

Friday 25 January 2013 – Morning

AS GCE COMPUTING

F452/01 Programming Techniques and Logical Methods

Candidates answer on the Question Paper.

OCR supplied materials:

None

Other materials required:

None

Duration: 1 hour 30 minutes



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **100**, of which marks are allocated to the assessment of the quality of written communication where an answer requires a piece of extended writing.
- This document consists of **24** pages. Any blank pages are indicated.

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1 A charity uses a website to organise raffles for valuable items.

The charity provides an image and a description of the item to be raffled. The public can log on and buy raffle tickets within a given time period. Providing the minimum number of tickets has been sold, a winner is selected.

(a) State **two** items of data, other than the image and description, which the charity needs to provide when putting an item up to be raffled.

1

2

[2]

(b) On the website, each item being raffled is displayed

- showing an image and description of the item being raffled
- indicating how far the raffle has progressed, making good use of the graphical user interface of the website
- allowing customers to select how many tickets they wish to buy, which gets added to a virtual shopping basket.

Design a suitable layout for the display in the space below.

You may annotate your design.

[8]

To claim a prize, the user must enter their email address and ticket number. For extra security, a function is used to decide whether the ticket number corresponds to the email address.

The code for the function is given below.

```
01 FUNCTION isValid(emailAddress, TicketNumber)
02     SpecialChar = MID(emailAddress,3)
03     Key = ASCII(SpecialChar)-96
04     RETURN (TicketNumber MOD Key) = 0
05 END FUNCTION
```

(c) This function is called with emailAddress = "jaj@tomo.net" and TicketNumber = 3210.

(i) In line 02, the function MID returns the character in the string at the specified position.

State the value of SpecialChar after line 02 is executed.

..... [1]

(ii) In line 03, the function ASCII returns the character code of a character. The character code of "a" is 97.

State the value of Key after line 03 is executed, using your answer from part (i).

..... [1]

(iii) State the value of TicketNumber MOD Key, using your answer from part (ii).

..... [1]

(iv) State the value which will be returned by the function call isValid("jaj@tomo.net, 3210).

..... [1]

(g) Here is a copy of line 04 of the code for the function isValid().

```
Return (TicketNumber MOD Key)= 0
```

The programmer decides to replace this line of code with the IF statement below.

Complete the gaps in the IF statement so that the result is the same.

```
IF (TicketNumber MOD Key) ..... 0 THEN  
  
    RETURN FALSE  
  
ELSE  
  
    RETURN .....  
  
END IF
```

[2]

2 (a) Iteration is one of the three basic constructs of procedural programming languages.

State the names of the other **two** basic constructs.

1
2 [2]

(b) The FOR loop and the WHILE loop are two different types of iteration construct.

Describe **one** difference between a FOR loop and a WHILE loop.

.....
.....
..... [2]

As part of her A-Level Computing project, Myriam writes the following code which displays how a bank investment will grow each year.

```
01 PROCEDURE B(p: INTEGER, r: REAL, t: INTEGER)
02     FOR i = 1 to t
03         p = p + p * r
04         OUTPUT t, p
05     NEXT i
06 END PROCEDURE
```

(c) State how many lines will be output if the procedure is called with the following arguments.

p = 10000, r = 0.05, t = 3

Number of lines output

P = 2500, r = 0.25, t = 0

Number of lines output [2]

(d) Rewrite this procedure so that it uses a WHILE loop instead of a FOR Loop.

.....
.....
.....
.....
..... [4]

(e) Myriam’s teacher says that she should change the identifiers in her code.

(i) State **all** the identifiers in Myriam’s code.

.....
 [2]

(ii) Explain why the identifiers in the code should be changed.

.....

 [2]

(f) As part of her project, Myriam carries out different types of test.

State the name of the type of test for each of the descriptions shown below.

Description	Type of test
Myriam does a demonstration to the end user to show that all parts of the program work correctly.	
Predefined test input data is entered and the output is compared with the expected result.	
Myriam gives the program to a few third-party testers to use and report any errors.	

[3]

- 3 A company produces a small device which calculates and outputs data about the performance of cyclists. The device has a clock which measures the time, and a sensor which detects each complete turn of a wheel.



When it is first switched on, the software in the device requires the user to initialise the current time and the circumference of the wheel.

- (a) State what is meant by initialisation and explain why it is needed in this case.

.....

.....

.....

.....

.....

