

Cambridge International AS & A Level

COMPUTER SCIENCE**9618/23**

Paper 2 Fundamental Problem-solving and Programming Skills

October/November 2024**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 **14** printed pages.

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 descriptions 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.

Mark scheme abbreviations

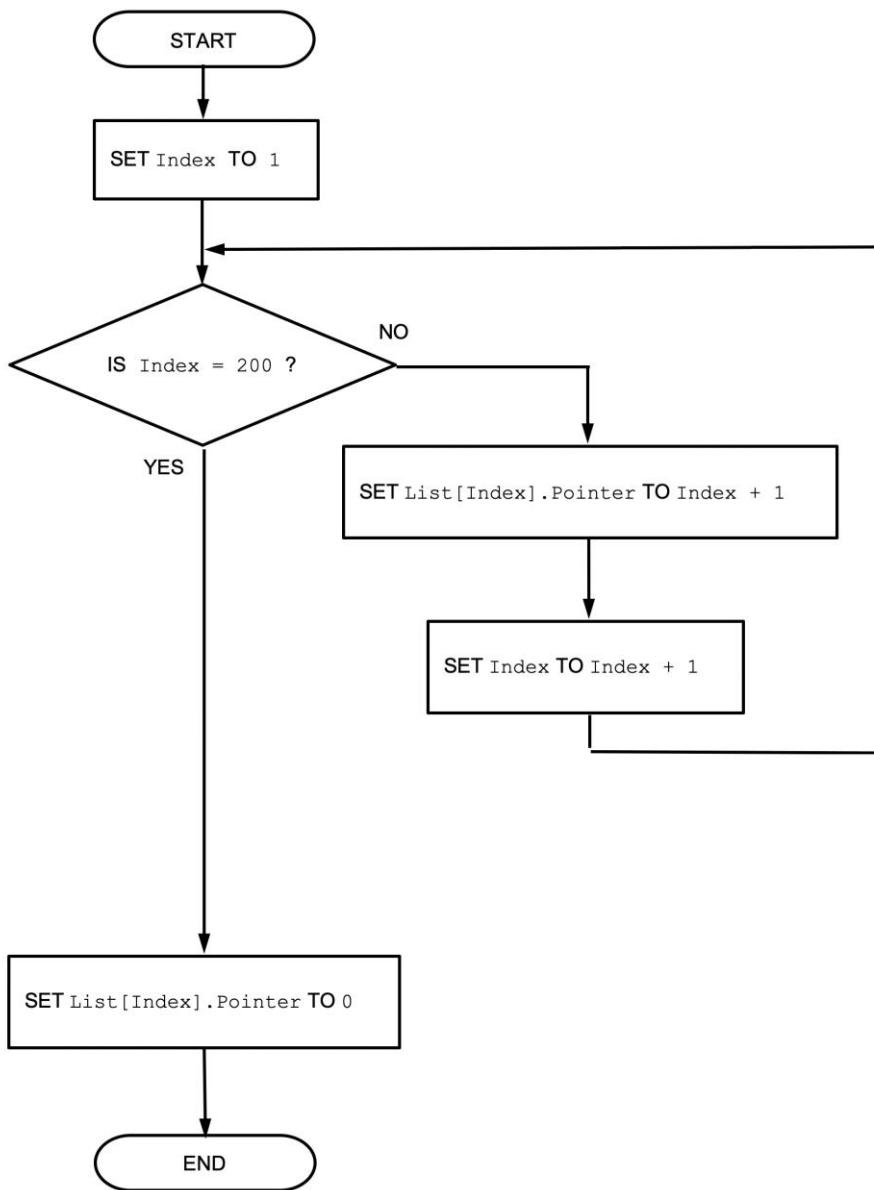
/	separates alternative words / phrases within a marking point
//	separates alternative answers within a marking point
underline	actual word given must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be awarded
()	the word / phrase in brackets is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

Note: No marks are awarded for using brand names of software packages or hardware.

