GCE A LEVEL MARKING SCHEME

SUMMER 2024

A LEVEL
COMPUTER SCIENCE - UNIT 4
1500U40-1

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.

GCE A LEVEL COMPUTER SCIENCE - UNIT 4

SUMMER 2024 MARK SCHEME

Question	Answer	Mark	AO1	AO2	AO3	Total
1	**1 mark** for a correct component, 1 mark for an associated description, to a maximum of **6 marks.** **ALU**. (1) implements all the arithmetic, logical, and shift operations (1) / decisions and calculations (1) required by program instructions. **Control Unit**. (1) Fetches the instructions from the main memory, decodes the instructions, and then executes them. (1) **Register Set** (1) includes general-purpose registers that save the temporary information needed by a program and special-purpose registers that execute various functions for the CPU. (1) (Accept individual registers Identified, 1 mark max).) **Cache** (1) a type of Random Access Memory within the processor which stores small amounts of frequently used data and instructions temporarily. (1) It reduces the amount of time needed to fetch the instructions from RAM. (1) **Clock**. (1) Controls the timing and speed of the functions of different components of the CPU. (1) / It sends out electrical signals which regulate the timing and speed of the CPU functions.(1)	6	1b			6

Question	Answer	Mark	AO1	AO2	AO3	Total
2 (a)	**1 mark** for each correct response • 524 • 924	2		2b		6
2 (b)	**1 mark** for each point up to a maximum of **3 marks.** Product codes will hash to a small number (10 in a 1000) of memory locations (1) so many collisions will occur (1) resulting in overflow which will involve slow serial access (1).	3				
2 (c)	Maximum **1 mark** for describing an improved hashing algorithm. which would reduce collisions. Example: Delete the last 2 digits '24' and carry out MOD 1000 on the remaining 4 digits.	1				
3.	**1 mark** for each point up to a maximum of **4 marks.** The CAD software used to design the object will produce large files to provide the printer with the coordinate data needed to produce the 3D objects. (1) A single memory buffer cannot accept data input and provide data output at the same time and therefore would result in a delay in the flow of data to the printer, (1). Such delays may lead to quality issues, such as surface pitting / imperfections / inaccuracies in the final product (1). Double buffering should minimise the delay between input and output operations. (1) The data in one buffer would be sent to the printer controller to enable production to continue, while the other buffer is being filled with output data from the CAD program. (1)	4		2b		4

<table>
<tr><th>Question</th><th>Answer</th><th>Mark</th><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th></tr>
<tr><td>4 (a) (i)</td><td>1 mark for two correct values. 2 marks for all values correct

<table><tr><td></td><td>N = 2</td><td>N = 20</td></tr><tr><td>P = 0.5</td><td>1.33</td><td>1.90</td></tr><tr><td>P = 0.9</td><td>1.82</td><td>6.90</td></tr></table></td><td>2</td><td></td><td>2b</td><td></td><td>10</td></tr>
<tr><td>4 (a) (ii)</td><td>1 mark for correct statement, 1 mark for associated explanation to a maximum of 4 marks.

Indicative content

The calculations indicate that at 50 % parallel processing the benefit in increasing the number of processors is limited (1). At 90% parallel processing the relative benefit of increasing the number of processors is more significant (1).

Whilst the number of processors used effects the performance.(1), but the level of parallelisation achieved in the software is the most significant factor (1)</td><td>4</td><td></td><td>2b</td><td></td><td></td></tr>
<tr><td>4 (b)</td><td>1 mark for each limitation correctly identified 1 mark for associated description to a maximum of 4 marks. Limitations include;

Concurrency (1). It must be possible to divide an algorithm into groups of operations that can execute concurrently.
Dependencies (1). dependencies between tasks intended to be carried out in parallel must be avoided.

Data distributions / communication (1). Data transfer speeds relating to inputs/outputs and memory access and locality (where the data is stored in relation to the processor that will be accessing it).

Computational load (1). The total computation and communication time needs to be balanced so that the maximum execution time per processor is minimised

Implementation (1) The coding of the parallel algorithm of a multithreaded process is complicated, and the program will be difficult to test and de-bug.

Accept any other valid response.</td><td>4</td><td>1b</td><td></td><td></td><td></td></tr>
</table>

Question	Answer	Mark	AO1	AO2	AO3	Total
5 (a)	**1 mark** for each correct event identified to a maximum of **2 marks** • A hardware device has signalled that it has data to process / completed a task. (1) • A software process needs a service to be provided / OS function to be performed. (1) • An allotted amount of time has expired, and an action needs to be performed. (1) • A hardware failure has occurred and needs to be addressed. (1)	2	1b			12
5 (b)	**1 mark** for each correct statement describing the setting / re-setting of processor priority level to a maximum of **4 marks**. **Indicative content** A priority level is assigned to the processor and is stored in the processor's status register. When the processor starts the execution of a program its priority level is re-set to be equal to the priority of the program in execution. (1) When executing the current program, the processor only accepts interrupts that have a higher priority level. (1) When the processor is executing the resulting interrupt service routine the processor priority level is again re-set to the priority of the interrupt (1) and the processor will only accept interrupts with higher priority and ignore interrupts with the same or low priority (1).	4	1b			

<table>
<tr><th>Question</th><th>Answer</th><th>Mark</th><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th></tr>
<tr><td>5 (c).</td><td>1 mark for each correct stage included in the correct order in the description of the process, to a maximum of 6 marks.

