GCE AS MARKING SCHEME

SUMMER 2024

**AS
COMPUTER SCIENCE - COMPONENT 1
B500U10-1**

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.

EDUQAS GCE AS COMPUTER SCIENCE - COMPONENT 1

SUMMER 2024 MARK SCHEME

Q	Answer	AO1	AO2	AO3	Tot
1	**Award one mark for a suitable example:** • Breaking down a complex problem / calculation into smaller sub-problems and solving them in parallel to speed up the overall solution • Dividing an image into smaller sections and processing each section on a different processor or core • Distributing a large database query across multiple processors or cores to speed up the search • Running multiple simulations or calculations simultaneously to save time and increase efficiency • Using parallel processing in machine learning to train and test multiple models simultaneously to find the best one. Accept any reasonable example.	1			6
	Award one mark for each of the following up to a maximum of five: • Parallel processing is a form of computation in which many calculations are carried out simultaneously • Parallel processing uses multiple cores • It operates on the principle that large problems can often be divided into smaller ones • Parallel processing in computer programs is more complex to design and to write than sequential computer programs • Communication and synchronisation between the different subtasks are typically some of the greatest obstacles to getting efficient parallel program performance Accepted not expected: • The maximum possible speed-up of a single program as a result of parallelisation is known as Amdahl's law: ○ $T(n) = T(1)(B + \frac{1}{n}(1 - B))$ ○ $Where$: ▪ $T(n) = time\ taken\ on\ n\ threads$ ▪ $n = number\ of\ threads$ ▪ $B = fraction\ of\ algorithm\ that\ is\ sequential$ • Example: If a program has a runtime of 10 hours when using a single core processor. If 80% (8 hours) of this program can be parallelised, then clearly a multi-core processor will reduce the runtime required. However, regardless of the number of cores used to execute this program, the minimum runtime cannot be less than the time taken to execute the non-	5			

Q	Answer	AO1	AO2	AO3	Tot
	parallelised 20% (2 hour). The remaining 20% will still be processed sequentially • Using the formula above with one thread (n=1) we get: o $T(n) = T(1)(B + \frac{1}{n}(1-B)$ o $T(1) = 10 \; hours \; \times (0.2 + \frac{1}{1}(1 - 0.2) = 10 \; hours$ o $T(1) = 10 \; hours$ • The speedup of a program using multiple processors in parallel computing is limited by the time needed for the sequential fraction of the program • Using the formula above with one thousand threads (n=1000) we get: o $T(n) = T(1)(B + \frac{1}{n}(1-B)$ $T(1000) = 10 \; hours \; \times (0.2 + \frac{1}{1000})$				
2	**Award one mark for each simplification, up to a maximum of six marks:** **Indicative content** • $(A + B).\left(A.\overline{B}\right) + B.\overline{A}$ • $A.A + A.\overline{B} + B.A + B.\overline{B} + B.\overline{A}$ • $A.A + A.\overline{B} + B.A + B.\overline{A}$ • $A + A.\overline{B} + B.A + B.\overline{A}$ • $A.(1 + \overline{B} + B) + B.\overline{A}$ • $A.(1) + B.\overline{A}$ **Award seven marks for** $A + B.\overline{A}$ **or** $A + B$		7		7
3	**Award one mark for each of the following, up to a maximum of three marks:** • The encoding system assigns a unique binary code to each character • Characters are stored in binary form using a standard encoding system such as ASCII, Unicode, or UTF-8 • Characters typically use a fixed number of bits (e.g., 7 or 8 bits for ASCII or 16 bits for Unicode) • The binary code for a character can be converted to its corresponding decimal, hexadecimal, or octal representation for **storage or transmission**	3			3