Question	Answer				Marks	
1(a)	Pseudocode example	Selection	Iteration	Subroutine	4	
	FOR Index ← 1 TO 3 IF Safe[Index] = TRUE THEN Flap[Index] ← 0 ENDIF NEXT Index	✓	✓			
	CASE OF Compound(3)	✓		✓		
	REPEAT UNTIL AllDone() = TRUE		✓	✓		
	WHILE Result[3] <> FALSE		✓			
One mark per row						
1(b)	Variable	Example data value	Data type		3	
	Available	TRUE	BOOLEAN			
	Received	"18/04/2021"	STRING			
	Index	100	INTEGER			
	One mark per row					
1(c)	Expression	Evaluates to			3	
	Available AND NOT(Index > 100)	TRUE				
	Index MOD 30	10				
	NUM_TO_STR(Index + "33")	ERROR				
	One mark per row					

Question	Answer	Marks
2(a)	<pre> DECLARE Count, Total, NextNumber : INTEGER Total ← 0 FOR Count ← 1 TO 100 OUTPUT "Input an integer value" INPUT NextNumber IF NextNumber > 0 THEN Total ← Total + NextNumber ENDIF NEXT Count OUTPUT Total </pre> <p>Mark as follows:</p> <p>MP1 Declarations of all variables used MP2 Loop for 100 iterations MP3 Prompt and input a value in a loop and MP4 Test for value $> 0 // \geq 1$ in a loop MP5 Sum the Total in a loop MP6 Output of Total after the loop</p> <p>Max 5 marks</p>	5
2(b)	<p>MP1 Construct: Iteration / Repetition MP2 Use: To loop through all <u>100</u> inputs // To loop <u>100</u> times</p> <p>ALTERNATIVE:</p> <p>MP1 Construct: Selection MP2 Use: To test whether the value input is positive</p>	2

Question	Answer	Marks
3(a)(i)	0 is not a valid <u>array</u> / <u>List index</u> value // No 0 th element in the array	1
3(a)(ii)	0 to 200	1

Question	Answer	Marks
3(b)	 <pre> graph TD START([START]) --> SET1[SET Index TO 1] SET1 --> Decision{IS Index = 200 ?} Decision -- NO --> SET2[SET List[Index].Pointer TO Index + 1] SET2 --> SET3[SET Index TO Index + 1] SET3 --> Decision Decision -- YES --> SET4[SET List[Index].Pointer TO 0] SET4 --> END([END]) </pre> <p>Mark as follows:</p> <ul style="list-style-type: none"> MP1 Use of variable as array index and initialisation to 1 / to first element of array MP2 Loop for 199 / 200 iterations MP3 Assign Index+1 to each pointer field in a loop MP4 Assign 0 to 200th pointer field 	4

Question	Answer	Marks
3(c)	<p>One mark per step:</p> <p>MP1 Assign HeadPointer to ThisPointer // Current Pointer // Identify first node using <u>headpointer</u></p> <p>MP2 Loop the following until ThisPointer value is 0 (zero) / null pointer reached</p> <p>MP3 ... Output data (field) from array element at index ThisPointer // Output data (field) of the current node / array element</p> <p>MP4 ... Assign pointer field from current array element / index / to ThisPointer / Current Pointer // Assign pointer field from current node to ThisPointer / Current Pointer</p>	4
4(a)	<p>One mark per highlighted part:</p> <pre> FOR Index ← 1 TO 5 Lower ← GB[Index] - 2 Upper ← <u>GB[Index] + 2</u> // <u>Lower + 4</u> IF Mark <u>>= Lower</u> AND Mark <u><= Upper</u> THEN // IF Mark <u><= Upper</u> AND Mark <u>>= Lower</u> THEN OUTPUT "Check this paper" ENDIF NEXT Index </pre>	4
4(b)(i)	<p>MP1 Use Mark as the <u>index</u> to the Check array // to specify an array element</p> <p>MP2 If value of indexed element is TRUE, then the paper will need to be checked</p>	2

Question	Answer	Marks
4(b)(ii)	<p>Example:solution</p> <pre> PROCEDURE GBInitialise() DECLARE GBIndex, GBMark, ThisIndex : INTEGER FOR ThisIndex ← 0 TO 75 Check[ThisIndex] ← FALSE // initialise all values NEXT ThisIndex FOR GBIndex ← 1 TO 5 GBMark ← GB[GBIndex] FOR ThisIndex ← GBMark - 2 TO GBMark + 2 Check[ThisIndex] ← TRUE //Set GBMark ± 2 to TRUE NEXT ThisIndex NEXT GBIndex ENDPROCEDURE Mark as follows: MP1 Procedure heading and ending MP2 Initialise Check array to FALSE MP3 Loop through GB array MP4 Extract the GB mark MP5 Loop for 5 elements across GBMark ± 2 // Check if within GBMark ± 2 MP6 Assign each element of Check array to TRUE ALTERNATIVE – Example using selection Version 1 FOR ThisIndex ← 0 TO 75 CASE ThisIndex GB[1] - 2 TO GB[1] + 2 : Check[ThisIndex] ← TRUE GB[2] - 2 TO GB[2] + 2 : Check[ThisIndex] ← TRUE GB[3] - 2 TO GB[3] + 2 : Check[ThisIndex] ← TRUE GB[4] - 2 TO GB[4] + 2 : Check[ThisIndex] ← TRUE GB[5] - 2 TO GB[5] + 2 : Check[ThisIndex] ← TRUE OTHERWISE: Check[ThisIndex] ← FALSE ENDCASE NEXT ThisIndex </pre>	6