1. The processor receives the interrupt and completes the fetch-decode-execute cycle of the instruction that it was running when it received the interrupt (1).
2. The current contents of the processor registers (including the program counter) are saved to memory (1).
3. The origin of the interrupt is identified so that the appropriate ISR (Interrupt Service Routine) is called (1).
4. All other lower-priority interrupts are suspended to allow the ISR to finish running (1).
5. The program counter is updated with the address of the first instruction of the ISR (1)
6. The ISR / interrupt completes its execution
7. The processor registers are reloaded with the values that were saved to memory
8. The lower-priority interrupts that were suspended are re-established (1).
9. The program counter is set to point to the address of the next instruction that needs to be executed in the program that the processor was running when it received the interrupt. (1).</td><td>6</td><td>1b</td><td></td><td></td><td></td></tr>
<tr><td>6 (a).</td><td>1 mark for the correct transmission speed and 1 mark for each correct routing cost.

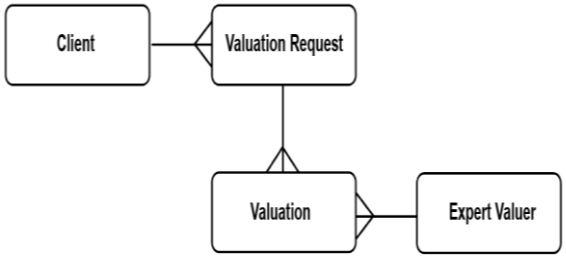
<table>
<tr><th>Network links</th><th>Transmission speed (Kbps)</th><th>Routing cost</th></tr>
<tr><td>A - B</td><td>250</td><td>4</td></tr>
<tr><td>A - D</td><td>50</td><td>20</td></tr>
<tr><td>B - C</td><td>100</td><td>10</td></tr>
<tr><td>B - F</td><td>80</td><td>12.5</td></tr>
<tr><td>C - D</td><td>250</td><td>4</td></tr>
<tr><td>C - F</td><td>500</td><td>2</td></tr>
<tr><td>D - E</td><td>100</td><td>10</td></tr>
<tr><td>E - F</td><td>250</td><td>4</td></tr>
</table></td><td>3</td><td></td><td>2b</td><td></td><td>4</td></tr>
<tr><td>6 (b).</td><td>1 mark for correct route.

• AB – BC – CF</td><td>1</td><td></td><td></td><td></td><td></td></tr>
</table>

Question	Answer	Mark	AO1	AO2	AO3	Total
7.	**1 mark** for input of code from keypad **1 mark** for 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 **Indicative Content** loop: IN input code from keypad SUB 01A0 subtract required code JZE correct jump out of the loop if correct code entered JMP loop repeat loop if code is not correct correct: OUT -1 send signal to unlock cabinet	6			3b	6

Question	Answer	Mark	AO1	AO2	AO3	Total
8 (a)	**1 mark** for correct description and **1 mark** for relevant example to a maximum of 4 marks Rounding is a method for expressing values to the closest value (higher or lower) allowed by the representation being used. (1).Rounding is more accurate (1) Example 4.85 in the register would be rounded to 0101 (1) Truncation is a method of approximating numbers by ignoring digits / fractions which are outside the representation being used. (1) Example 4.85 in the same register would be truncated to 0100 (1)	4	1b			14
8 (b)	Award **1 mark** for each correct value: • $1A_{16} = 00011010_2$ • $14_{16} = 00010100_2$ • $-14_{16} = 11101100$ • 00011010_2 + 11101100_2 = 00000110_2 11110000	4		2a		
8 (c)	Award **1 mark** for each correct value: $52.875_{10} = 110100.1110_2$ $= 0.11010011100$ with 0110_2	3		2a		
8 (d)	Award **1 mark** for each of the following Calculate exponent: 5_{10} Move binary point: 001001.01 Decimal Equivalent 9.25	3				

Question	Answer	Mark	AO1	AO2	AO3	Total
9 (a)	**1 mark** for basic explanation and **1 mark** for further details as indicated to a maximum of **2 marks** A data dictionary provides a record of the names, definitions and attributes of the data elements / meta data stored in a database (1) Further details may include reference to; relationships between tables and key fields (1) data types, field lengths and any validation rules. (1)	2	1b			8
9 (b).	**1 mark** for each correct point to a maximum of **6 marks**. A DBMS enables a database administrator to • Organise files and control the stored data. • Set user permissions to control the addition, editing and updating of data. • Allow users to manipulate the data / run queries. • Control concurrency: concurrent access (meaning 'at the same time') to the same database by multiple users. • Set security rules to prevent unauthorised access to data • Utilise processes to back-up the data regularly and recover data if a problem occurs. • Set rules to verify / validate data input improve the integrity of the data. • Monitor and optimise database performance / workflow / system resources.	6	1b			

