

Cambridge International AS & A Level

COMPUTER SCIENCE

9618/21

Paper 2 Fundamental Problem-solving and Programming Skills

May/June 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.

Cambridge International is publishing the mark schemes for the May/June 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **12** 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:

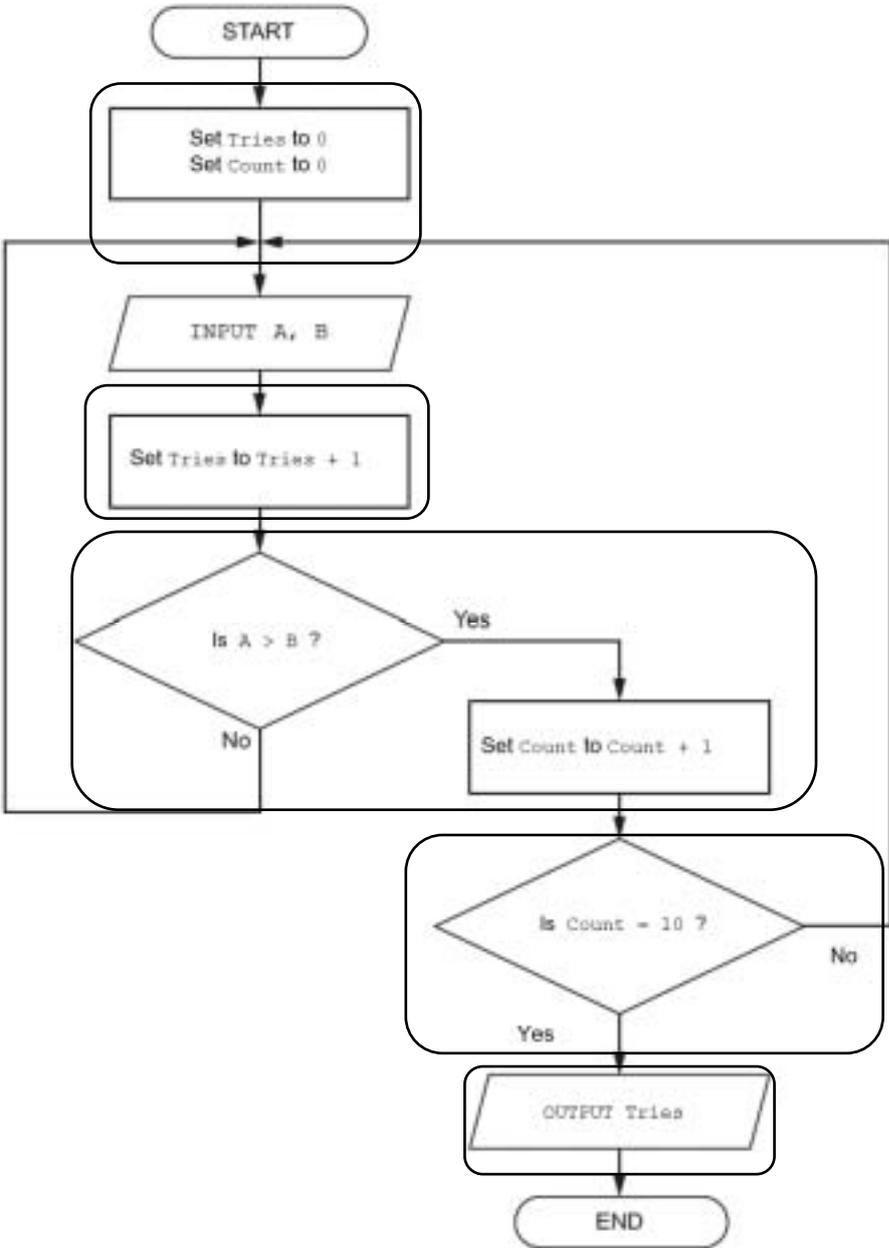
Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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)	<table border="1" data-bbox="308 248 1203 595"> <thead> <tr> <th data-bbox="308 248 823 315">Assignment statement</th> <th data-bbox="823 248 1203 315">Data type</th> </tr> </thead> <tbody> <tr> <td data-bbox="308 315 823 383">A ← LEFT(MyName, 1)</td> <td data-bbox="823 315 1203 383">CHAR / STRING</td> </tr> <tr> <td data-bbox="308 383 823 450">B ← Total * 2</td> <td data-bbox="823 383 1203 450">INTEGER / REAL</td> </tr> <tr> <td data-bbox="308 450 823 517">C ← INT(ItemCost) / 3</td> <td data-bbox="823 450 1203 517">REAL</td> </tr> <tr> <td data-bbox="308 517 823 584">D ← "Odd OR Even"</td> <td data-bbox="823 517 1203 584">STRING</td> </tr> </tbody> </table> <p data-bbox="308 629 544 663">One mark per row</p>	Assignment statement	Data type	A ← LEFT(MyName, 1)	CHAR / STRING	B ← Total * 2	INTEGER / REAL	C ← INT(ItemCost) / 3	REAL	D ← "Odd OR Even"	STRING	4
Assignment statement	Data type											