Question	Answer	Marks
4(b)(ii)	<p>ALTERNATIVE – Example using selection Version 2</p> <pre> DECLARE ThisIndex, GBIndex : INTEGER DECLARE Lower, Higher : INTEGER FOR ThisIndex ← 0 TO 75 For GBIndex ← 1 TO 5 Lower ← GB[GBIndex] - 2 Higher ← GB[GBIndex] + 2 IF ThisIndex >= Lower AND ThisIndex <= Higher THEN Check[ThisIndex] ← TRUE ELSE Check[ThisIndex] ← FALSE ENDIF NEXT Index NEXT ThisIndex </pre> <p>Mark as follows:</p> <p>MP1 Procedure heading and ending MP2 Loop through <code>Check</code> array// loop from 0 to 75 MP3 Attempt at using CASE / Selection structure with five clauses/ five checks for range MP4 Extract GB grade MP5 Compare <code>ThisIndex</code> with each element in GB array ± 2 MP6 Assign each element of <code>Check</code> array to TRUE if in range or FALSE if not in range</p>	

Question	Answer	Marks										
5(a)	<table border="1"> <thead> <tr> <th>Activity</th> <th>Name of life cycle stage</th> </tr> </thead> <tbody> <tr> <td>A compiler is be used.</td> <td>Coding</td> </tr> <tr> <td>A program that has been released for general use is modified</td> <td>Maintenance</td> </tr> <tr> <td>The dry run method is used.</td> <td>Testing</td> </tr> <tr> <td>The program structure is specified.</td> <td>Design</td> </tr> </tbody> </table> <p>One mark per row</p>	Activity	Name of life cycle stage	A compiler is be used.	Coding	A program that has been released for general use is modified	Maintenance	The dry run method is used.	Testing	The program structure is specified.	Design	4
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A compiler is be used.	Coding											
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The program structure is specified.	Design											
5(b)	<p>One mark for method – two marks for the description</p> <p>MP1 Stub testing MP2 The modules <u>Test A()</u> and <u>Test B()</u> are replaced by dummy modules MP3 ... which return a known result // An output statement is displayed when called (to check it works) // gives expected output</p>	3										

Question	Answer	Marks
6	<p>Loop Solution</p> <p>Example solution:</p> <pre>FUNCTION AdjustClock(ThisYear : INTEGER) RETURNS INTEGER DECLARE ThisDayNumber, SundayCount : INTEGER DECLARE ThisDate : DATE ThisDayNumber ← 0 SundayCount ← 0 REPEAT ThisDayNumber ← ThisDayNumber + 1 ThisDate ← SETDATE(ThisDayNumber, 3, ThisYear) IF DAYINDEX(ThisDate) = 1 THEN SundayCount ← SundayCount + 1 ENDIF UNTIL SundayCount = 3 RETURN ThisDayNumber ENDFUNCTION</pre> <p>Mark as follows:</p> <p>MP1 Function heading, parameter, ending and return type MP2 Declare local integer variable that is used to create a date MP3 Loop until 3rd Sunday found MP4 Attempt to use both SETDATE () and DAYINDEX () in a loop MP5 Correctly generate value of type DATE using SETDATE () in a loop MP6 Test if value represents a Sunday using DAYINDEX() in a loop MP7 Increment Sunday count in a loop and initialised correctly before loop MP8 Return day number of third Sunday</p> <p>Max 7 marks</p> <p>Non-loop solution</p> <p>Example solution:</p> <pre>FUNCTION AdjustClock(ThisYear : INTEGER) RETURNS INTEGER DECLARE FirstDayIndex: INTEGER DECLARE ThisDate : DATE ThisDate ← SETDATE(1, 3, ThisYear) FirstDayIndex ← DAYINDEX(ThisDate) IF FirstDayIndex = 1 THEN ThirdSunday ← FirstDayIndex + 14 //First day is Sunday ELSE ThirdSunday ← 23 - FirstDayIndex // Other days ENDIF RETURN ThirdSunday ENDFUNCTION</pre>	7

