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COMPUTER SCIENCE

9608/22

Paper 2 Fundamental Problem-solving and Programming Skills

May/June 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.

- 1 (a) A farm has a number of greenhouses used to grow vegetables. Each greenhouse has a different identification number. A program is needed to store temperature information for each greenhouse throughout the day.

Give a suitable **identifier name** for each of the data items.

Description of data item	Suitable identifier name
The temperature inside the greenhouse	
The temperature outside the greenhouse	
The greenhouse identification number	
The time of the temperature measurements	

[4]

- (b) (i) Program variables have values as follows:

Variable	Value
Mark	60
Subject	"Computer Science"
Grade	'B'
CourseCompleted	TRUE
AverageMark	49.5

Evaluate each expression in the following table.

If an expression is invalid, write ERROR.

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

Expression	Evaluates to
"Fas" & MID(Subject, 6, 3)	
LEFT(Mark, 1)	
10 + ASC(Grade)	
MOD(AverageMark * 2, 3)	
CourseCompleted AND (Mark >= 60)	

[5]

3

(ii) Programming languages support different data types.

Give an appropriate data type for each of these variables from **part (b)(i)**.

Variable	Data type
Mark	
Subject	
Grade	
CourseCompleted	
AverageMark	

[5]

2 The following is a function design in pseudocode.

Line numbers are given for reference only.

```

01 FUNCTION CountDigits(InString : STRING) RETURNS CHAR
02
03 DECLARE nc : CHAR
04 DECLARE c : INTEGER
05 DECLARE n : INTEGER
06
07
08 c ← 0
09 n ← LENGTH(InString) // get number of characters for loop
10
11 WHILE n > 0 // repeat until no more characters left
12
13 nc ← LEFT(InString,1)
14 n ← n - 1
15 InString ← RIGHT(InString,n) // remove first character
16
17 IF (nc < '0') OR (nc > '9')
18 THEN
19 // do nothing
20 ELSE
21 c ← c + 1
22 ENDIF
23
24 ENDWHILE
25
26 RETURN c
27
28 ENDFUNCTION

```

(a) (i) This pseudocode includes features that make it easier to read and understand.

State **two** such features.

Feature 1

Feature 2 [2]

(ii) State **two** additional features that should be used to make this pseudocode easier to read and understand.

Feature 1

Feature 2 [2]

(b) Study the function `CountDigits()`. Identify the features of the function in the following table.

Feature	Answer
A line number containing an example of an assignment statement	
A line number containing the start of a 'pre-condition' loop	
A line number containing the end of a 'pre-condition' loop	
A line number containing the start of a selection statement	
The number of parameters passed to the <code>LEFT()</code> function	
The Boolean operator used	
The number of times the function <code>LEFT()</code> is called from within <code>CountDigits()</code> resulting from the call: <code>Result ← CountDigits("AB27C4")</code>	
The number of local variables	

[8]

(c) (i) There is a mistake in the pseudocode that would produce a data type mismatch error if a programmer were to write similar program code.

Describe this mistake and how it may be corrected.

.....

.....

.....

..... [2]

(ii) Lines 17 to 22 of the pseudocode could be written in a simplified form.

Re-write the lines in a simplified form.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

6

3 A chocolate factory produces bars of chocolate. A computer program controls the process.

The weight of each bar is stored in an array, `BarWeight`. The array contains 100 elements, representing the weights of 100 bars that make up one shipping box.

A procedure, `CheckWeight()`, is required to:

1. examine each array element and count how many times the weight has exceeded `MaxWeight`
2. compare the count obtained with a limit value, `Threshold`. Call procedure `ServiceCheck()` if the count exceeds the `Threshold`
3. output a message if the count does not exceed the `Threshold`. For example:

```
"ShippingBox OK - maximum weight exceeded 3 times."
```

Draw a program flowchart on the next page to represent the algorithm for the `CheckWeight()` procedure.

Assume that:

- the array contains 100 valid weight values and the first element is `BarWeight[1]`
- `MaxWeight`, `Threshold` and `BarWeight` are global variables.

Variable declarations are not required in program flowcharts.