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1(b)	<table border="1" data-bbox="308 696 1136 1021"> <thead> <tr> <th data-bbox="308 696 877 763">Expression</th> <th data-bbox="877 696 1136 763">Evaluates to</th> </tr> </thead> <tbody> <tr> <td data-bbox="308 763 877 831">Tries < 10 AND NOT Sorted</td> <td data-bbox="877 763 1136 831">TRUE</td> </tr> <tr> <td data-bbox="308 831 877 898">Tries MOD 4</td> <td data-bbox="877 831 1136 898">1</td> </tr> <tr> <td data-bbox="308 898 877 965">TO_LOWER(MID(ID, 3, 1))</td> <td data-bbox="877 898 1136 965">'a' // "a"</td> </tr> <tr> <td data-bbox="308 965 877 1021">LENGTH(ID & "xx") >= Tries</td> <td data-bbox="877 965 1136 1021">TRUE</td> </tr> </tbody> </table> <p data-bbox="308 1055 544 1088">One mark per row</p>	Expression	Evaluates to	Tries < 10 AND NOT Sorted	TRUE	Tries MOD 4	1	TO_LOWER(MID(ID, 3, 1))	'a' // "a"	LENGTH(ID & "xx") >= Tries	TRUE	4
Expression	Evaluates to											
Tries < 10 AND NOT Sorted	TRUE											
Tries MOD 4	1											
TO_LOWER(MID(ID, 3, 1))	'a' // "a"											
LENGTH(ID & "xx") >= Tries	TRUE											
1(c)(i)	The names do not reflect / indicate the purpose of the variable // the names are not meaningful	1										
1(c)(ii)	They make the program more difficult to understand / debug / maintain	1										
1(c)(iii)	<p data-bbox="308 1290 512 1323">One mark from:</p> <ul data-bbox="308 1323 778 1496" style="list-style-type: none"> <li data-bbox="308 1323 778 1357">• Indentation / use of white space <li data-bbox="308 1357 778 1391">• Capitalisation of keywords <li data-bbox="308 1391 778 1424">• Use of comments <li data-bbox="308 1424 778 1458">• Use of modular programming <li data-bbox="308 1458 778 1491">• Use of local variables <p data-bbox="308 1496 555 1529">Note: max 1 mark</p>	1										