Question	Answer	Marks
6	<p>Mark as follows:</p> <p>MP1 Function heading, parameter, ending and return type</p> <p>MP2 Declare local integer variable that is used to hold a day number</p> <p>MP4 Attempt to use both <code>SETDATE()</code> and <code>DAYINDEX()</code></p> <p>MP5 Correctly generate value of type <code>DATE</code> using <code>SETDATE()</code> for first of March / specific day in March</p> <p>MP6 Test if date represents a Sunday / specific day using <code>DAYINDEX()</code> and calculate third Sunday // Correctly calculate third Sunday for a value returned by <code>DAYINDEX()</code> for one day</p> <p>MP7 Calculate third Sunday for other six days</p> <p>MP8 Return day number of third Sunday</p> <p>Max 7 marks</p>	

Question	Answer	Marks
7(a)	<p>One mark per answer:</p> <p>MP1 Analysis</p> <p>MP2 Named document, examples include:</p> <ul style="list-style-type: none"> • A <u>requirement specification</u> • Definition of System Objectives • List of problems with existing system • Survey results • Feasibility study • Interview notes <p>Max 2 marks</p>	2

Question	Answer	Marks
7(b)	<p>One mark for name and use</p> <p>Mark as follows:</p> <p>Examples include:</p> <p>Sub-module: ScanCard() / GetID() Use: Read the barcode from the loyalty card / Get the customer ID from the barcode</p> <p>Sub-module: GetPoints() Use: Get the number of points the customer has</p> <p>Sub-module: ExchangePoints() / UpdateCard() Use: Reduce the number of loyalty points</p> <p>Sub-module: GetDiscount() / CalculateDiscount() Use: Calculate the discount</p> <p>Sub-module: CalculatePoints() Use: Calculate points (following a purchase)</p> <p>Sub-module: UpdatePoints() Use: Update total points a customer has (following a purchase)</p> <p>Sub-module: ShowDiscount() Use: Display the discount</p> <p>Max 4 marks</p>	4

Question	Answer	Marks
8(a)	<p>Example solution</p> <pre> PROCEDURE Count(ThisPlayer : INTEGER, ThisRole : STRING) DECLARE Index, Num, Total : INTEGER Num ← 0 Total ← 0 FOR Index ← 1 TO 45 IF Character[Index].Player = ThisPlayer AND __ Character[Index].Role = ThisRole THEN Num ← Num + 1 Total ← Total + Character[Index].SkillLevel NEXT Index IF Num > 0 THEN OUTPUT "Player ", ThisPlayer, __ " has ", Num, " characters with the role of ", ThisRole, " and the total skill level is ", Total ELSE OUTPUT "No characters with that role are assigned to this player" ENDIF ENDPROCEDURE </pre> <p>MP1 Initialisation of local integers for Num and Total MP2 Loop through 45 elements MP3 Attempt to check Player and Role fields in a loop MP4 Correctly compare Player field with parameter in a loop MP5 Correctly compare Role field with parameter in a loop MP6 ... if player and role found, increment Num and sum Skill Total in a loop MP7 Test for any matches after the loop MP8 Both possible OUTPUT statements correctly formed following an attempt at MP6 but outputting one only</p> <p>Max 7 marks</p>	7

Question	Answer	Marks
8(b)	<p>Example solution:</p> <pre> PROCEDURE Restore() DECLARE Index : INTEGER DECLARE Line : STRING OPENFILE "SaveFile.txt" FOR READ FOR Index ← 1 TO 45 READFILE "SaveFile.txt", Line Character[Index].Player ← STR_TO_NUM(Extract(Line, 1)) Character[Index].Role ← Extract(Line, 2) Character[Index].Name ← Extract(Line, 3) Character[Index].Skill ← STR_TO_NUM(Extract(Line, 4)) NEXT Index CLOSEFILE "SaveFile.txt" ENDPROCEDURE </pre> <p>Mark as follows:</p> <p>MP1 Open the file in read mode and subsequently close MP2 Loop through 45 elements MP3 Read a line from the file in a loop MP4 Attempt to use <code>Extract()</code> in a loop MP5 Correct use of <code>Extract()</code> for all fields in a loop MP6 Use of <code>STR_TO_NUM()</code> on Player and Skill in a loop MP7 Completely correct extraction and assignment of all fields in a loop</p>	7
8(c)	<p>MP1 The <u>Character array</u> / <u>character data</u> can be saved before the program is closed MP2 Allowing the game to continue using the same data / from the point it was saved</p>	2