Cambridge Assessment International Education

Cambridge International AS & A Level

COMPUTER SCIENCE **9618/23**

Paper 2 Fundamental Problem-solving and Programming Skills **October/November 2023**

MARK SCHEME

Maximum Mark: 75

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Mark scheme abbreviations

/ separates alternative words / phrases within a marking point
// separates alternative answers within a marking point
underline actual word given must be used by the candidate (grammatical variants accepted)
max indicates the maximum number of marks that can be awarded
( ) the word / phrase in brackets is not required but sets the context

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(a)</td><td>
<table>
<tr><th>Assignment statement</th><th>Data type</th></tr>
<tr><td>MyVar1 ← Total1 / Total2</td><td>REAL</td></tr>
<tr><td>MyVar2 ← 27/10/2023</td><td>DATE</td></tr>
<tr><td>MyVar3 ← "Sum1 / Sum2"</td><td>STRING</td></tr>
<tr><td>MyVar4 ← Result1 AND Result2</td><td>BOOLEAN</td></tr>
</table>
</td><td>4</td></tr>
<tr><td>1(b)</td><td>
<table>
<tr><th>Expression</th><th>Evaluates to</th></tr>
<tr><td>Fraction >= 0.2 AND NOT Active</td><td>FALSE</td></tr>
<tr><td>INT((Fraction1 * 100) + 13.3)</td><td>33</td></tr>
<tr><td>STR_TO_NUM(MID(Code, 4, 2)) + 5</td><td>28</td></tr>
<tr><td>LENGTH("TRUE" & Code)</td><td>11</td></tr>
</table>
</td><td>4</td></tr>
<tr><td>1(c)</td><td>The use of a program library (routines)</td><td>1</td></tr>
<tr><td>1(d)</td><td>MP1 Type: Adaptive
MP2 Reason: The (user) requirement(s) changes // to accommodate legislative changes</td><td>2</td></tr>
</table>