Question	Answer	Marks
2(a)	 <pre> graph TD Start([START]) --> Init[Set Tries to 0 Set Count to 0] Init --> LoopStart(()) LoopStart --> Input[/INPUT A, B/] Input --> IncTries[Set Tries to Tries + 1] IncTries --> Cond1{Is A > B?} Cond1 -- Yes --> IncCount[Set Count to Count + 1] Cond1 -- No --> LoopStart IncCount --> Cond2{Is Count = 10?} Cond2 -- No --> LoopStart Cond2 -- Yes --> Output[/OUTPUT Tries/] Output --> End([END]) </pre> <p>One mark per outlined region:</p> <ol style="list-style-type: none"> 1 Initialise both counts 2 Increment <code>Tries</code> every time a pair is input 3 Compare <code>A > B</code> and increment <code>Count</code> if TRUE 4 Test for <code>Count = 10</code> (10th time <code>A > B</code>) – MUST include Yes / No labels 5 If so output <code>Tries</code>, otherwise loop 	5
2(b)	<p>One mark per point:</p> <ol style="list-style-type: none"> 1 A (variable of type) string will be input // by example e.g. "67,72" 2 A special / identified character would need to be used to separate each numeric value // all numbers are fixed length 	2

Question	Answer	Marks							
3(a)	One mark per point: 1 The PS contains a null pointer 2 The PF points to the first element on the free list 3 All the nodes are on the free list	3							
3(b)	Max 2 marks for 'Variables': <table border="1" data-bbox="308 515 1182 1106"> <tr> <td data-bbox="308 515 1182 582">The two variables will be of type Integer</td> </tr> <tr> <td data-bbox="308 582 1182 680">The two variables will be used as pointers / indexes to the arrays.</td> </tr> <tr> <td data-bbox="308 680 1182 779">The values stored in the two variables will indicate the first element in each list</td> </tr> <tr> <td data-bbox="308 779 1182 846">The first 1D array will be of type String</td> </tr> <tr> <td data-bbox="308 846 1182 945">The first 1D array will be used to store the values // data items // User IDs</td> </tr> <tr> <td data-bbox="308 945 1182 1012">The second 1D array will be of type Integer</td> </tr> <tr> <td data-bbox="308 1012 1182 1106">The second 1D array will be used to store the pointers // point to next item</td> </tr> </table> Mark as follows: One mark for each of the first three rows One mark for both Array 1 rows One mark for both Array 2 rows	The two variables will be of type Integer	The two variables will be used as pointers / indexes to the arrays.	The values stored in the two variables will indicate the first element in each list	The first 1D array will be of type String	The first 1D array will be used to store the values // data items // User IDs	The second 1D array will be of type Integer	The second 1D array will be used to store the pointers // point to next item	5
The two variables will be of type Integer									
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The second 1D array will be of type Integer									
The second 1D array will be used to store the pointers // point to next item									

Question	Answer	Marks
4	<p>Example:</p> <pre> FUNCTION Check() RETURNS STRING DECLARE Odd, Even, Index : INTEGER Odd ← 0 Even ← 0 FOR Index ← 1 TO 100 IF Index MOD 2 = 0 THEN Even ← Even + Data[Index] ELSE Odd ← Odd + Data[Index] ENDIF NEXT Index ENDFUNCTION </pre> <p>Mark as follows:</p> <ol style="list-style-type: none"> 1. Function heading, ending and return type 2. Declare local variables Odd, Even and Index as integers 3. Initialise Odd and Even 4. Loop for 100 iterations // through array 5. Sum Odd and Even element values in a loop 6. Compare Odd and Even after the loop and Return appropriate string 	6

Question	Answer	Marks
6(a)	<pre> FUNCTION IsRA(x1, y1, x2, y2, x3, y3 : INTEGER) RETURNS BOOLEAN DECLARE Len1, Len2, Len3 : INTEGER Len1 ← (x1 - x2) ^ 2 + (y1 - y2) ^ 2 Len2 ← (x1 - x3) ^ 2 + (y1 - y3) ^ 2 Len3 ← (x2 - x3) ^ 2 + (y2 - y3) ^ 2 IF (Len1 = Len2 + Len3) OR (Len2 = Len1 + Len3) OR (Len3 = Len1 + Len2) THEN RETURN TRUE ELSE RETURN FALSE ENDIF ENDFUNCTION </pre> <p>Mark as follows:</p> <ol style="list-style-type: none"> 1 Calculate the square of the length of at least one side 2 Calculation of all three lengths squared correctly 3 One correct comparison of square of three lengths 4 All three comparisons... 5 combined using logical operators / nested IF // completely correct selection 6 Return result correctly in both cases 	6
6(b)	<p>1 mark for statement of problem:</p> <p>Problem:</p> <ul style="list-style-type: none"> • The function will return an incorrect value // the test will fail <p>1 mark for solution:</p> <p>Solution:</p> <ul style="list-style-type: none"> • Round the calculated values (to a known number of decimal places) • Define a threshold below which any difference can be ignored 	2

