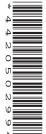


Cambridge International Examinations

Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME					
CENTRE NUMBER			CANDIDATE NUMBER		



COMPUTER SCIENCE 9608/23

Paper 2 Fundamental Problem-solving and Programming Skills

October/November 2018

2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer **all** questions.

No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

The maximum number of marks is 75.



Question 1 begins on the next page.

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1 (a) The following table contains statements written in pseudocode.

Show the type of programming construct each statement represents.

Put a tick (\checkmark) in the appropriate column for each statement.

Statement	Assignment	Selection	Repetition (Iteration)
CASE OF TempSensor1			
ELSE			
REPEAT			
ENDFOR			
DayNumber ← DayNumber + 1			
Error ← TRUE			

[6]

(b) (i) The following table contains statements written in pseudocode.

Give the most appropriate data type for the variable used in each statement.

Statement	Data type
Revision ← 500	
FuelType ← 'P'	
MinValue ← -6.3	
ServiceDue ← FALSE	
ModelRef ← "W212DEC15"	

[5]

(ii) The following table contains statements written in pseudocode.

Complete the table by evaluating each expression using the values from part (b)(i).

If any expression is invalid, write "ERROR" in the **Evaluates to** column.

For the built-in functions list, refer to the **Appendix** on page 16.

Expression	Evaluates to
"Month: " & MID(ModelRef, 5, 3)	
INT(MinValue * 2)	
ASC(Revision)	
Revision > 500	
ServiceDue = TRUE OR FuelType = 'P'	

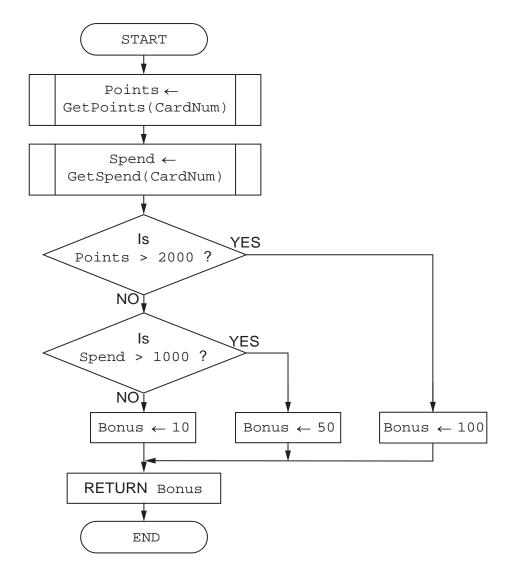
[5]

2 Shop customers have a discount card with a unique card number. Customers collect points when they buy items. At the end of each year, customers are given bonus (extra) points related to the total amount they have spent during the year, and the number of points they have on their card.

The function CalcBonus() takes the card number as a parameter. It returns the bonus points for the customer. A flowchart for the function is shown.

The function uses the following variables and functions.

Identifier	Data type	Description
CardNum	STRING	A numeric string representing the unique card number
Points	INTEGER	The number of points collected
Spend	REAL	The total amount that customer has spent during the year
Bonus	INTEGER	The number of bonus points
GetPoints()	FUNCTION	Takes the card number as a parameter and returns the number of points already collected
GetSpend()	FUNCTION	Takes the card number as a parameter and returns the total amount that customer has spent during the year



(a)	(i)	Write pseudocode for the CalcBonus() function.
		Your solution should follow the flowchart for the function as closely as possible.
		[A]

)	The function ${\tt GetCardNumber}()$ prompts the user to input a card number until the number input is valid.
	A valid card number has 16 characters. Each character is a numeric character ($^{\circ}$ 0 $^{\circ}$ to $^{\circ}$ 9 $^{\circ}$).
	Write pseudocode to complete the <code>GetCardNumber()</code> function.
	You should refer to the function IS_NUM() in the Appendix on page 16.
	FUNCTION GetCardNumber() RETURNS STRING
	ENDFUNCTION

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(b) The function ${\tt CalcBonus}(\)$ is written in a high-level language.

	(i)	The function is tested using black-box testing and does not contain any syntax errors.	
		Name and describe one other type of error that black-box testing could find.	
		Name	
		Description	
		[2	 2]
	(ii)	The function CalcBonus() is tested using white-box testing.	
		State two different pairs of values for Spend and Points that can be used to ted different paths through the function. Justify your choices.	st
		Spend Points	
		Justification	
		Spend Points	
		Justification	
		[4	 4]
(c)	Nan	ne two types of program maintenance and state the reason why each is needed.	
	Nan	ne	
	Rea	ason	
	Nan	ne	
	Rea	ason	
			 4]

3

An array contains 100 integer values. An algorithm will find the maximum and minimum values stored in the array.					
(a)	A programmer has started to write this program using a conditional loop.				
	Name a more appropriate loop structure for this task and justify your choice.				
	Name				
	Justification				
	ici				
	[2]				
(b)	Outline the steps the program will need to follow to implement the algorithm.				
	Do not write pseudocode or program code.				
	roz				

Question 4 begins on the next page.