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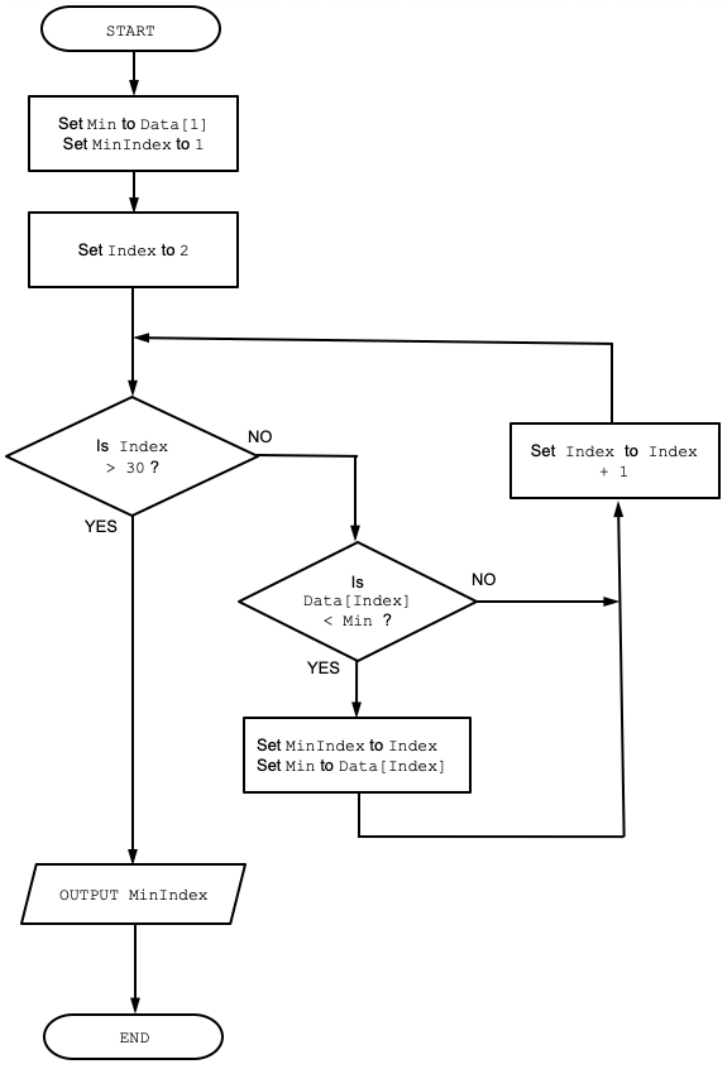
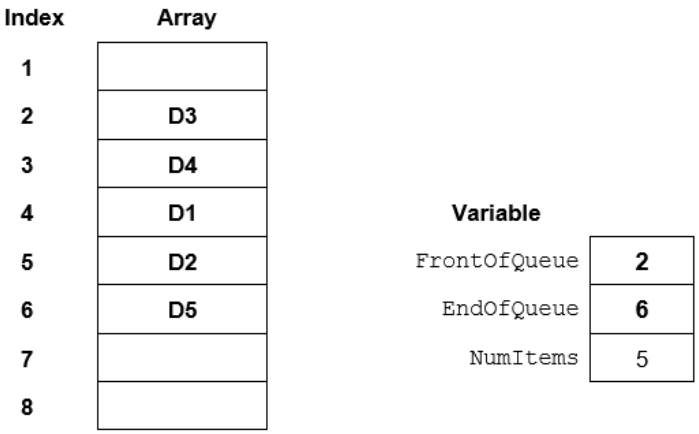
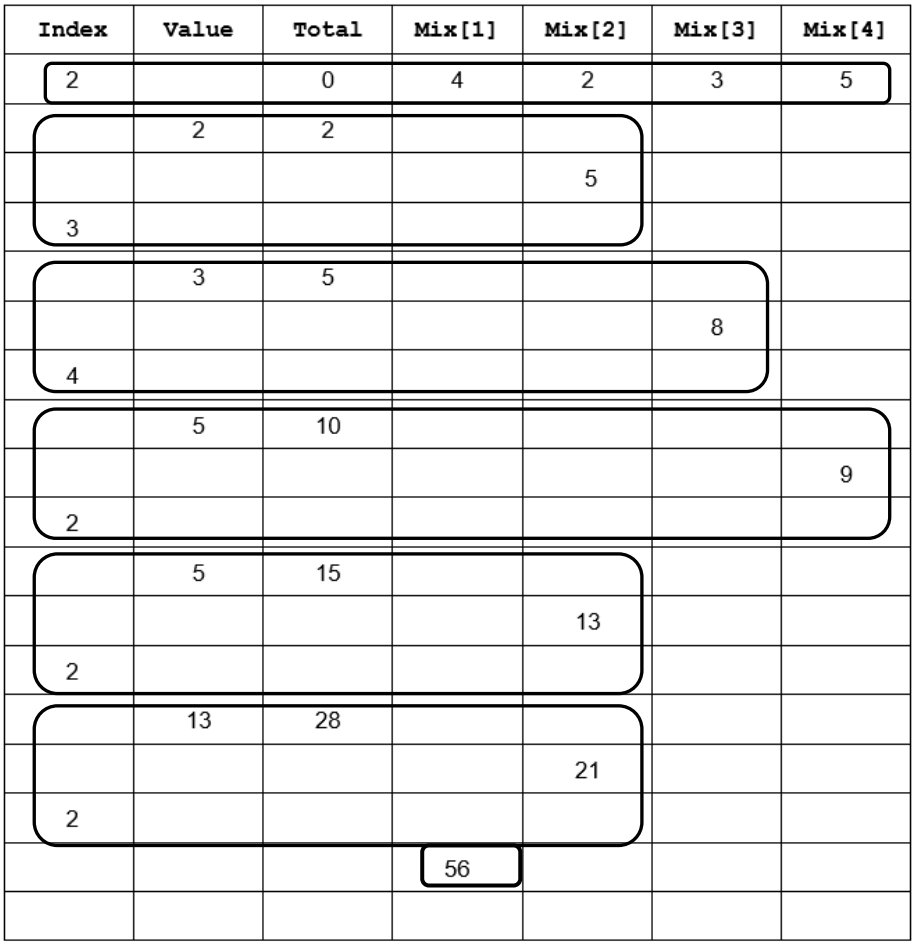
Question	Answer	Marks
2(a)	 **MP1** Initialise `Min` to first value in `Data` **and** `MinIndex` to 1 **MP2** Loop through 29 more values (or 30 values in total) **MP3** Compare element from `Data[]` with `Min` **MP4** Set new `Min` **AND** save `MinIndex` when element value < `Min` **in a loop** **MP5** Output `MinIndex`	**5**
2(b)	**MP1** Simplifies the algorithm // easier to write / understand / test / debug **MP2** It is possible to iterate through the values // can use a loop // allows the storage of many values using a single identifier	**2**
2(c)	**One** mark per underlined section `DECLARE Data : ARRAY[1:120] OF REAL`	**2**

