OXFORD CAMBRIDGE AND RSA EXAMINATIONS
AS GCE
F452/01
COMPUTING
Programming Techniques and Logical Methods

THURSDAY 6 JUNE 2013: Afternoon
DURATION: 1 hour 30 minutes
plus your additional time allowance

MODIFIED ENLARGED

Candidate forename		Candidate surname	

Centre number					Candidate number				

Candidates answer on the Question Paper.

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

None

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.

- Use black ink. HB pencil may be used for graphs and diagrams only.

- Answer <u>ALL</u> 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).

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 <u>100</u>, of which marks are allocated to the assessment of the quality of written communication where an answer requires a piece of extended writing.

- Any blank pages are indicated.

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1   The manager of a small restaurant requests a computer program which allows employees to clock in when they arrive and clock out when they leave. At the end of the week the program should calculate the number of hours they have worked and their weekly wage.

(a) The program will be produced using a top-down design with stepwise refinement.

(i) Describe stepwise refinement.

_____

_____

_____

_____ [2]

(ii) State TWO advantages of using a top-down design.

1 _____

_____

2 _____

_____
[2]

(b) The program will have two sections, one section for the manager and one for the employees.

In the manager's section there will be a facility for managing employees (adding new employees, removing employees and editing employee data). There will also be facilities for calculating the employees' wages and printing pay slips.

The employees' section will allow the employee to log in, clock in and clock out.

Draw a top-down design for the system as described above.

You do not need to enter any additional detail which is not in the description. [6]

The program needs to store employee data, which is currently kept on cards. An example of the data card for one employee is shown below.

NAME: Emmanuel Squibb
NATIONAL INSURANCE NUMBER: AA321292H
HOURLY WAGE: £15.50

(c) (i) Complete the table to show the data type and maximum size of each item of data. [6]

ITEM OF DATA	DATA TYPE	MAXIMUM SIZE (BYTES)
Name		
National Insurance Number		
Hourly wage		

(ii) There are 12 employees.

Calculate an estimate of the size of the employee file, showing your working.

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_____

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_____ [3]

(d) The employee data will be stored in a serial file.

(i) Describe what is meant by a serial file.

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_____ [2]

(ii) Describe the process for deleting an employee's record from the serial file.

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_____ **[4]**

(e) Another type of file is an indexed sequential file.

Describe how data is organised in an indexed sequential file and compare the benefits and limitations of serial and indexed sequential files for storing data.

The quality of written communication will be assessed in your answer to this question. **[8]**

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2 Siteswap patterns are lists of numbers.

Not every list of numbers is a valid siteswap pattern. For patterns with three numbers, a valid list will always follow these two rules:

Rule 1:	The total value of the numbers in the list must be a multiple of 3.
Rule 2:	No number must be one less than the previous number, even if the pattern is repeated indefinitely.

For this question, you do not need to understand how siteswap works. You only need to know the two rules.

Here are some valid siteswap patterns with three numbers which follow the two rules:

5 2 2

4 4 1

Here are some examples of invalid siteswap patterns with three numbers:

3 1 1 (3 + 1 + 1 = 5, which is not a multiple of 3, so this does not follow rule 1)

6 5 1 (5 is one less than the previous number, so this does not follow rule 2)

5 1 6 (when this is repeated you get 5 1 6 5 1 6 5 1 6 … and 5 is one less than the previous number, so this does not follow rule 2)

(a) State why the following lists of three numbers are NOT valid siteswap patterns.

(i) 4 0 5

_____

_____ **[1]**

(ii) 7 7 2

_____

_____ **[1]**

(b) Write code in a high level language of your choice which:

Prompts the user to enter three numbers, one after the other

Outputs "INVALID SITESWAP" if the sequence of numbers does not follow the two rules.

State the language you are using and use good programming style to ensure that your code can easily be understood. [7]

Name of language _____

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3 The organisers of a flower show ask a software company to produce a mobile phone application. This application allows visitors to obtain information about the flowers in a flower bed by pointing their mobile phone at the flower bed.

(a) Before the application can be used, it needs to be installed. This is done on the mobile phone by clicking a link on the website of the flower show.

Describe TWO reasons why an installation is needed.