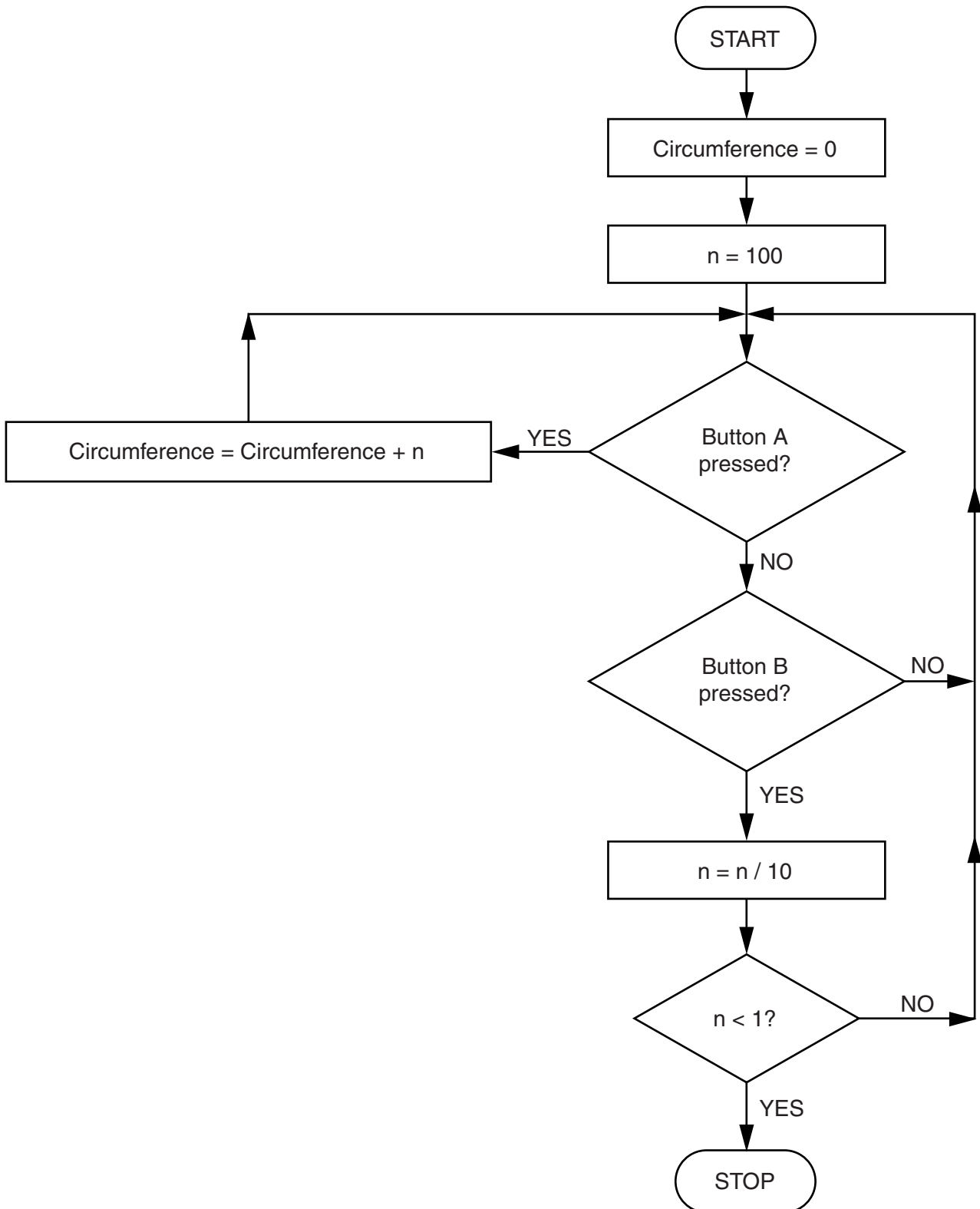
.....

.....

.....

..... [3]

The device has two buttons A and B. These are used to enter the circumference of the wheel in centimetres, using the algorithm shown in the flowchart below.



(b) State the circumference which will be input using the following button sequences.

(i) ABAAAABAAB

.....
.....

[1]

(ii) BAABAAAB

.....
.....

[1]

(c) Give the correct button sequence to input a circumference of 210 cm.

.....
..... [3]

(d) The device stores the time as SecondsSinceMidnight. This is an integer which represents the number of seconds since midnight.