Question	Answer	Marks
3(a)	 : **MP1** D3, D4, D1, D2 and D5 in question order or reversed - in any five consecutive locations **MP2** `FoQ` value matches index with D3 **MP3** `EoQ` value matches index with D5	**3**
3(b)	**MP1** If `NumItems` **is / = 8 // (queue) full** then jump to step 6 **MP2** Increment **`EndOfQueue`** **MP3** If **`EndOfQueue` = 9** then set `EndOfQueue` to **1** **MP4** Increment **`NumItems`** **MP5** Set the **Element** at the index … **MP6** stored in **`EndOfQueue`** to **value/data/item** being added Mark as follows: Steps 1 to 4: One mark for gaps filled as shown Step 5: One mark for 'element' and one mark for other two terms	**6**

Question	Answer	Marks

4(a)	`PROCEDURE RandList()`
	`  DECLARE Count, BaseNum, ThisNum : INTEGER`
	`  CONSTANT StepVal = 10`
	`  BaseNum ← 0`
	
	`  FOR Count ← 1 TO 25`
	`  ThisNum ← BaseNum + INT(RAND(StepVal))`
	`  OUTPUT ThisNum`
	`  BaseNum ← BaseNum + StepVal`
	`  NEXT Count`
	
	`ENDPROCEDURE`
	
	MP1 Procedure heading and ending
	MP2 Local loop counter `Count` as integer
	MP3 Loop to iterate 25 times or more for each unique number
	MP4 'Attempt' to generate a random number including use of `INT()` **in a loop**
	MP5 Ensure that number generated is greater than previous and change 'previous'
	MP6 Output random number after an attempt at MP5 **in a loop**
		6

4(b)	**One** mark for simplified logical expression: **MP1** `Result[x + 1] <= Result[x]` ALTERNATIVE SOLUTION: `Result[x] >= Result[x + 1]`	**1**

Question	Answer	Marks
5		**6**

Index	Value	Total	Mix[1]	Mix[2]	Mix[3]	Mix[4]
2		0	4	2	3	5
	2	2				
				5		
3						
	3	5				
					8	
4						
	5	10				
						9
2						
	5	15				
				13		
2						
	13	28				
				21		
2						
			56			

MP1 Row 1 (initialisation)

Each iteration (1 – 5):
MP2 1 – Total 2
MP3 2 – Total 5
MP4 3 – Total 10
MP5 4 – Total 15
MP6 5 – Total 28 **and** final `Mix[1]` = 56

Question	Answer	Marks

6	`FUNCTION TestNum(ThisNum : STRING) RETURNS INTEGER`
	
	`  IF LEFT(ThisNum,3) = RIGHT(ThisNum 3) THEN`
	`  RETURN 3`
	`  ENDIF`
	
	`  IF RIGHT(ThisNum, 3) = "000" THEN`
	`  RETURN 2`
	`  ENDIF`
	
	`  IF MID(ThisNum, 4, 1) = MID(ThisNum, 5, 1)__`
	`  AND MID(ThisNum, 5, 1) = MID(ThisNum, 6, 1) THEN`
	`  RETURN 1`
	`  ENDIF`
	
	`  RETURN 0`
	
	`ENDFUNCTION`
	
	MP1 Function heading and ending **including** parameter and return type
	MP2 Test for Condition 1
	MP3 Test for Condition 2
	MP4 Test for Condition 3
	MP5 Return the highest value if more than one condition is satisfied
	MP6 Return zero if no condition matched
		6

