



Cambridge International AS & A Level

COMPUTER SCIENCE

9608/41

Paper 4 Written Paper

October/November 2020

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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This document consists of **15** printed pages.

PUBLISHED**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.

Question	Answer																				Marks			
1	A																				5			
	B																							
	C																							
	D																							
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	Week number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19		20		
<ul style="list-style-type: none"> • A(1) and B(3) following A • C(6) following B and D(4) following B • E(2) following D, F(2) following E, G(1) following F • H(2) following G, I(2) following G, J(3) following G • K(4) following H 																								

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Question	Answer					Marks																														
2(a)	<table border="1"> <thead> <tr> <th data-bbox="360 213 1296 277">Statement</th> <th data-bbox="1308 213 1496 277">Integration</th> <th data-bbox="1496 213 1688 277">Acceptance</th> <th data-bbox="1688 213 1805 277">Alpha</th> <th data-bbox="1805 213 1912 277">Beta</th> </tr> </thead> <tbody> <tr> <td data-bbox="360 277 1308 341">Software is tested in-house by dedicated testers</td> <td data-bbox="1308 277 1496 341">✓</td> <td data-bbox="1496 277 1688 341"></td> <td data-bbox="1688 277 1805 341">✓</td> <td data-bbox="1805 277 1912 341">(✓)</td> </tr> <tr> <td data-bbox="360 341 1308 405">Software is tested by the client before it is signed-off</td> <td data-bbox="1308 341 1496 405"></td> <td data-bbox="1496 341 1688 405">✓</td> <td data-bbox="1688 341 1805 405"></td> <td data-bbox="1805 341 1912 405"></td> </tr> <tr> <td data-bbox="360 405 1308 501">Software is tested by combining modules that have previously been tested to check they work as expected.</td> <td data-bbox="1308 405 1496 501">✓</td> <td data-bbox="1496 405 1688 501"></td> <td data-bbox="1688 405 1805 501"></td> <td data-bbox="1805 405 1912 501"></td> </tr> <tr> <td data-bbox="360 501 1308 564">Software is tested using normal, abnormal and boundary data.</td> <td data-bbox="1308 501 1496 564">✓</td> <td data-bbox="1496 501 1688 564">✓</td> <td data-bbox="1688 501 1805 564">✓</td> <td data-bbox="1805 501 1912 564">(✓)</td> </tr> <tr> <td data-bbox="360 564 1308 676">Software is tested by releasing it to selected customers, who test it in normal circumstances</td> <td data-bbox="1308 564 1496 676"></td> <td data-bbox="1496 564 1688 676"></td> <td data-bbox="1688 564 1805 676"></td> <td data-bbox="1805 564 1912 676">✓</td> </tr> </tbody> </table>	Statement	Integration	Acceptance	Alpha	Beta	Software is tested in-house by dedicated testers	✓		✓	(✓)	Software is tested by the client before it is signed-off		✓			Software is tested by combining modules that have previously been tested to check they work as expected.	✓				Software is tested using normal, abnormal and boundary data.	✓	✓	✓	(✓)	Software is tested by releasing it to selected customers, who test it in normal circumstances				✓					4
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2(b)	One from: <ul style="list-style-type: none"> • dry run • walkthrough • white-box • black-box 					1																														

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Question	Answer	Marks
3(a)	<ul style="list-style-type: none"> • Correct header and close (where applicable) with no parameters ... • ...Correct values assigned to correct identifiers <p>PYTHON</p> <pre>def __init__(self): self.__PlayerID = "PL12a3" self.__Name = "" self.__Score = 0</pre> <p>PASCAL</p> <pre>Constructor PuzzlePlayer.Create(); begin PlayerID := 'PL12a3'; Name := ''; Score := 0; end;</pre> <p>VB</p> <pre>Public Sub New() PlayerID = "PL12a3" Name = "" Score = 0 End Sub</pre>	2

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Question	Answer	Marks
3(b)	<ul style="list-style-type: none">• Correct function header and close (where applicable) no parameter (if returns value must be string)• Returns correct value <code>PlayerID</code> <p>PYTHON</p> <pre>def GetPlayerID(self): return(self.__PlayerID)</pre> <p>PASCAL</p> <pre>Function GetPlayerID() : String; Begin GetPlayerID := PlayerID; End;</pre> <p>VB</p> <pre>public function GetPlayerID() return(PlayerID) End Function</pre>	2