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2 _____

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[4]

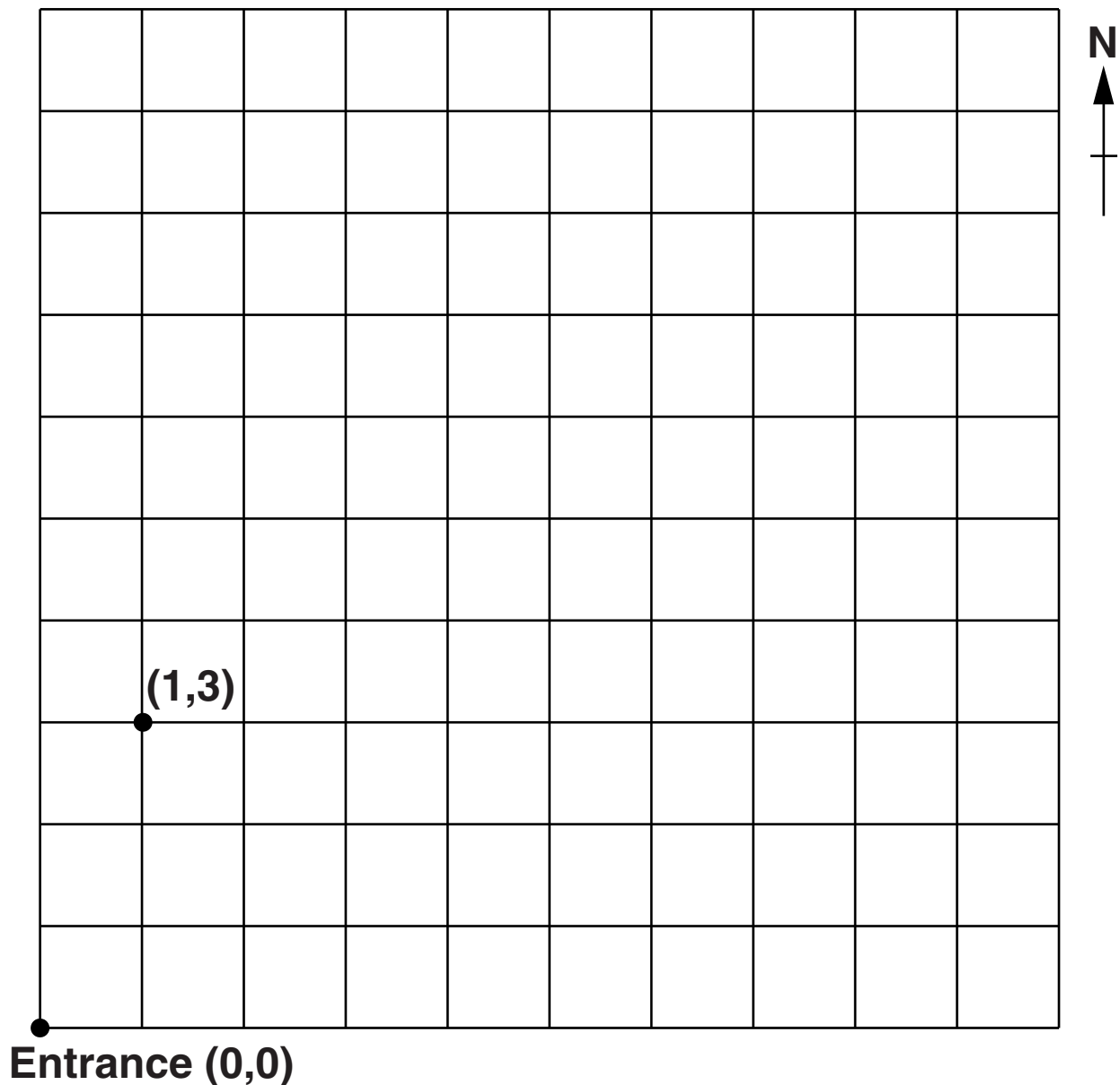**(b)** Before the application is released, the organisers insist that the application should be tested thoroughly.

    (i) Describe what is meant by alpha testing, stating how it would be carried out in this case.

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_____ **[3]**

   (ii) Describe what is meant by acceptance testing, stating how it would be carried out in this case.

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_____ **[3]**

The flower show is organised in a square field. The field is divided into 100 plots in a 10 by 10 grid pattern separated by paths running north to south and east to west.

N

(1,3)

Entrance (0,0)

A sensor on the mobile phone gives its position in the field using coordinates. If the coordinates are (1,3) this means that the phone is 1 square east and 3 squares north from the entrance.

(c) The application needs to determine whether the position of the phone is on a path. This is tested using black box testing.

Complete the table below giving THREE different types of test. State in each case the reason for the test. [6]

TEST DATA	REASON FOR TEST

(d) Another sensor gives the direction the phone is pointing, as an angle in degrees, clockwise from North. Therefore, North is 0, East is 90, South is 180 and West is 270.

