OCR
Oxford Cambridge and RSA

Tuesday 14 June 2016 – Afternoon

GCE COMPUTING

F452/01 Programming Techniques and Logical Methods

Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:
- You may use a calculator

Duration: 1 hour 30 minutes

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Candidate forename		Candidate surname	

Centre number						Candidate number				

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**, the quality of written communication will be assessed where an answer requires a piece of extended writing.
- This document consists of **20** pages. Any blank pages are indicated.

1 ChillDel Limited distributes chilled food from food manufacturers to supermarket distribution depots, using refrigerated vehicles. During transit, the temperature of chilled food must be maintained in the temperature range 0.0 °C to +4.5 °C.

There are five temperature sensors located within the body of the vehicle, which are sampled every second, and their values are recorded during the transportation of the foods.

(a) In the vehicle is a display that shows information gathered from the five temperature sensors during transportation. This display is 16 characters wide by 8 characters high.

The information displayed is:

- the lowest and highest values recorded during transportation from any of the sensors
- the **current** sampled lowest and highest values from the sensors
- the **current** average value.

The temperature range of the sensors is –4.9 °C to +9.9 °C.

Design an output screen to display the required information.

[5]

(b) (i) All the sampled data from the sensors is stored on a memory card for analysis at the receiving distribution depot. Complete the data table below.

	Data type	Size in bytes
Date (dd/mm/yyyy)		
Time (hh:mm:ss)		
Sensor 1		
Sensor 2		
Sensor 3		
Sensor 4		
Sensor 5		
Error flag		

[4]

(ii) If the samples are taken every second, and the length of the journey is three hours, calculate an estimate of the file size in kilobytes (KB). Show your working.

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(c) The software code written to sample and record the sensor data carries out the following actions:

Module number	Action
1	Get the system DateTime
2	Read each sensor value
3	Check sensor reading is within range
4	Initialise values
5	Get sensor value
6	Write sample record to serial file
7	Set error flag
8	Do nothing

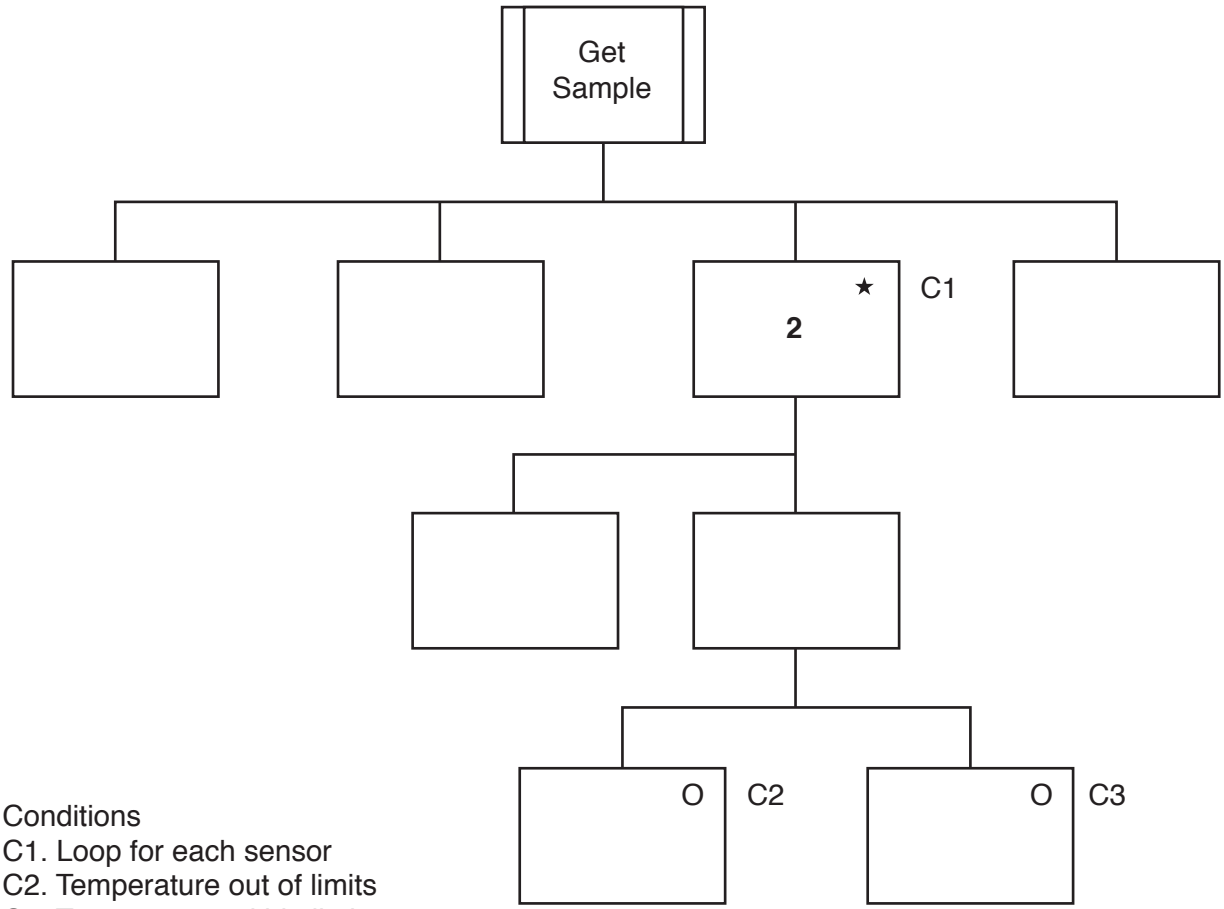
The modules are not in any particular order.