Question	Answer	Marks
7(a)	**MP1** iteration / looping **MP2** naming all four modules correctly in the correct sequence //_e.g. `Module-A` repeatedly calls `Sub-Y1`, then `SubY2` then `Sub-9`	**2**

7(b)(i)	`TYPE MyType`
	`  DECLARE RA  : INTEGER`
	`  DECLARE RB  : STRING`
	`  DECLARE RC  : BOOLEAN`
	`ENDTYPE`
	
	MP1 `TYPE MyType... ENDTYPE`
	MP2 `RA` as integer and `RB3` as string
	MP3 `RC` as Boolean
		3

7(b)(ii)	`PROCEDURE Sub-9(BYREF Param : MyType)` **MP 1** One mark for `BYREF` **MP 2** One mark for the rest of the statement	**2**

Question	Answer	Marks

8(a)	`PROCEDURE ReceiveFile(FileName : STRING)`
	`  DECLARE FileData : STRING`
	`  DECLARE CharCount : INTEGER`
	`  CONSTANT Terminator = "****"`
	
	`  OPENFILE FileName FOR WRITE`
	`  FileData ← GetData()`
	`  CharCount ← 0`
	
	`  WHILE FileData <> Terminator`
	`  WRITEFILE FileName, FileData`
	`  CharCount ← CharCount + LENGTH(FileData)`
	`  FileData ← GetData()`
	`  ENDWHILE`
	
	`  CLOSEFILE FileName`
	
	`  OUTPUT CharCount (, " characters were written to ", FileName)`
	
	`ENDPROCEDURE`
	
	MP1 OPEN file in WRITE mode and subsequently CLOSE
	MP2 Conditional loop until terminator received
	MP3 'Attempted' use of `GetData()` – Ignore CALL …
	MP4 Fully correct use `GetData()` to return the data **in a loop**
	MP5 Maintain `CharCount` **in a loop**
	MP6 Write each line to the file - **except** the terminator **in a loop**
	MP7 Final output of message giving number of characters written **outside loop**
		7

8(b)	**Max 3** marks Problem: • If the file being sent contains a line of the string "****" • then the file being written by `ReceiveFile()` will end at this point // subsequent file lines will be lost Solution: • Read the file (at the sending end) to find the number of lines it contains • Send an initial message which defines the number of lines in the file ALTERNATIVE SOLUTION: • (Transmitter program) chooses a **different** terminator string / character that doesn't occur in the file • Transmitter program sends the terminator string / character before first line of file / before the transfer begins	**3**

Question	Answer	Marks

8(c)	`PROCEDURE Chat(Destination : STRING, Port : INTEGER)`
	`  DECLARE Data : STRING`
	`  DECLARE Finished : BOOLEAN`
	`  CONSTANT Terminator = "Bye"`
	`  CONSTANT STX = CHR(2)`
	`  CONSTANT ETX = CHR(3)`
	
	`  Finished ← FALSE`
	
	`  REPEAT`
	`  Data ← GetData()`
	`  OUTPUT Data`
	`  IF Data = Terminator THEN`
	`  Finished ← TRUE`
	`  ENDIF`
	
	`  IF NOT Finished THEN  //about to reply`
	`  INPUT Data`
	`  Transmit(STX & Destination & MyID & Data & ETX, Port)`
	`  IF Data = Terminator THEN`
	`  Finished ← TRUE`
	`  ENDIF`
	`  ENDIF`
	
	`  UNTIL Finished = TRUE`
	
	`ENDPROCEDURE`
	
	Conditional loop
	MP1 Conditional loop
	MP2 Test for terminator in both cases
	MP3 Use `GetData()` to get the data from the message
	MP4 `OUTPUT` the data **in a loop**
	MP5 `INPUT` the data reply
	MP6 'Attempted ' use of `Transmit` to send it **in a loop**
	MP7 Correct formation of parameters to `Transmit()`
		7

8(d)	**Note: Max 3** marks **(from either limitation or modification list)** Limitation: 1 `GetData()` does not return a value until a message has been received 2 So once a message has been sent the user has to wait for a reply // chat is half-duplex Modification: 3 If no response allow the receiver to exit chat at any time … 4 `GetData()` should immediately return a suitable message // set a time limit 5 ... which `Chat()` can detect and respond by allowing the conversation to continue	**3**