If the phone is along a north-south path, the following IF statement can be used to determine whether the application should use the flower bed to the west or to the east of the path.

```
01 IF Direction > 0 AND Direction < 180
   THEN
02   Use the flower bed on EAST of path
03 ELSE
04   IF Direction > 180 AND Direction <
      360 THEN
05     Use the flower bed on WEST of
       path
06   END IF
07 END IF
```

Using a similar format, write an IF statement which can be used when the phone is along an east-west path, to determine whether the application should use the flower bed to the north or to the south of the path.

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_____ **[5]**

4 Words can be used to make 4-digit numbers easy to remember. Each letter in the word is replaced by the number of the button on which that letter appears on a standard telephone key pad.
For example, the word MIST represents the number 6478.

	ABC	DEF
1	2	3
GHI	JKL	MNO
4	5	6
PQRS	TUV	WXYZ
7	8	9
*	0	#

A program is written to do this conversion.

An extract of the code for the program is shown below. (Lines 08 to 28 are not shown.)

```
01 PROGRAM Converter
02   VARIABLE MyWord : STRING, I : INTEGER,
     Letter : Character
03   FUNCTION LetterToDigit(): CHARACTER
04     VARIABLE Digit : CHARACTER
05     IF Letter = "A" OR Letter = "B" OR
       Letter = "C" THEN
06       Digit = "2"
07     END IF
   …
29     RETURN Digit
30   END FUNCTION
31 MAIN PROGRAM
32   INPUT MyWord
33   FOR i = 1 TO 4
34     Letter = MID(MyWord,i,1)
35     OUTPUT LetterToDigit()
36   NEXT i
37 END PROGRAM
```

(a) The program uses selection and iteration.

    (i) State what is meant by selection, using an example from the code.

_____

_____

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_____ **[3]**

    (ii) State what is meant by iteration, using an example from the code.

_____

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_____ **[3]**

(b) Lines 05 to 07 deal with the letters A, B and C.

   (i) Using similar notation, write the code for lines 26 to 28 which deal with the letters W, X, Y and Z.

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   _____ **[2]**

   (ii) Show how lines 05 to 28 can be rewritten using SELECT instead of IF statements.

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   _____ **[4]**

(iii) Explain the advantages of using SELECT rather than IF statements in this case.

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_____ **[2]**

Here is a copy of the code from the beginning of this question.

```
01 PROGRAM Converter
02   VARIABLE MyWord : STRING, I : INTEGER,
     Letter : Character
03   FUNCTION LetterToDigit(): CHARACTER
04     VARIABLE Digit : CHARACTER
05     IF Letter = "A" OR Letter = "B" OR
       Letter = "C" THEN
06       Digit = "2"
07     END IF
   …
29     RETURN Digit
30   END FUNCTION
31 MAIN PROGRAM
32   INPUT MyWord
33   FOR i = 1 TO 4
34     Letter = MID(MyWord,i,1)
35     OUTPUT LetterToDigit()
36   NEXT i
37 END PROGRAM
```

(c) The extract of code shown contains local and global variables.

   (i) Define the term variable.

   _____

   _____

   _____

   _____ **[2]**

28

(ii) Identify ONE local variable and ONE global variable used in the code.

Local variable: _____

Global variable: _____

[2]

(iii) Explain what is meant by the scope of a variable.

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_____ **[4]**

(d) **The code includes a function LetterToDigit.**

   (i) **Describe what is meant by a function.**

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   _____ **[3]**

   (ii) **Explain the difference between the command RETURN on line 29 and the command OUTPUT on line 35.**

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   _____ **[4]**

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Here is a copy of the code from the beginning of this question.

```
01 PROGRAM Converter
02    VARIABLE MyWord : STRING, I : INTEGER,
      Letter : Character
03    FUNCTION LetterToDigit(): CHARACTER
04      VARIABLE Digit : CHARACTER
05      IF Letter = "A" OR Letter = "B" OR
        Letter = "C" THEN
06        Digit = "2"
07      END IF
  …
29      RETURN Digit
30    END FUNCTION
31 MAIN PROGRAM
32    INPUT MyWord
33    FOR i = 1 TO 4
34      Letter = MID(MyWord,i,1)
35      OUTPUT LetterToDigit()
36    NEXT i
37 END PROGRAM
```

(e) The code for the main program is upgraded so that it can be used for telephone numbers. The telephone numbers may be of varying lengths and may already have digits, spaces and other characters, as well as the letters to be converted.

For example +44 1632 EAT VEG should be converted to +44 1632 328 834.

Write an algorithm in the lined space over the page in pseudo-code for the upgraded main program, that:

Allows the user to input a string

Goes through all the characters that have been input

Determines whether the character needs to be converted

Uses the function LetterToDigit to do the conversion, if needed

Outputs the result

You do not need to rewrite lines 01–30 of the program. [8]

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END OF QUESTION PAPER