages of a calculation to maximum available decimal places (1) with rounding or truncation only carried out after obtaining the final result. (1)	2				
2 (c)	**1 mark** for: Using 16 bits: +152 = 0000 0000 1001 1000 **2 marks** for: Obtaining the two's complement: -152 = 1111 1111 0110 1000	3				

Question	Answer	Mark	AO1	AO2	AO3	Total
3.	**1 mark** for each valid point up to a maximum of **4 marks.** Indicative content. **Error checking**. TCP includes comprehensive error checking to prevent and correct errors (1). UDP uses only checksum to avoid errors and cannot correct errors (1). **Order of data**. TCP data packets are sequenced (1) UDP data packets arrive in no fixed order, but are re-assembled in the order they are received, resulting in possible inaccuracies. (1). **Broadcasting**. TCP is suitable for point to point transmission. UDP is suitable for broadcasting data packets to groups of endpoints. **Reliability.** TCP is suitable for uses where data integrity is essential (1). UDP is used where transmission speed is such that a few dropped packets do not matter (1).	4		2b		4

Question	Answer	Mark	AO1	AO2	AO3	Total
4 (a)	**1 mark** for each valid point to a maximum of **2 marks.** No key field / duplicate data, so confusion between members with the same name: Name field is not atomic. Names should be stored in separate Surname and Forename fields, to allow easy searching/sorting by surname: Time field contains multiple data items. Each record should only contain one time slot. No method of preventing double booking.	2		2b		12
4(b)(i)	Entity-relationship diagram, **1 mark** for each correct relationship to a maximum of **3 marks**  	3		2b		
4(b)(ii)	**1 mark** for 2 primary keys identified. **2 marks** for 4 primary keys identified.**1 mark** for each correct foreign key field identified to a maximum of **2 marks.** **Indicative content:** **COURT**: CourtID [Pk], Surface, Floodlights **TIMESLOT**: SlotID [PK], Date, StartTime **MEMBER**: MemberID [Pk], Surname, FirstName, DOB **BOOKING**: BookingID [Pk], SlotID [Fk], CourtID [Fk], MemberID [Fk]	4		2b		
4(b)(iii)	**1 mark** for each valid suggestion, to a maximum of **3 marks.** • Add Boolean / Availability field to TIMESLOT table. • Use update query to amend Availability field when booking is made. • Use select query to display only available slots on booking interface.	3		2b		

Question	Answer	Mark	AO1	AO2	AO3	Total
5 (a)	**1 mark** for: SELECT CheckNo, Comment FROM VANCHECK	1			3b	10
5 (b).	**1 mark** for. SELECT RegNo FROM VANCHECK WHERE StaffID = 'MS'	1				
5 (c).	**2 marks** for: **UPDATE** VANCHECK **SET** StaffID = 'JO' **WHERE** CheckNo = 67	2				
5 (d)	SELECT Date FROM VANCHECK WHERE StaffID = (SELECT StaffID FROM STAFF (WHERE Surname = 'Patel' AND FirstName = 'Veer')) **1 mark** for SELECT Date FROM VANCHECK WHERE StaffID = **1 mark** for SELECT StaffID FROM STAFF WHERE Surname = 'Patel' AND FirstName = 'Veer' OR SELECT Date Location FROM (VANCHECK JOIN STAFF ON StaffID) WHERE Surname = 'Patel' AND FirstName = 'Veer' **1 mark** for joining the two tables in a query, **1 mark** for selecting both Surname and FirstName	2				
5 (e)	**1 mark** for each of the following to a maximum of **4 marks**. Correct construct (CREATE TABLE with brackets positioned correctly) Identifying PRIMARY KEY NOT NULL on key field Numeric (x,2), must include ,2 Indicative content CREATE TABLE E_VANS (E_VanID int NOT NULL, Registration String NOT NULL, Make String, ChargeTime numeric(5,2), PRIMARY KEY (E_VanID))	4				