Q	Answer	AO1	AO2	AO3	Tot
4 (a) (i)	**Award one mark for the following:** • A collection of 8 bits.	1			11
(ii)	**Award one mark for the following:** • The total number of bits that can be processed as a single unit by the CPU.	1			
(b)	**Award one mark for each of the following, up to a maximum of four marks:** • $2A_{16}$ `00101010` • 74_{10} <u>`01001010`</u> • Carry `1 1` • Answer <u>`01110100`</u>		4		
(c)	**Award one mark for each of the following, up to a maximum of three marks:** • Mantissa: 0.6015625_{10} • Exponent: 6_{10} • Answer: 38.5_{10}		3		
(d)	**Award one mark for each of the following, up to a maximum of two marks:** • Truncation: `110101.10` • Rounding: `110101.11`		2		

3

Q	Answer	AO1	AO2	AO3	Tot
5	**Award one mark for each of the following, up to a maximum of six marks:** Serial file access • Records are entered in the order of their creation / chronological / append to end of file • As such, the file is unordered, and is at best in chronological order • Serial files are primarily used as transaction files in which the transactions are recorded in the order that they occur. Sequential file access • Sequential files are ordered in a logical sequence based **on a key field** • This key is usually the primary key, though secondary keys may be used as well • Sequential files are primarily used in applications where there is a high file hit rate o Hit rate is a measure of the proportion of the records that is accessed in a single run of the application • When records are added, a temporary file is created. Records are copied over until an insertion point. The new record is added and the remaining records are copied over. The old file is deleted and the temp file is renamed. • When records are deleted, a temporary file is created. Records are copied over, leaving out the record that is to be deleted. The old file is deleted and the temp file is renamed.	6			6

Q	Answer	AO1	AO2	AO3	Tot
6	**Award one mark for each of the following, up to a maximum of six marks** • Access levels / rights – certain users would have different/restricted access to certain data or parts of the system • Write-protect mechanisms – only certain users will have permission to write/edit data already stored on the system. • Unique username and a strong secure password – the organisation limits access to the network by ensuring that all authorised users have unique username and a strong secure password. • Encryption – unauthorised users are prevented from reading the confidential files even they gain access to it because the data is unintelligible / scrambled • Firewall - the servers would be protected with firewall software blocking / checking all network traffic entering or leaving specified ports / stop programs accessing the internet • Antivirus software - regularly scans all files stored on them for possible infection by malware.	6			6

Q	Answer	AO1	AO2	AO3	Tot
7	**Award one mark for each of the following, up to a maximum of six marks** • A range check is a technique used to validate whether a value falls within an acceptable range of values o Example: check can be used to verify that a temperature reading is within a specific range, such as -40°C to 50°C. • A format check is a technique used to pre-define the format of the data entered o Example: check can be used to validate that a phone number is in the correct format, such as (02920 000000) • A length check is a technique used to validate that data is the correct length o Example: check can be used to validate that a national insurance number is nine characters long. Accept any reasonable example.	6			6
8	**Award one mark for each of the following, up to a maximum of five marks:** • Before the disaster: risk analysis, preventative measures and staff training o ensure that when a disaster happens, loss of data is minimised and the company has ensured that the data can be recovered. • During the disaster: staff response – implement contingency plans o prevents further damage to the data and begins immediate recovery of data • After the disaster: recovery measures, purchasing replacement hardware, re-installing software, restoring data from backups o restores normal running and recovers all data. **Award one mark for each of the following, up to a maximum of two marks:** • fire, flood, lightning, terrorist attacks etc. • hardware failure, e.g. power supply unit failing • software failure, e.g. virus damage • accidental damage • malicious damage, e.g. hacking	6			6

6

Q	Answer	AO1	AO2	AO3	Tot
9 (a)	**Award one mark for the following:** • Binary search / flow chart		1		11
(b)	**Award one mark for each of the following, up to a maximum of six marks:** • Initialise variables • Input searchValue • Start by identifying the middle element of the sorted list • Compare the middle element to the searchValue. If they are equal • If the searchValue is greater than the middle element, repeat the search on the right half of the list / change start = mid + 1 • If the searchValue is less than the middle element, repeat the search on the left half of the list / change end = mid - 1 • Repeat the above steps until the searchValue is found or the search is exhausted • Output a message with the searchValue location • If the target value is not found, output a message to indicate that the value is not in the list.		6		

