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**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.

This document consists of **16** printed pages.

**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 (✓) 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'	

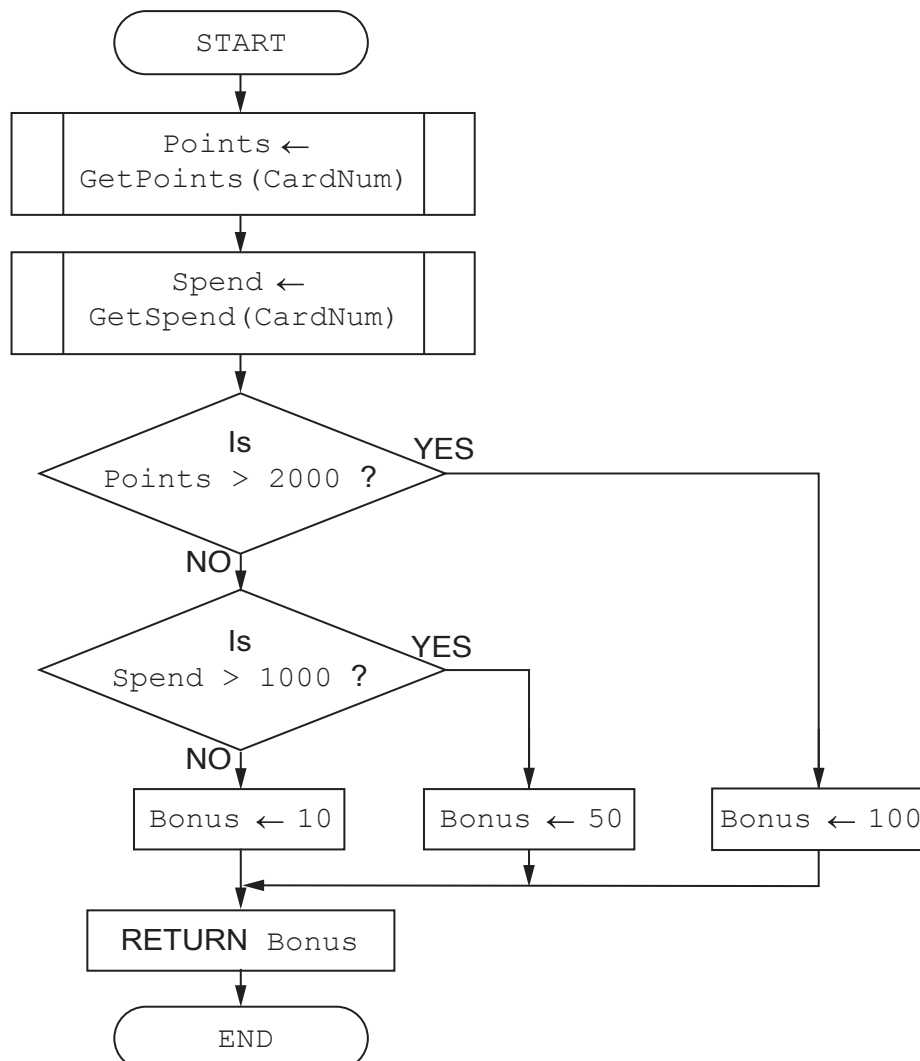
[5]

- 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





(ii) The function `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 ('0' to '9').

Write **pseudocode** to complete the `GetCardNumber()` function.

You should refer to the function `IS_NUM()` in the **Appendix** on page 16.

FUNCTION `GetCardNumber()` RETURNS STRING

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ENDFUNCTION

[6]

(b) The function 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 .....

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.....

[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 test different paths through the function. Justify your choices.

Spend ..... Points .....

Justification .....

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Spend ..... Points .....

Justification .....

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[4]

(c) Name **two** types of program maintenance **and** state the reason why each is needed.

Name .....

Reason .....

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Name .....

Reason .....

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[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 .....

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[2]

(b) Outline the steps the program will need to follow to implement the algorithm.

Do **not** write pseudocode or program code.

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[3]



**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
101     DECLARE ArrayIndex : INTEGER
102     DECLARE Found : BOOLEAN
103
104     ArrayIndex ← 1
105     Found ← FALSE
106
107     WHILE ArrayIndex ≤ LastElement AND Found = FALSE
108         IF ThisArray[ArrayIndex, 1] > NewData
109             THEN
110                 Found ← TRUE
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 ← 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 Update() function. Do **not** use pseudocode in your answer.

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.....[4]

- (b) Line 118 of the function `Update()` calls the subroutine `Insert()`. A designer decides to convert `Insert()` from a procedure to a function. `Insert()` returns `TRUE` or `FALSE`.

A programmer must amend the function `Update()` as follows:

- If `Insert()` returns `FALSE` then the function `Update()` returns `-1`
- If `Insert()` returns `TRUE` then the function `Update()` 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

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(c) The function `Update ()` is an example of a module within a program.

Describe the mechanism that supports the transfer of values between modules.

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(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 '\*'.  
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Programming language .....

Program code

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(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
<code>FileName</code>	STRING	The name of the text file
<code>FileLine</code>	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 "\*\*\*\*\*"



## 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