Question	Answer	Marks
3(c)	<ul style="list-style-type: none"> • Function header (and close), value passed as parameter (returning Boolean/String if present) • Checks parameter is 6 characters in length • AND checks the first two characters in parameter are "PL" • ...Returns true if parameter is valid and stores in PlayerID • ...Returns false if parameter is not valid (and stores in PlayerID or not) <pre> FUNCTION SetPlayerID(NewPlayerID) RETURNS BOOLEAN DECLARE Valid : BOOLEAN Valid ← TRUE IF Length(NewPlayerID) = 6 AND Substring(NewPlayerID,0,2) = "PL" THEN PlayerID ← NewPlayerID ELSE Valid ← FALSE ENDIF RETURN Valid ENDFUNCTION </pre>	5
3(d)(i)	<ul style="list-style-type: none"> • A class contains objects/instances of another class • Quiz class has objects of type Question class // The objects/items in the array QuizQs have the attributes/methods of the class Question // The array QuizQs is of data type class Question 	2
3(d)(ii)	<p>e.g.</p> <ul style="list-style-type: none"> • Inheritance • A child class can use attributes/methods from the parent class • Polymorphism • A child class can overwrite the methods of the parent class 	2
3(d)(iii)	<ul style="list-style-type: none"> • Correct identifier, 100 elements, type Quiz and clearly array (i.e. brackets) <pre> DECLARE QuizBank : ARRAY[0:99] OF Quiz </pre>	1

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Question	Answer	Marks
3(d)(iv)	<ul style="list-style-type: none"> • Instance of object and assignment to first element of array (0 or 1) • Correct parameters (in any order) <p>PYTHON QuizBank[0] = Quiz("Famous people", "Low", 10)</p> <p>PASCAL QuizBank[0] := Quiz.Create('Famous people', 'Low', 10);</p> <p>VB QuizBank[0] = New Quiz ("Famous people", "Low", 10)</p>	2

Question	Answer	Marks
4(a)	<ul style="list-style-type: none"> • type(camembert) • soft(camembert) • strong_smell(camembert) • origin(camembert, france) 	4
4(b)	<ul style="list-style-type: none"> • type(X) • AND country(Y) • AND NOT • soft(X) <p>IF type (X) AND country (Y) AND NOT soft(X)</p>	4

Question	Answer	Marks
5(a)	Four from: <ul style="list-style-type: none"> • Uses a sorted and unsorted list • Takes first value and makes it sorted list // compare second item to first item • Find location of next value in the sorted list • ...description of suitable method (e.g. switching values, taking value out, comparing with sorted values) • Insert item in correct position in sorted list • Repeat until all items are in the sorted list (dependent on suitable method) 	4
5(b)	<pre> Counter ← NumberOfItems - 2 REPEAT DataSwapped ← FALSE FOR CurrentValue ← 0 TO Counter // NumberOfItems - 2 IF DataList[CurrentValue] > DataList[CurrentValue + 1] THEN ValueTemp ← DataList[CurrentValue] DataList[CurrentValue] ← DataList[CurrentValue + 1] DataList[CurrentValue + 1] ← ValueTemp DataSwapped ← TRUE ENDIF ENDFOR UNTIL DataSwapped = FALSE </pre>	5

Question	Answer	Marks
6(a)	<ul style="list-style-type: none"> • A–B–E • E–C–D with D null pointer 	2
6(b)	It indicates the end of the list // it doesn't point anywhere/to any data/to another node	1

Question	Answer	Marks
6(c)(i)	<pre>FUNCTION FindValue(Value : INTEGER) RETURNS INTEGER DECLARE CurrentPointer : INTEGER CurrentPointer ← StartPointer WHILE CurrentPointer <> NULL AND LinkedList[CurrentPointer].Data <> Value CurrentPointer ← LinkedList[CurrentPointer].Pointer ENDWHILE IF LinkedList[CurrentPointer].Data = Value THEN RETURN CurrentPointer ELSE RETURN -1 ENDIF ENDFUNCTION</pre>	6