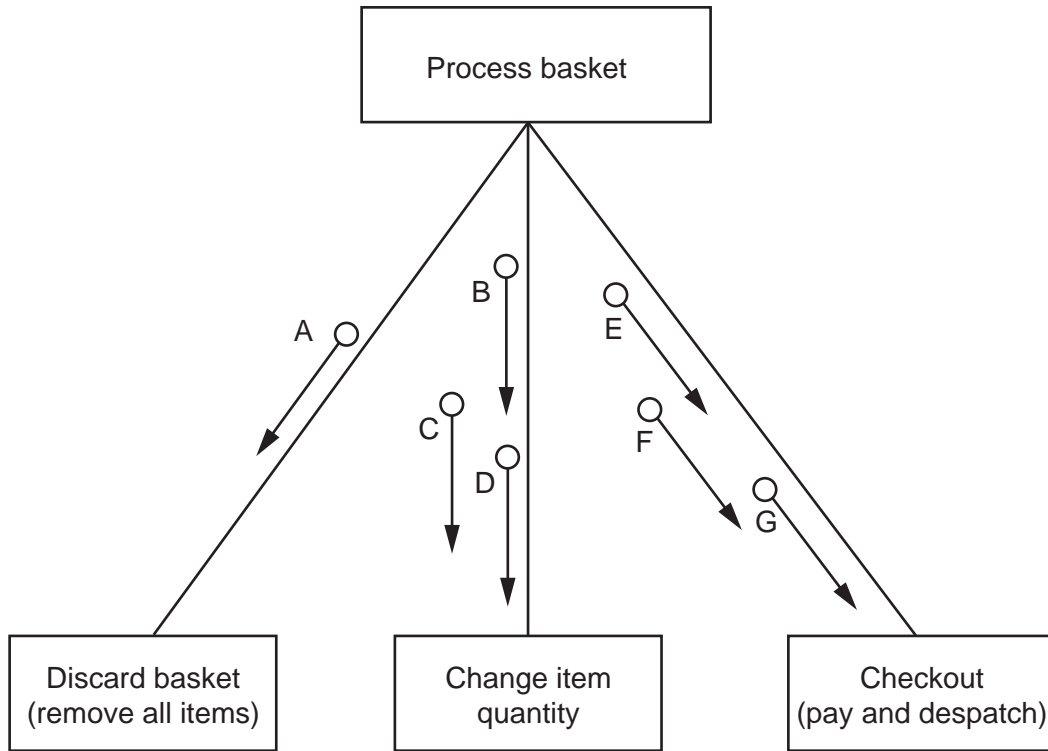


[10]

[Turn over

Question 4 begins on the next page.

4 The structure chart shows part of the design of a program for an online shopping system.



(a) (i) Draw on the chart to show the following facts.

- Each of the modules at the lower level returns a Boolean parameter, X.
- Process basket will call only one of the modules shown at the lower level.

[2]

(ii) The parameters A to G shown on the chart will be used to pass the following information.

PaymentDetails
 Quantity
 BasketID
 DeliveryAddress
 ItemID

Complete the following table to show the parameter and the information it represents.

Parameter	Information
A	
B	
C	
D	
E	
F	
G	

[3]

5 A golf club holds information about its members. When a member completes a round of golf, their score is stored along with their membership number and the date of the round.

A program is to be written to store and process the score information. The information to be stored is formed into a string as follows:

```
<MembershipNumber><Date><Score>
```

(a) The program designer considers storing the strings in either a 1D array, RoundScore or as a separate variable for each round, for example, RoundScore01, RoundScore02, RoundScore03 and so on.

Describe **two** advantages of storing the strings in a 1D array rather than as separate variables.

Advantage 1

.....

Advantage 2

.....

[2]

(b) A procedure, AddNewScores() is being developed. The procedure will be coded using an Integrated Development Environment (IDE).

Name **two** features provided by an IDE that assist in the **initial detection of errors** in the procedure.

Feature 1

.....

Feature 2

.....

[2]

- 6 (a) Individual elements in a 1D array are referenced using an integer value that is used as the subscript to the array.

Give the technical terms for the minimum and maximum values the subscript may take.

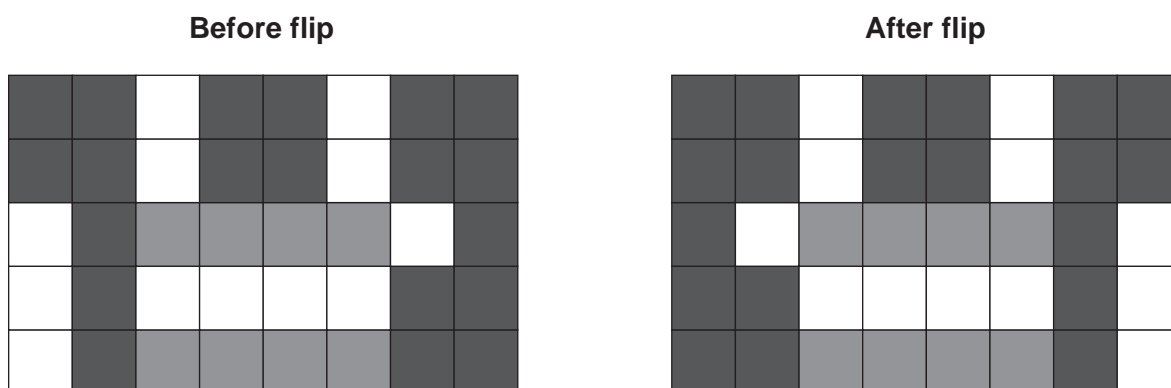
Minimum value

Maximum value

[2]

- (b) A 2D array, `Picture`, contains data representing a bitmap image. Each element of the array represents one pixel of the image. The image is grey-scale encoded where the value of each pixel ranges from 0 (representing black) to 255 (representing white) with intermediate values representing different levels of grey.

A graphics program needs a procedure, `Flip()`, to flip (reflect) the image. An example of an image before and after the function is:



The values contained in the 2D array before the flip are as follows:

Data values

80	80	255	80	80	255	80	80
80	80	255	80	80	255	80	80
255	80	120	120	120	120	255	80
255	80	255	255	255	255	80	80
255	80	120	120	120	120	80	80

In pseudocode, the array is declared as follows:

```
DECLARE Picture : ARRAY[1:5, 1:8] OF INTEGER
```


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"

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

Example: LENGTH("Happy Days") returns 10

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"

ASC(ThisChar : CHAR) RETURNS INTEGER
returns the ASCII value of character ThisChar

Example: ASC('A') returns 65

MOD(ThisNum : INTEGER, ThisDiv : INTEGER) RETURNS INTEGER
returns the integer value representing the remainder when ThisNum is divided by ThisDiv

Example: MOD(10,3) returns 1

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

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