(i) State what is meant by an integer.

.....
..... [1]

The following algorithm is used to display the value of SecondsSinceMidnight as a time in hours, minutes and seconds.

```
01 PROCEDURE DisplayTime
02     TotalSeconds = SecondsSinceMidnight
03     Secs = TotalSeconds MOD 60
04     TotalMinutes = TotalSeconds DIV 60
05     Mins = TotalMinutes MOD .....
06     Hours = TotalMinutes .....
07     OUTPUT CONCATENATE(Hours, Mins, Secs)
08 END PROCEDURE
```

(ii) Complete lines 05 and 06. [2]

(iii) State how the time will be displayed 30 seconds after midnight, when the value of SecondsSinceMidnight is 30.

.....
..... [1]

- (iv) Explain how the code should be modified so that the time is displayed correctly in 24 hour format (e.g. 14:03:00 for 3 minutes past 2 pm).

.....

.....

.....

.....

.....

.....

.....

.....

.....

[4]

The device uses the variables LatestTime and PreviousTime

- LatestTime stores the value of SecondsSinceMidnight when the wheel completed the last turn
- PreviousTime stores the value of SecondsSinceMidnight when the wheel completed the last but one turn

This is used to calculate the speed of the bicycle.

(e) The following algorithm was used to update the values of LatestTime and PreviousTime. This code contains an error.

```
01 PROCEDURE UpdateTimes
02     LatestTime = SecondsSinceMidnight
03     PreviousTime = LatestTime
04 END PROCEDURE
```

(i) Describe the error in this algorithm and state how it may be corrected.

.....

.....

.....

.....

.....

.....

..... [3]

(ii) State the name for this type of error.

..... [1]

- (f) To calculate the speed, the circumference is divided by the difference between the two stored times. The result is then multiplied by 0.036 to convert it to kilometres per hour.

The following code was written to calculate and display the speed. This algorithm contains an error in the operator precedence.

```
01 PROCEDURE CalculateSpeed
02     OUTPUT Circumference / LastTime - PreviousTime * 0.036
03 END PROCEDURE
```

- (i) State what is meant by operator precedence.

.....
..... [1]

- (ii) Describe the operator precedence on line 02 and show how it can be corrected using parentheses.

.....
.....
.....
..... [3]

- (iii) State **two** other ways the code can be improved to make it easier to follow.

1

2

..... [2]

.....
..... [8]

Question 4 begins on page 18

4 Adam is creating a computer program which uses a list of words to generate a word search puzzle. The word search puzzle is represented using a 2-dimensional array called Puzzle.

(a) Describe what is meant by a 2-dimensional array.

.....
.....
.....
.....
.....
.....
.....
..... [4]

(b) The word search puzzles created by the program have 100 letters (A to Z only) arranged in a 10 by 10 square.

Show how the array Puzzle should be declared in a high level language you have studied. You should state the name of the language.

Name of language:

Declaration:
.....
.....

[3]

The program asks the user to input words, one at a time. If the word is valid then the program tries to fit the word into the puzzle it is creating. The word is inserted in any direction but must be in a straight line.

(c) State **two** ways that the word which is input should be validated.

1

.....

2

.....

[2]

The procedure used to insert words into the array is given in pseudocode below.

```

01 PROCEDURE Insert(Word, StartColumn, StartRow, ColumnChange,
    RowChange)
02     CurrentColumn = StartColumn
03     CurrentRow = StartRow
04     CurrentLetter = first letter from Word
05     REPEAT
06         Puzzle(CurrentRow, CurrentColumn) = CurrentLetter
07         CurrentColumn = CurrentColumn + ColumnChange
08         CurrentRow = CurrentRow + RowChange
09         CurrentLetter = next letter from Word
10     UNTIL all letters from Word have been inserted
11 END PROCEDURE

```

Adam tests the program by calling the procedure a number of times. First he makes the procedure call:

Insert("SUGAR",1,1,1,0)

The result is that the word SUGAR is inserted at the top left hand corner of the square, going from left to right. This is shown in the diagram below.

S	U	G	A	R					

(d) What is the result of the following calls?

You may write in the diagram, or describe the result in words.

Insert("PRINCE",7,3,0,1)

..... [3]

Insert("IRON",4,10,-1,-1)

..... [3]

(e) Explain the errors that will occur if the program is then tested with the call:

Insert("HURRICANE",1,4,1,-1)

..... [4]

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