(c)	**Award two marks for each of the following, up to a maximum of four marks:**
	
	• Variable / searchValue / start / end / mid
	  o A placeholder used to store and manipulate data
	• Sequence
	  o The specific order in which instructions are performed in an algorithm / instructions are carried out one after the other
	• Selection / if start <= end, if myArray[mid] = searchValue)
	  o Execute a set of instructions if a condition is met / applied description
	• Repetition / iteration / loop while start <= end / loop until searchValue is found
	  o Repeatedly execute a set of instructions until a condition is met / applied description
			4		

Q	Answer	AO1	AO2	AO3	Tot

10	**Indicative content**
	
	``
	1 declare translations[2,9999] as string
	2 set word as string
	3 set flag as Boolean
	4
	5 set flag = FALSE
	6
	7 output "Please enter the English word
	   the you wish to translate"
	8 input word
	9
	10 for i = 0 to 9998
	11 if word = translations[0,i] then
	12 output "The translation for ",
	   word, "is" translations[1,i]
	13 set flag = TRUE
	14 end if
	15 next i
	16
	17 if flag = FALSE then
	18 output "Word not found, please check
	   your spelling"
	19 end if
	``
	
	Award one mark for each of the following, up to a maximum of seven marks:
	
	• Declare array or initialise of variables
	• Input word
	• Loop structure + increment
	• Word comparison
	• Output translation
	• Output error message if word is not found
	• Algorithm works as intended.
				7	7

Q	Answer	AO1	AO2	AO3	Tot
11 (a)	**Award one mark for each of the following, up to a maximum of four marks:** • A bank maintains a master file containing records for all of its customer accounts o Records in this file are stored in sequential order • Each record contains information such as account number, customer name, and current account balance • When a customer performs a transaction, such as withdrawing money from an ATM, the transaction details are recorded in a transaction file o Records in this file are stored in serial / chronological order • To update the master file with the transaction details, the bank can use a program that reads the sorted transaction file • And updates the corresponding account balance in the master file • Error is file is produced.		4		6
(b)	**Award one mark for each of the following, up to a maximum of two marks:** • Allows for efficient updates to the master file: o Only needs to be updated when there are changes to the account balances, rather than having to read and update the entire file each time a transaction is made o Batch processing may be used to utilise resources during off-peak times • The master file can be re-created from the transaction file if corrupt or lost • It provides a record of all transactions made on the account, which can be useful for auditing and security purposes.		2		

9

Q	Answer	AO1	AO2	AO3	Tot
12 (a)	**Award one mark for each of the following, up to a maximum of two marks:** • An object is an instance of a class • An object represents a specific occurrence of a class (unique properties and behaviours) • A class is a template for an object • Classes are used to define an object's attributes and methods • An object may inherit methods and attributes from a class.	2			7
(b) (i)	**Award one mark for any one of the following:** • `+setAmount (Double)` • `+getAmount () : Double` • `+getProcessed() : Boolean` • `+setProcessed(Boolean) : String` • `+setNumber(Integer)` • `+setType(String)` • `+setExpiry(Integer)` • `+authorise() : Boolean` • `+tender(cashTendered)` • `+getChangeDue : Double` • `+setBank(String)`		1		
(b) (ii)	**Award one mark for any one of the following:** • `+setAmount(Double)` • `+setProcessed(Boolean) : String` • `+setNumber(Integer)` • `+setType(String)` • `+setExpiry(Integer)` • `+tender(cashTendered)` • `+setBank(String)`		1		
(b) (iii)	**Award one mark for any one of the following:** • `+getAmount() : Double` • `+getProcessed() : Boolean` • `+authorise() : Boolean` • `+getChangeDue : Double`		1		

