



Cambridge International AS & A Level

COMPUTER SCIENCE

9618/22

Paper 2 Fundamental Problem-solving and Programming Skills

May/June 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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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 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)(i)	Use of constants	1
1(a)(ii)	<p>One mark per bullet point (or equivalent to max 3):</p> <ol style="list-style-type: none"> 1 Postal rates are entered once only 2 Avoids input error / changing the cost accidentally // avoids different values for postal rates at different points in the program 3 When required, the constant representing the postal rate value is changed once only // easier to maintain the program when the postal rates change 4 Makes the program easier to understand <p>Note: Max 3 marks</p>	3
1(b)	<p>One mark per bullet point:</p> <ul style="list-style-type: none"> • Indentation • White space • Comments • Sensible / meaningful variable names // use of Camel Case • Capitalised keywords <p>Note: Max 3 marks</p>	3
1(c)	<p>One mark per bullet point:</p> <ul style="list-style-type: none"> • BOOLEAN • REAL • STRING 	3

Question	Answer	Marks
2(a)	<code>MyDOB ← SETDATE(17, 11, 2007)</code>	1
2(b)	<p><u><code>NumMonths ← 12 - MONTH(MyDOB)</code></u></p> <p>One mark per underlined part</p>	2

Question	Answer	Marks
2(c)	<p>One mark per array definition bullet:</p> <ul style="list-style-type: none"> • A (1D) array containing 7 elements • of type STRING <p>One mark per Step:</p> <p>Step1: Assign value "Sunday" to first element, "Monday" to second element etc.</p> <p>Step2: Use the function <code>DAYINDEX()</code> to return / find the day number from <code>MyDoB</code></p> <p>Step3: Use the returned value as the array index / to access the element that contains the name / string</p> <p>Step4: Output the element / name / string</p> <p>Note: Max 2 for Array definition, Max 4 for steps</p>	6

Question	Answer	Marks
3(a)(i)	<p>One mark per point:</p> <ol style="list-style-type: none"> 1 Check that the queue is not full 2 <code>EoQ</code> pointer will move to point to location 9 3 Data item Orange will be stored in location referenced by <code>EoQ</code> pointer 4 <code>EoQ</code> pointer will move to point to location 0 5 Data item Yellow will be stored in location referenced by <code>EoQ</code> pointer <p>Note: max 4 marks</p>	4
3(a)(ii)	7	1
3(b)	<p>One mark per bullet:</p> <ol style="list-style-type: none"> 1 Open file in <code>READ</code> mode 2 Loop to <code>EOF()</code> // read / process all the lines in file 3 Loop will end when return value from <code>AddToQueue()</code> is <code>FALSE</code> / queue is full 4 Read a line from the file in a loop 5 Pass string to <code>AddToQueue()</code> // <code>AddToQueue()</code> is executed with line as parameter 	5

Question	Answer	Marks
4	<pre>Function GetNum(ThisString : STRING, ThisChar : CHAR) RETURNS INTEGER DECLARE Index, Count : INTEGER Count ← 0 FOR Index ← 1 TO LENGTH(ThisString) IF MID(ThisString, Index, 1) = ThisChar THEN Count ← Count + 1 ENDIF NEXT Index RETURN Count ENDFUNCTION</pre> <p>Mark as follows:</p> <ol style="list-style-type: none"> Function heading and end, including parameters and return type Declare local Integers for <code>Index</code> and <code>Count</code> Loop for length of <code>ThisString</code> Extract a character and compare with <u>parameter in a loop</u> Increment <code>Count</code> if match <u>in a loop</u> Return <code>Count</code> after loop 	6

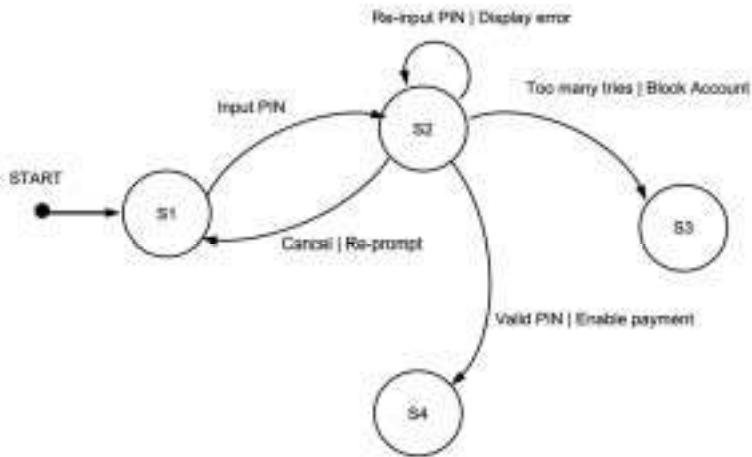
Question	Answer	Marks
5(a)	<p>One mark per point:</p> <ul style="list-style-type: none"> parameter / <code>Num</code> has been passed by reference // should have been passed by value so when the value / <code>ThisNum</code> is modified (in procedure <code>DisplaySqrt()</code>) the new value will be used in the loop (lines 40–43) // <code>Num</code> will be changed to modified value 	3
5(b)	<ul style="list-style-type: none"> The rules of the language have not been broken // there are no syntax errors 	1
5(c)	<p>Could use an IDE to:</p> <ul style="list-style-type: none"> Set a breakpoint to stop the program at a certain line / statement / point Step through the program line by line / statement by statement checking the value of '<code>num</code>' / a variable using a report / watch window <p>One mark per bullet</p>	3