Question	Answer	Mark	AO1	AO2	AO3	Total
6(a)(i)	**1 mark** for each correct point to a maximum of **4 marks**. Symmetric encryption is a type of encryption where only one key (a secret key) is used to both encrypt and decrypt electronic data. The parties communicating via symmetric encryption must exchange the key so that it can be used in the decryption process. Using symmetric encryption algorithms, data is "scrambled" so that it cannot be understood by anyone who does not possess the secret key to decrypt it. Once the intended recipient who possesses the key has the message, the algorithm reverses its action so that the message is returned to its original readable form. The secret key that the sender and recipient both use could be a specific password/code, or a random string of letters or numbers generated by a secure random number generator (RNG).	4	1b			10
6(a)(ii)	**1 mark** for performance, **1 mark** for bulk encryption and **1 mark** for suitable example **Indicative content** Due to the better performance / faster speed of symmetric encryption (compared to asymmetric), it is typically used for bulk encryption / encrypting large amounts of data, e.g., for database encryption. Examples of where symmetric encryption is used include: • Payment applications, such as card transactions where PII needs to be protected to prevent identity theft or fraudulent charges. • Validations to confirm that the identity of the sender of a message is as claimed. • Random number generation or hashing	3		2b		

Question	Answer	Mark	AO1	AO2	AO3	Total
6(b)	**3 marks** for correct encryption 'ZLAVV' **1 mark** for V shift [1] = 'Z' and I shift [2] = 'L' **1 mark** for R shift [3] = (3*3) MOD 26 = 'A' **1 mark** for U shift [4] = (3*9) MOD 26 = 'V' and S shift [5] = (3*1) MOD 26 = 'V'	3		2b		
7.	**2 marks** for the concept / general description: Distributed processing is the technique of carrying out a large computing task by sharing the processing between computers in different locations. (1) Each computer will run its own programs and have its own store of data but will share data with other computers in the distributed processing network as necessary. (1) **1 mark** for each valid point, up to a maximum of **4 marks,** describing distributed processing in the context of a chosen application. **Indicative Content:** A specific record keeping system Computers in various locations. will be linked in a wide area network. Each computer will have the software necessary to carry out database operations on records, and to display any included associated information / images. Records will generally be held locally but additional records may also be held centrally when needed. Staff / users may access and update information at any of the locations by means of the network. The overall system may provide summary management data. The system will be able to inform users of updates and any actions needed.	2 4	1b	2b		6

Question	Answer	Mark	AO1	AO2	AO3	Total
8(a)	**1 mark** for each correct point on fixed length records to a maximum of **2 marks.** **1 mark** for each comparative point on variable length records to a maximum of **2 marks.** **Fixed length records.** The length of the fields in each record is set to be a certain maximum number of characters / bytes. If all the fields in the record have a fixed length, then each record is the same length. If each field does not contain the maximum number of characters allowed, storage space will be needlessly set aside and wasted. Data may be lost if it is too large to fit inside the allowed space in a field. **Variable length records**. The length of a field can change to allow data of any size to fit. Advantage - space is not wasted, only the space needed is ever used. **Fixed length records** make file processing much easier because the start and end of each record is fixed, making it simple to locate both individual records and fields. **Variable length records**. More complex to program / difficult to locate the start and end of individual records and fields. Each field needs an end- of- field marker. When records need to be located the end- of-field markers are used to locate individual records and fields.	4	1b			10

Question	Answer	Mark	AO1	AO2	AO3	Total
8 (b)	**1 mark** for each correct point on file organisation to a maximum of **3 marks.** **1 mark** for each correct point on file access, hashing to a maximum of **3 marks.** File organisation, records are stored in random order in the file with no sequencing. The file is organised using a pre-defined relationship between the key of the record and its location within the file. The value of the record key is mapped by a function to its address within the file, enabling direct access. Access times should be consistent as the location of the record within the file is not a factor in the access time of the record. Hashing – The usual method for mapping, is to employ a hash function to calculate the address. A hash function generates the record address by performing some simple operations on the key or parts of the key. A good hashing function should be quick to calculate, cover the full range of the address space, give an even distribution and avoid frequent collisions.	6	1b			