Q	Answer	AO1	AO2	AO3	Tot
(c)	**Award one mark for each of the following, up to a maximum of three marks:** • Private (-) - only the current class will have access to the attribute or method • Protected (#) - only the current class and its subclasses will have access to the attribute or method.	2			
13	**Award one mark for each of the following, up to a maximum of six marks:** • **Automation:** Computers can automate many tasks that were previously performed by humans o **Job loss:** This could lead to the displacement of workers in certain industries • **Increased productivity:** Computers can increase productivity by allowing workers to perform tasks more efficiently and accurately • **Telecommuting:** Computers enable people to work from home or remote locations, allowing for greater flexibility in work arrangements • **Increased skill requirements:** As more tasks are automated, the skills required for certain jobs may shift towards more technical or specialised areas • **Job creation:** The growth of the technology industry can create new jobs in areas such as software development, technical support, and data analysis o **Income increase:** access to employment in remote locations opens job opportunities • **Globalisation**: Computers enable businesses to operate on a global scale, which can result in the outsourcing of jobs to countries with lower labour costs • **Income inequality:** The impact of computerisation on the job market can exacerbate income inequality, with high-skilled workers earning more than low-skilled workers • **Changes in education and training:** The rise of computers in the workplace may require changes in education and training to equip workers with the necessary skills to succeed in the new job market • **Job satisfaction:** The impact of computers on job satisfaction is mixed, with some workers feeling empowered by the use of technology, while others may feel that it dehumanises the workplace. Accept any other valid effect.	6			6

11

Q	Answer	AO1	AO2	AO3	Tot
14	**Indicative content** Direct changeover • Sudden change to new system • Could be used where a failure would not be catastrophic • Can be cheaper to implement • New system is available immediately if required • Can be the least disruptive if implemented well Parallel changeover • Both systems running together for a time • Safest option as if new system fails they still have existing system • New system is available immediately if required • The outputs from the old and new systems can be compared to check that the new system is running correctly User documentation • step-by-step 'getting started' guides or tutorials for the main features of the system • installation guide • licence information • reference manual • online help, at the level of both individual controls, such as input fields, and at the task level • error messages and trouble-shooting guide • frequently asked questions (FAQs) detailing common questions and problems • glossary. Maintenance documentation • Any form of diagrams used in analysis and design. • Descriptions of procedures and subroutines used. • The data structure: o What data structures have been used, database table designs and any other information about what data needs to be stored. • Algorithm designs: o Algorithms will normally be presented in pseudo-code or flowchart form. • Annotated code listings: o Code listings that abide by the coding standards set out by the development company. Normally self-documenting and/or annotated. • Variable lists: o Lists of the key variables listing their data types and purpose. More temporary variables, such as loop counters, would not be included. • Data dictionary:	12			12

Q	Answer	AO1	AO2	AO3	Tot
	o This will describe all of the fields that need to be stored in the data structure including data type, size, relationship with other tables and a description. • Design documents: o Any relevant documentation from design phase. • Hardware and software requirements. • Configuration guide and options.				

Band	AO1.1b 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 indicative content. Clear knowledge is defined as a response that provides nine to twelve relevant detailed points which relate to an extensive amount of the indicative content for **both** changeover and documentation • addressed the question appropriately with minimal repetition and no irrelevant material • has presented a balanced discussion and justified their answer with examples used appropriate technical terminology referring to the indicative content 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 as specified in the indicative content. Satisfactory knowledge is defined as a response that provides five to eight points as signalled in the indicative content. • has presented a discussion with limited examples used appropriate technical terminology referring to the indicative content.
1	**1 - 4 marks** The candidate has: • 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. Superficial knowledge is defined as a response that provides one to four points as signalled in the indicative content used limited technical terminology referring to the indicative content.
0	**0 marks** Response not credit worthy or not attempted.

Total	**100**	**57**	**36**	**7**	**100**