(i) Below is a particular type of structure diagram showing stepwise refinement.

It uses:

- The order (left to right) of the boxes on each level to represent sequence
- ★ to show iteration
- O to show selection.

Using the module numbers fill in the diagram below.



Conditions
C1. Loop for each sensor
C2. Temperature out of limits
C3. Temperature within limits

[6]

(ii) Module 6 is called 'Write sample record to serial file'.

Write the subroutine in pseudocode to perform this action.

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..... **[6]**

(d) The temperature sampling system is to be modified to record as many trips as possible on the same memory card. When the card is full, the oldest trip will be deleted to make space for the current trip. The sampling unit manufacturer is looking at the use of either fixed-length records or variable-length records.

Describe the terms 'fixed-length records' and 'variable-length records', and evaluate these types of record in the context of the sampling system.

The quality of written communication will be assessed in your answer to this question.

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

2 ChillDel Ltd have decided to install a satellite tracking system on each vehicle, which will be linked to the company's main database to keep track of deliveries.

(a) (i) The software company producing the user interface is going to use Rapid Application Development (RAD). Explain the term 'RAD'.

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(ii) The company will also use Stepwise refinement for the design of the program. Explain the term 'stepwise refinement'.

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(b) Testing will be performed by the development team during development of the program.

Name and describe **three** testing strategies that may be used.

1. Name .....

   Description .....

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2. Name .....

   Description .....

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3. Name .....

   Description .....

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[9]

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3 A programmer has been asked to produce a procedure that will generate a unique username from a person's first name, surname and date of birth (DoB – dd/mm/yyyy). The username is a fixed length of 14 characters.

The format of the username is:
- the first three characters of the first name
- two random digits (taken from DoB)
- the last three characters of the surname
- day of birth, month of birth and the last two digits of year of birth.

For example, John Smith born on 12/03/1989, could give Joh29ith120389.

(a) The programmer has written the following function to generate a random digit from the DoB:

```
01  FUNCTION RandomDigit(DateOfBirth: STRING) :CHAR

02  INTEGER P

03  P = 0
04  WHILE ((P < 1 ) OR (P > 10))
05      P = RANDINT(1,10) { RANDINT produces an INTEGER value between 1 and 10
        inclusive.}
06      IF ((P = 3) AND (P = 6)) THEN
07          P = 0
08      ENDIF
09  END WHILE

10  RETURN MID(DateOfBirth,P,1)

11  END FUNCTION
```

(i) The function compiles correctly, but when tested the function sometimes returns the symbol / rather than a digit.

Name this type of error and state how it can be corrected.

Type of error .....

Correction required .....

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[2]

(ii) Identify **two** improvements that could be made to the code to make it easier to maintain. Provide examples from the code to support your answer.

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[4]

(iii) Using the function RandomDigit, complete the following procedure to generate the user name (UserName).

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PROCEDURE Generate(UserName:STRING; FirstName:STRING; Surname:STRING;
DoB:STRING)

UserName=" " {Initialise to zero length STRING}

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END PROCEDURE
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[5]

(iv) The procedure could be rewritten as a function to return the value UserName.

Describe **two** differences between a function and a procedure.

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[6]

(b) State the **three** basic programming constructs used to control the flow of execution, giving your own example of each.

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Example .....

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Example .....

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Example .....

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[6]

(c) A variable can be declared as global or local and is said to have scope.

(i) Explain what is meant by the term 'variable'.

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(ii) Explain what is meant by 'scope' in relation to global and local variables.

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4 An online supermarket keeps a record of a customer's favourite items based on what they have ordered in the past. The list (barcodes) of favourite items is kept in a serial file called **Favourites.dat**. When an item is added to the online shopping basket, its barcode is passed to procedure **UpdateFavourites**, which checks to see if it is already in the favourite items file. If it is not, the procedure appends the item to the end of the favourite items file.

(a) Assume the Favourites.dat file exists. Write an algorithm for the procedure **UpdateFavourites**.

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(b) The supermarket has decided to change the favourite items file from serial to a sequential file.

Explain how you would search the sequential file to find the target record.

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5 The procedure below manipulates a passed integer value and gives a single or multiple outputs.

```
PROCEDURE ChangeInteger(Value:INTEGER)

    INTEGER P, X, M

    REPEAT

        P = Value DIV 10
        X = P * 10
        M = Value – X
        OUTPUT M
        Value = P

    UNTIL Value <= 0

    OUTPUT '+'

END PROCEDURE
```

For example, ChangeInteger(1234) would output 4 3 2 1 +

(a) (i) Complete the trace table for the following procedure call ChangeInteger(4082).

Value	P	X	M	OUTPUT

[3]

(ii) Complete the trace table for the following procedure call ChangeInteger(-243).

Value	P	X	M	OUTPUT

[2]

(b) The output produced for a negative value is not in the correct format of digit(s) and a single sign. Modify the procedure ChangeInteger to give the correct format output for both positive and negative values.

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END OF QUESTION PAPER

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