Question	Answer	Marks
5(d)	<p>Answers include:</p> <ul style="list-style-type: none">• Change the statement into a comment• Change the statement to a string representing a literal value and assign it to a variable / output it <p>Note: max 1 mark</p>	1

Question	Answer	Marks
6	<p>Example of iterative solution:</p> <pre> PROCEDURE Square(Dim : INTEGER) DECLARE Count : INTEGER DECLARE ThisChar : CHAR DECLARE StringA, StringB : STRING CONSTANT FILLER = '*' StringA ← "" ThisChar ← NUM_TO_STR(Dim) FOR Count ← 1 TO Dim StringA ← StringA & ThisChar //build up first & last line NEXT Count StringB ← ThisChar FOR Count ← 1 TO Dim - 2 StringB ← StringB & FILLER //build up intermediate line NEXT Count StringB ← StringB & ThisChar // add final digit OUTPUT StringA FOR Count ← 1 TO Dim - 2 OUTPUT StringB NEXT Count IF Dim <> 1 THEN OUTPUT StringA ENDIF ENDPROCEDURE </pre> <p>For loop-based solutions, mark as follows:</p> <ol style="list-style-type: none"> 1 Procedure heading and ending including parameter 2 Loop using parameter, containing attempt to construct first line / last line 3 Construct first line / last line 4 Attempt at loop to construct intermediate line 5 Output first / last line of square when Dim > 2 6 Output all intermediate lines in a loop 7 Correct output of first two squares <p>Note: Max 6 marks</p>	6

Question	Answer	Marks
6	<p>Example of selection-based solution:</p> <pre> PROCEDURE Square(Dim : INTEGER) DECLARE Count : INTEGER CASE OF Dim 1 : OUTPUT "1" 2 : OUTPUT "22" OUTPUT "22" 3 : OUTPUT "333" OUTPUT "3*3" OUTPUT "333" 4 : OUTPUT "4444" FOR Count ← 1 TO 2 OUTPUT "4**4" NEXT Count OUTPUT "4444" 5 : OUTPUT "55555" FOR Count ← 1 TO 3 OUTPUT "5***5" NEXT Count OUTPUT "55555" 6 : OUTPUT "666666" FOR Count ← 1 TO 4 OUTPUT "6****6" NEXT Count OUTPUT "666666" 7 : OUTPUT "7777777" FOR Count ← 1 TO 5 OUTPUT "7*****7" NEXT Count OUTPUT "7777777" 8 : OUTPUT "88888888" FOR Count ← 1 TO 6 OUTPUT "8*****8" NEXT Count OUTPUT "88888888" 9 : OUTPUT "999999999" FOR Count ← 1 TO 7 OUTPUT "9*****9" NEXT Count OUTPUT "999999999" ENDCASE ENDPROCEDURE </pre> <p>For in-line / selection-based solutions, mark as follows:</p> <ol style="list-style-type: none"> 1 Procedure heading and ending including parameter 2 Correct use of parameter to select all required squares 3 Correct output of first two squares 4 At least six squares correctly output 5 At least one loop to output lines with multiple asterisks 6 All number squares output correctly 	

Question	Answer	Marks
7(a)(i)	<p>Correct answers include:</p> <ul style="list-style-type: none"> • Information: customer name Justification: to personalise / address the email • Information: email address Justification: so that the email can be delivered correctly • Information: product category preference Justification: to check that the customer would be interested in the product • Information: contact preference Justification: to check that the customer will accept contact via email • Information: order history Justification: to send details of product similar to that already bought // to identify frequent shoppers • Information: new product information Justification: to include information about the new product in the email <p>One mark for each piece of information and matching justification</p> <p>Note: Max 3 marks</p>	3
7(a)(ii)	<p>One mark for each piece of information and matching justification:</p> <ul style="list-style-type: none"> • postal address Justification: sending an email, not a letter • payment details Justification: Nothing being bought / sold at this stage • order history Justification: Customer preference used to decide if new product is relevant <p>Note: Max 2 marks</p>	2