4 Part of a program written in pseudocode is shown.

```
010 DECLARE ThisArray : ARRAY [1:100, 1:10] OF STRING
011 DECLARE LastElement : INTEGER
100 FUNCTION Update(NewData : STRING) RETURNS INTEGER
       DECLARE ArrayIndex : INTEGER
101
102
       DECLARE Found : BOOLEAN
103
104
       ArrayIndex \leftarrow 1
105
       Found ← FALSE
106
107
       WHILE ArrayIndex <= LastElement AND Found = FALSE
108
          IF ThisArray[ArrayIndex, 1] > NewData
109
            THEN
               Found \leftarrow TRUE
110
111
             ELSE
112
              ArrayIndex ← ArrayIndex + 1
113
          ENDIF
114
       ENDWHILE
115
116
       IF Found = TRUE
117
         THEN
118
            CALL Insert(ArrayIndex, NewData)
119
         ELSE
120
            ArrayIndex \leftarrow 0
121
       ENDIF
122
123
       RETURN ArrayIndex
124 ENDFUNCTION
```

(a) (i) Examine the pseudocode and complete the following table.

Answer

The name of a global identifier	
The name of a user-defined procedure	
The scope of ArrayIndex	
The number of dimensions of ThisArray	
The scope of NewData	

[5]

(ii)	Describe in detail, the purpose of lines 107 to 114 in the $\tt Update()$ function. Do not use pseudocode in your answer.				

(a)	convert Insert() from a procedure to a function. Insert() returns TRUE or FALSE.	es to
	A programmer must amend the function <code>Update()</code> as follows: • If <code>Insert()</code> returns <code>FALSE</code> then the function <code>Update()</code> returns <code>-1</code> • If <code>Insert()</code> returns <code>TRUE</code> then the function <code>Update()</code> returns the value as before.	
	Write program code to implement the amended Update() function.	
	Visual Basic and Pascal: You should include the declaration statements for variables. Python: You should show a comment statement for each variable used with its data type.	
	Programming language	
	Program code	
		[8]

(c)	The	function Update() is an example of a module within a program.
	Des	scribe the mechanism that supports the transfer of values between modules.
		[2]
(d)	(i)	CharArray is a 1D array of type CHAR. It contains 200 elements.
		Write program code to change all the numeric characters ('0' to '9') in CharArray to '*'.
		Programming language
		Program code
		[3]
	(ii)	A programmer decides to declare LastElement as a constant instead of a variable.
		Write a statement in pseudocode to declare LastElement as the value 200.
		[1]

Question 5 begins on the next page.

5 The function ReadFileLine() returns a specific line from a text file.

The function takes two parameters:

Identifier	Data type	Description
FileName	STRING	The name of the text file
FileLine	INTEGER	The line number that is required

The following pseudocode gives an example of the use of the function.

```
FileData ← ReadFileLine(FileName, FileLine)
```

The function ReadFileLine() will:

- open the file, FileName
- read each line from the file until line FileLine is found or the end of the file is reached
- if the line exists, return the string from this line; otherwise return the string "****"

Write pseudocode for the ReadFileLine() function.
[10

16

Appendix

Built-in functions (pseudocode)

Each function returns an error if the function call is not properly formed.

MID(ThisString : STRING, x : INTEGER, y : INTEGER) RETURNS STRING returns a string of length y starting at position x from ThisString

Example: MID ("ABCDEFGH", 2, 3) returns string "BCD"

LEFT(ThisString : STRING, x : INTEGER) RETURNS STRING returns leftmost x characters from ThisString

Example: LEFT("ABCDEFGH", 3) returns string "ABC"

RIGHT(ThisString: STRING, x: INTEGER) RETURNS STRING returns rightmost x characters from ThisString

Example: RIGHT("ABCDEFGH", 3) returns string "FGH"

LENGTH(ThisString : STRING) RETURNS INTEGER returns the integer value representing the length of ThisString

Example: LENGTH("Happy Days") returns 10

INT(x : REAL) RETURNS INTEGER returns the integer part of x

Example: INT(27.5415) returns 27

ASC(ThisChar : CHAR) RETURNS INTEGER

returns the ASCII value of ThisChar

Example: ASC('A') returns 65

IS_NUM(ThisString : STRING) RETURNS BOOLEAN returns the value TRUE if ThisString contains only numeric characters ('0' to '9').

Example: IS_NUM("1234X67") returns FALSE

Operators (pseudocode)

Operator	Description
&	Concatenates (joins) two strings Example: "Summer" & " " & "Pudding" produces "Summer Pudding"
AND	Performs a logical AND on two Boolean values Example: TRUE AND FALSE produces FALSE
OR	Performs a logical OR on two Boolean values Example: TRUE OR FALSE produces TRUE