Question	Answer	Mark	AO1	AO2	AO3	Total
9.	LOD S, 0 {initialise the count variable} LOD T, 0 {initialise the total variable} LOOP IN R {start loop, input a value and store in R} JLZ R, END {jump out of loop if value is negative, but continue if the value input is positive} INC S {add 1 to the count} ADD T, R {add current data value to the total} JMP LOOP {repeat the loop} END: OUT T {loop ends, output total} OUT S {output count} **1 mark** for initialising count or total to zero **1 mark** for label marking start of the loop. **2 marks** for correct operation of the loop (1 mark for checking for negative rogue value, 1 mark for jump(s) which correctly continue or end the loop. Other possible combinations of jump commands allowed. Do not allow if rogue value is added to the total or count) **1 mark** for updating total or count. **1 mark** for output of total or count.	6			3b	6

Question	Answer	Mark	AO1	AO2	AO3	Total
10 (a).	**1 mark** for identifying characteristic, **1 mark** for use. Biometric data refers to measurement and recording of some physical characteristic of a person, (1) which can be used to uniquely identify that person. (1) **1 mark** for example **1 mark** for corresponding description to a maximum of **2 marks.** Relevant examples might include: • Facial recognition data. Measurements of the distances between key points on the face, e.g. eyes, nose, ears. • Fingerprint data. Patterns of whirls and loops in the fingerprint pattern. • Iris scan data. Colour pattern of the iris at the front of the eye. • Voice pattern recognition – characteristic frequencies of spoken sounds. • DNA data. Patterns of base sequences in the DNA of the individual, obtained from a sample of hair, cells from the mouth, etc.	4	1b			**12**
10 (b).	**1 mark** for each stage in the process. Data capture (e.g., by photography or scanning) The data would be digitised and stored on a database. Access request - data would again be captured and compared to the reference record stored in the database. A decision made, based upon the comparison.	4	1b			

Question	Answer	Mark	AO1	AO2	AO3	Total
10 (c)	**1 mark** for identifying an objection. **1 mark** for describing the associated issue to a maximum of **4 marks.** Indicative content Inconvenience and intrusion of privacy in having to be photographed/ fingerprinted. Cost of the system, e.g. in increasing the fee that has to be paid by individuals for a biometric passport. The facial recognition database could allow officials to carry out unauthorised surveillance by monitoring CCTV pictures. Possible errors in the system, (e.g. through misidentifying persons in poorly lit street following a crime.	4	1b			
11(a)	5 processors = 1.8 hours / 1 hour 48 mins. **1 Mark.** 20 processors = 1.2 hours / 1 hour 12 mins. **1 Mark.**	2		2b		4
11(b)	**1 mark** for each correct limitation. Serial fraction remains the most significant value in the time calculations. Increasing the number of processors has a diminishing effect on processing time.	2		2b		

Question	Answer	Mark	AO1	AO2	AO3	Total
12	Band Marked - Indicative content. Advantages may include; Can store more knowledge than one person that can easily be kept up to date. Helps to give a more accurate decision. Does not get ill, retire, go on holiday, etc. available 24/7and allows access to an expert where not available locally. Increases competitive advantage / Improves company efficiency and profitability. Used to centralise decision making (more consistency) and allow lower management levels to make decisions making better use of management time. Allow broader distribution of expertise throughout the company. A good expert system explains its decision so that a user can decide whether to accept the decision. Expert systems can learn from experience and allow employees to learn from the system. Disadvantages may include: No common sense used in making decision. Lack of creative responses that human experts are capable of Lack of ability to adapt to changing environments and to recognize when there is no answer.		1b			8

Band	Q12 Max 8 marks
3	**7 – 8 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. • addressed the question appropriately with minimal repetition and no irrelevant material. • has presented a balanced response 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	**4 - 6 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. • presented a response 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	**1- 3 marks** **The candidate has:** • written a response that that lacks sufficient reasoning and structure. • produced a response 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 is not credit worthy or not attempted.