Question	Answer	Marks
7(a)(i)	To make the solution easier to design / implement / solve	1

Question	Answer	Marks
7(a)(ii)	<p>One mark per item and justification</p> <p>Item: mobile phone number Justification: to send the text message</p> <p>Item: name Justification: to personalise the text message</p> <p>Item: exercise interest Justification: to determine whether this member would be interested</p>	3
7(a)(iii)	<p>Examples include:</p> <ul style="list-style-type: none"> • Add a member to a list of those interested in the new class • Remove the member from future SMS messages • Read/process Message • Identify who from <p>One mark for each.</p> <p>Max 2 marks</p>	2
7(b)(i)	<p>Means that Update calls (one of) either Sub-A, Sub-B or Sub-C</p> <p>One mark for each point:</p> <ul style="list-style-type: none"> • reference to selection / decision / if • naming all four modules correctly 	2
7(b)(ii)	<p><u>PROCEDURE Sub-A (Name : STRING, BYREF P2 : BOOLEAN)</u></p> <p><u>FUNCTION Sub-B (P1 : REAL) RETURNS REAL</u></p> <p>One mark per underlined part in each case</p>	4

Question	Answer	Marks
8(a)	<pre> FUNCTION DeleteComment(Line : STRING) RETURNS STRING DECLARE NewLine, TwoChars : STRING DECLARE Count, TrimTo : INTEGER CONSTANT Comment = "//" NewLine ← Line TrimTo ← 0 Count ← 1 WHILE Count < LENGTH(Line) AND TrimTo = 0 TwoChars ← MID(Line, Count, 2) // extract 2 chars IF TwoChars = Comment THEN TrimTo ← Count ENDIF Count ← Count + 1 ENDWHILE IF TrimTo <> 0 THEN NewLine ← LEFT(Line, TrimTo - 1) ENDIF RETURN NewLine ENDFUNCTION </pre> <p>Mark as follows:</p> <ol style="list-style-type: none"> 1 Loop to length of Line (parameter) // length of Line -1 2 Terminate loop on first double slash 3 Attempt to extract one/two characters in a loop 4 Check for "/" after attempt at extraction in a loop 5 Record start position of comment // Calculate amount of trim required 6 Attempt to trim Line from start of comment 7 Completely correct trimmed Line from start of comment 8 Return Line after a reasonable overall attempt 	8

Question	Answer	Marks
8(b)	<p>Example:</p> <pre> FUNCTION Stage_1(StudentName : STRING) RETURNS INTEGER DECLARE OldFile, NewFile, Line : STRING DECLARE Count : INTEGER OldFile ← StudentName & "_src.txt" NewFile ← StudentName & "_S1.txt" OPENFILE OldFile FOR READ OPENFILE NewFile FOR WRITE Count ← 0 WHILE NOT EOF(OldFile) READFILE OldFile, Line Line ← DeleteComment(Line) IF LENGTH(Line) <> 0 THEN WRITEFILE NewFile, Line Count ← Count + 1 ENDIF ENDWHILE CLOSEFILE OldFile CLOSEFILE NewFile RETURN Count ENDFUNCTION </pre> <p>Mark as follows:</p> <ol style="list-style-type: none"> 1 Generate filenames condone missing “_” 2 Open both files in correct modes and subsequently close 3 Loop to EOF(OldFile) 4 Read a line from OldFile and execute DeleteComment() in a loop 5 Skip blank lines after DeleteComment() in a loop 6 Write Line to stage 1 file and increment Count 7 Return the number of lines after a reasonable attempt at counting 	7