Question	Answer	Marks
7(b)	 <p>One mark for each:</p> <ol style="list-style-type: none"> 1 Line from S1 to S2 and label 2 S2 loop label 3 S3 circle and label on incoming 4 S4 circle and label on incoming 	4

Question	Answer	Marks
8(a)	<pre> FUNCTION CheckInfo(NewLine: STRING) RETURNS BOOLEAN DECLARE ThisNum : STRING DECLARE Index : INTEGER IF LENGTH(NewLine) < 19 THEN RETURN FALSE ENDIF FOR Index ← 1 TO 4 IF NOT IS_NUM(MID(NewLine, Index, 1)) THEN RETURN FALSE ENDIF NEXT Index ThisNum ← LEFT(Newline, 4) IF ThisNum < "0001" OR ThisNum > "5999" THEN RETURN FALSE ENDIF IF NOT OnlyAlpha(MID(Newline, 5, 3)) THEN RETURN FALSE ENDIF RETURN TRUE ENDFUNCTION </pre> <p>Mark as follows:</p> <ol style="list-style-type: none"> 1 Test length of parameter 2 Extract first 4 characters of parameter (as ItemNum) 3 Test first four characters are all numeric 4 Test ItemNum in range "0001" to "5999" 5 Extract characters 5 to 7 of parameter (as SupplierCode) 6 Use of OnlyAlpha() with extracted SupplierCode 7 Return BOOLEAN value correctly in all cases, must have been declared as local 	7

Question	Answer	Marks
8(b)	<pre> PROCEDURE AddItem(NewLine : STRING) DECLARE NewItemNum, ThisItemNum : STRING OPENFILE "Stock.txt" FOR READ OPENFILE "NewStock.txt" FOR WRITE NewItemNum ← LEFT(NewLine, 4) WHILE NOT EOF("Stock.txt") READFILE("Stock.txt", ThisLine) ThisItemNum ← LEFT(ThisLine, 4) IF ThisItemNum > NewItemNum THEN WRITEFILE("NewStock.txt", NewLine) // write New Line... NewItemNum ← "9999" // ...once only ENDIF WRITEFILE("NewStock.txt", ThisLine) ENDWHILE IF NewItemNum <> "9999" THEN WRITEFILE("NewStock.txt", NewLine) //New last line in the file ENDIF CLOSEFILE "Stock.txt" CLOSEFILE "NewStock.txt" ENDPROCEDURE </pre> <p>Mark as follows:</p> <ol style="list-style-type: none"> 1 Open both files, in correct modes, and subsequently close 2 Conditional loop until end of file Stock.txt 3 Read a line from Stock.txt AND extract ThisItemNum in a loop 4 Test ThisItemNum > NewItemNum then write NewLine to NewStock.txt 5 ...including mechanism to only do this once only 6 Write line read from Stock to NewStock 7 Deal with the case where NewLine is the new last line 	7

Question	Answer	Marks
8(b)	<p>Example of array-based solution:</p> <pre> PROCEDURE AddItem(NewLine : STRING) DECLARE ThisItemNum, ThisLine : STRING DECLARE Temp : ARRAY [1:5999] OF STRING DECLARE Index : INTEGER FOR Index ← 1 TO 5999 Temp[Index] ← "" //Initialise array NEXT Index Index ← STR_TO_NUM(LEFT(NewLine, 4)) Temp[Index] ← NewLine //Add new line to array OPENFILE "Stock.txt" FOR READ WHILE NOT EOF("Stock.txt") READFILE("Stock.txt", ThisLine) Index ← STR_TO_NUM(LEFT(ThisLine, 4)) Temp[Index] ← ThisLine //Add line from file to array ENDWHILE CLOSEFILE "Stock.txt" OPENFILE "NewStock.txt" FOR WRITE FOR Index ← 1 TO 5999 IF Temp[Index] <> "" THEN //Write non-blank element... WRITEFILE("NewStock.txt", Temp[Index]) //...to new file ENDIF NEXT Index CLOSEFILE "NewStock.txt" ENDPROCEDURE </pre> <p>Mark as follows:</p> <ol style="list-style-type: none"> 1 Open both files, in correct modes, and subsequently close 2 Declare AND initialise Temp array 3 Store NewLine in appropriate array element 4 Loop until end of file Stock.txt 5 Read a line from Stock.txt AND extract Index in a loop 6 Assign line read to appropriate array element in a loop 7 Loop through array, writing non-blank elements to file NewStock.txt 	

Question	Answer	Marks
8(c)	<p>One mark for method:</p> <p>Method: Stub testing</p> <p>Two marks for description:</p> <ul style="list-style-type: none">• The modules <code>SuppExists()</code> and <code>CheckSupplier()</code> are replaced by dummy modules• ...which return a known result / contain an output statement to show they have been called	3