Question	Answer	Mark	AO1	AO2	AO3	Total
10 (a)	**1 mark** for identifying redundancy / associated problems to a maximum of **2 marks**. Repetition of data stored in the database ('data redundancy') (1) leading to problems such as; Data inconsistency where the same data exists in different formats in different locations. (1) Data corruption arising from writing or processing errors in repeating fields (1) Increase in database size / longer load times. (1)	2	1b			10
10 (b)(i)	**1 mark** per correct relationship **1 mark** for 4 suitable table names  	4		2b		
10 (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:** • Client (ClientID **[P]**, Name, Address, Telephone, Email) • Valuation Request (RequestRef **[P]**, ClientID **[F],** Items Description) • Valuation (ValuationID **[P**], RequestRef **[F].** ValuerID **[F],** Date) • ExpertValuer (ValuerID **[P]**,Name, Mobile Ignore additional fields	4		2b		

Question	Answer	Mark	AO1	AO2	AO3	Total
11 (a)	**1 mark** for purpose of a query languages in general and **1 mark** for purpose of SQL. **Indicative content** Query languages are used to create access and modify / data in and out from a database / database management system (DBMS). (1) SQL is a special purpose programming language designed for managing data stored in a relational DBMS (1) Allow other responses that refer to interrogation of database data using simple commands.	2	1b			8
11 (b) (i)	SELECT Make, Model FROM Cars (1) WHERE Type = 'Electric' (1)	2			3b	
11 (b) (ii)	**1 mark** for: SELECT Name from Members WHERE MemberID =(…) **1 mark** for: SELECT MemberID FROM CarHireMarch WHERE Date='3 Mar 24' Accept a solution using JOIN: SELECT Name FROM (Members JOIN CarHireMarch ON MemberID) WHERE Date='3 Mar 24' **1 mark** for: SELECT Name FROM (MEMBER JOIN RESULT.) **1 mark** for: WHERE Date='3 Mar 24'	2			3b	

Question	Answer	Mark	AO1	AO2	AO3	Total
11 (b) (iii)	CREATE TABLE HirePayments (PaymentID Integer PRIMARY KEY, Date String, MemberID Integer, PaymentDue Double, / other valid decimal Paid Boolean); Maximum of **2 marks** can be awarded. **1 mark** for: CREATE TABLE HirePayments **1 mark** for four suitable field types. **1 mark** for setting PaymentID as PRIMARY KEY.	2			3b	

Question	Answer	Mark	AO1	AO2	AO3	Total
12	**Indicative content** Advantages **Cost saving** as expenditure on hardware, hard disks etc is reduced. Portability is built into the cloud, with all data available via the Internet. **Remote updates and synchronisation** Updating a cloud file means the file now looks the same to everyone accessing it on every device and use of synchronization (sync) apps will update or sync the files instantly across every device, removing any need to manually upload or download the updated file. **File sharing** simply involves selecting a file in the cloud folder and selecting "share." To produce a link that can be sent and the recipient will be able to download or view your file. **Remote working**. Cloud technology enables remote working as all cloud files are accessible from any internet connection. **Unlimited storage capacity**. Additional storage can be made available as and when needed. **Encryption**. Zero-knowledge encryption, a type of encryption where the encryption key is known only to the file owner and the encryption takes place before the files are sent to the cloud service. This removes concerns that the Cloud provider could decrypt and access private files. Problems **Compromise of data integrity**. This property refers to data that has not been changed, destroyed, or lost in an unauthorised or accidental manner. The need for data integrity is especially evident if data is transmitted across the Internet, where data could be intercepted. **Unauthorised Access.** Cloud-based files are outside any private network and directly accessible from the public Internet. This		1b			12

Question	Answer	Mark	AO1	AO2	AO3	Total
	improves accessibility of, but also makes it easier for an attacker to gain unauthorised access **Cyberattacks.** Cloud-based resources contain a great deal of sensitive and valuable data resulting in them being a common target of cyberattacks. **Denial of Service Attacks**. A successful DoS attacks where the attacker demands a ransom to stop the attack pose a significant threat to cloud-based resources. **Data Loss/Leakage.** The ability to share data easily with other parties via direct email invitations or by sharing a public link to the data is a major asset and key to collaborative working but it does create concerns regarding data loss or leakage. **Data Privacy/Confidentiality**. Data protection regulations like the General Data Protection Regulation (GDPR) require the protection of data and impose strict penalties for security failures. Placing data on the cloud has security implications. **Legal and Regulatory Compliance.** Data protection regulations require that access to protected information is controlled, achieving and demonstrating regulatory compliance in respect of cloud data can be more difficult. Other points may include; • Misconfiguration arising from requirements to be user friendly and support file sharing. • Insecure Interfaces/APIs (Application Programming Interfaces). • Hijacking of Accounts due to weak password security. • Lack of Visibility / Ownership. Limiting the ability to monitor cloud-based resources and protect them against attack.					

Band	Q12 Max 12 marks
3	**9 – 12 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	**5 - 8 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- 4 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.