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Question	Answer	Marks
6(c)(ii)	<p>One mark per bullet point to max 7</p> <ul style="list-style-type: none"> • Function header, taking parameter (and returning Boolean) • Assign a new pointer to StartPointer • Iterate/recursive calls through nodes correctly updating current pointer • Checking for empty list and returning FALSE • Checking if end of list ... • ... check data in last node • Checking if data found... • ... set pointer of found node to NULL (return to free chain) • ... if found update previous node pointer to NULL • ... return TRUE • If end of list and not found then return FALSE <pre> FUNCTION DeleteNode(NodeData : STRING) RETURNS BOOLEAN IF StartPointer = NULL THEN RETURN FALSE ELSE CurrentPointer ← StartPointer IF LinkedList[CurrentPointer].Data = NodeData THEN StartPointer ← LinkedList[CurrentPointer].Pointer RETURN TRUE ELSE PreviousPointer ← CurrentPointer WHILE CurrentPointer <> NULL AND LinkedList[CurrentPointer].Data <> NodeData PreviousPointer ← CurrentPointer CurrentPointer ← LinkedList[CurrentPointer].Pointer ENDWHILE </pre>	7

Question	Answer	Marks
6(c)(ii)	<pre> IF CurrentPointer = NULL THEN IF LinkedList [CurrentPointer].Data = NodeData THEN LinkedList [PreviousPointer].Pointer ← NULL RETURN TRUE ELSE RETURN FALSE ENDIF ELSE IF LinkedList [CurrentPointer].Data = NodeData THEN LinkedList [PreviousPointer].Pointer ← LinkedList [CurrentPointer].Pointer LinkedList [CurrentPointer].Pointer ← NULL RETURN TRUE ENDIF ENDIF ENDIF ENDIF ENDIF ENDFUNCTION </pre>	

Question	Answer				Marks
7	Label	Op Code	Operand	Comment	
		LDR	#0		
		LDM	#0		
		STO	LENGTH	// initialise LENGTH to 0	
	LOOP:	IN			
		CMP	EXCLAMATIO N	// is character = EXCLAMATION ('!')?	[1]
		JPE	OUTPUT	// if true, jump to OUTPUT	[1]
		STX	USERNAME	// store character in USERNAME + contents of IX	[1]
		INC	IX	// increment Index Register	
		LDD	LENGTH		
		INC	ACC	// increment LENGTH	[1]
		STO	LENGTH		
		CMP	MAX	// is LENGTH = MAX ?	[1]
		JPN	LOOP	// if FALSE, jump to LOOP	[1]
	OUTPUT:	LDR	#0		
		LDM	#0	// initialise COUNT to 0	[1]
		STO	COUNT		
		LDX	USERNAME		
		OUT			
		INC	IX		
		LDD	COUNT		
		INC	ACC	// increment COUNT	
		STO	COUNT		
		CMP	LENGTH	// is COUNT = LENGTH ?	[1]
		JPN	OUTPUT		
		END		// end program	
	LENGTH:				
	EXCLAMATION:	B0010001			
MAX:	8				
COUNT:					
USERNAME:					

Question	Answer	Marks																																										
8(a)	<ul style="list-style-type: none"> • 8 ... • ...it calls itself 	2																																										
8(b)	<p>1 mark each:</p> <ul style="list-style-type: none"> • Final return value = 5 • Output column • Return value column • Value 1 and Value 2 columns • Temp column <table border="1" data-bbox="365 598 1485 1058" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Value1</th> <th>Value2</th> <th>Temp</th> <th>EndValue</th> <th>OUTPUT</th> <th>Return Value</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1</td> <td>1</td> <td>12</td> <td>1</td> <td>5</td> </tr> <tr> <td>2</td> <td></td> <td></td> <td></td> <td>2</td> <td>4</td> </tr> <tr> <td>3</td> <td>2</td> <td>2</td> <td></td> <td>3</td> <td>3</td> </tr> <tr> <td>5</td> <td>3</td> <td>3</td> <td></td> <td>5</td> <td>2</td> </tr> <tr> <td>8</td> <td>5</td> <td>5</td> <td></td> <td>8</td> <td>1</td> </tr> <tr> <td>13</td> <td>8</td> <td></td> <td></td> <td>13</td> <td>0</td> </tr> </tbody> </table>	Value1	Value2	Temp	EndValue	OUTPUT	Return Value	1	1	1	12	1	5	2				2	4	3	2	2		3	3	5	3	3		5	2	8	5	5		8	1	13	8			13	0	5
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3	2	2		3	3																																							
5	3	3		5	2																																							
8	5	5		8	1																																							
13	8			13	0																																							
8(c)	To output/find a value that is the addition of the two previous values // (output) Fibonacci sequence	1																																										