

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GCE

F452/01

COMPUTING

**Programming Techniques and
Logical Methods**

MONDAY 9 JUNE 2014: Afternoon

**DURATION: 1 hour 30 minutes
plus your additional time allowance**

MODIFIED ENLARGED

Candidate forename		Candidate surname	
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Centre number						Candidate number				
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Candidates answer on the Question Paper.

OCR SUPPLIED MATERIALS:

Loose sheet for Question 1

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 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).

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.

Any blank pages are indicated.

Answer all questions

- 1 Beryl has to write a program that explains patterns in crystals, using the following information.**

All the patterns in crystals have two lengths, x and y , and an angle A .

If A is 90° you need to check the lengths.

If the lengths are equal it is a square crystal.

If the lengths are NOT equal it is a rectangular crystal.

If A is NOT 90° it may be a hexagonal crystal. These crystals have angles of 60° and 120° and the lengths are always equal.

If A is NOT 60° or 90° or 120° it must be a parallelogram crystal if the lengths are NOT equal, or a rhombic crystal if the lengths are equal.

- (a) Beryl uses the information to draw the flow chart opposite.**

Complete the flow chart by writing HEXAGONAL, PARALLELOGRAM and RHOMBIC in the correct output boxes. [3]

(b) Beryl's flow chart contains variables.

(i) What is meant by a variable?

[2]

(ii) List the variables in Beryl's flow chart.

[1]

Here are the first few lines of code Beryl produces.

```
01  BEGIN PROGRAM
02  INPUT x
03  INPUT y
04  INPUT A
05  IF A = 90 THEN
06      IF x = y THEN
07          OUTPUT "SQUARE"
08      ELSE
09          OUTPUT "RECTANGULAR"
10  ...
```

An end-user will measure crystals and enter the measurements into the program. The code should allow for small errors in measurements.

- (c) (i) Rewrite the IF statement in line 05 so that it allows for an error of up to 2° in the measurement of A.**

[2]

- (ii) Rewrite the IF statement in line 06 so that the condition is true if the difference between x and y is less than 10% of the length of x.**

[4]

(d) During alpha testing, both white box testing and black box testing are used.

(i) State what is meant by alpha testing.

_____ [1]

(ii) Describe how Beryl will use white box testing in her program.

_____ [2]

(iii) Beryl prepares a set of test data for black box testing. Three test cases where the angle is exactly 90° are given in the table opposite.

Complete the table by stating the values of x and y to be tested, the reason for the test and the expected outcome. The first row has been completed as an example.

Test data	Reason for test	Expected outcome
A = 90 x = 100 y = 100	The angle is exactly 90 and the two sides are exactly equal	SQUARE
A = 90 x = _____ y = _____		
A = 90 x = _____ y = _____		

[6]

- 2 **José works for a company that provides loans to its customers. When customers take out a loan they decide how much money to borrow and for how many years.**

The interest rate is currently 10% but it may change in the future.

José writes the following program to calculate the monthly payment for a loan.

```
01 PROGRAM LoanCalculator
02
03     CONST InterestRate = 10
04
05 BEGIN
06     INPUT Amount
07     INPUT Years
08     AnnualInterest = Amount *
        InterestRate / 100
09     TotalToPay = (AnnualInterest *
        Years) + Amount
10     MonthlyPayment = TotalToPay /
        (Years * 12)
11     OUTPUT MonthlyPayment
12 END
```


(a) Using the code opposite, show the value that will be output if the inputs are:

Amount: 600

Years: 5

You MUST show all your working.

[3]

(b) Parentheses have been used in lines 09 and 10.

(i) State why the parentheses in line 09 are NOT essential.

_____ [1]

(ii) Explain why the parentheses in line 09 are useful.

_____ [2]

(iii) Explain why the parentheses in line 10 are essential.

_____ [2]

(c) The algorithm uses a constant.

Identify the constant, and explain why a constant has been used.

Constant: _____

Explanation: _____

_____ **[3]**

- (d) The company also offers a savings plan. Customers pay a fixed amount each year into the savings plan. At the end of each year, the company adds the value of the savings plan at the start of the year to the amount paid, and then adds interest of 10% to obtain the final value for the year.

For example, if a customer saves £100 each year, the value of the savings plan for 5 years is shown in the table below.

Year	Start	Paid in	Interest	Final
1	0.00	100.00	10.00	110.00
2	110.00	100.00	21.00	231.00
3	231.00	100.00	33.10	364.10
4	364.10	100.00	46.41	510.51
5	510.51	100.00	61.05	671.56

Write an algorithm which allows the user to input the amount saved each year and the number of years, and outputs the growth of the savings plan in the format shown above. [7]

- 3 A company organises a word guessing game to be played using text messages. Players have to guess a six letter word and send it to the company's computer. The program which processes the message contains several subroutines.**

The code for one of these subroutines is shown below.

```
01  PROCEDURE ReceiveMessage(Message,
    PhoneNumber)
02      Message = UPPERCASE(Message)
03      IF LENGTH(Message) <> 6 THEN
04          Result = "INCORRECT LENGTH"
05      ELSE IF NotInDictionary(Message) THEN
06          Result = "UNKNOWN WORD"
07      ELSE
08          Result = CheckAnswer(Message)
09      END IF
10      SendMessage(Result, PhoneNumber)
11  END PROCEDURE
```

(a) The subroutine ReceiveMessage has two parameters.

(i) Define the term parameter.

[2]

- (ii) State the names of the TWO parameters of the procedure `ReceiveMessage`. For each parameter, state the most appropriate data type.

[3]

- (b) The subroutine `ReceiveMessage` is a procedure.

State whether each of the following subroutines, which are called within `ReceiveMessage`, is a function or a procedure.

`NotInDictionary`: _____

`CheckAnswer`: _____

`SendMessage`: _____ [3]

- (c) Line 02 converts the message to uppercase.

Explain why it is necessary for the word to be in uppercase in this program.

[2]

(d) The procedure uses validation.

Describe the validation checks in the procedure.

[4]

- (e) The program uses a file containing all the six letter words in the English language. This file is currently a random file. The company is considering converting it to an indexed sequential file.**

Evaluate the use of a random file and an indexed sequential file IN THIS SITUATION.

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

[illegible]

[illegible]

- (f) The subroutine **CheckAnswer** uses iteration to compare a player's guess (a six letter word) to the correct word.

If a letter in the player's guess matches the letter in the same position in the correct word, the return string contains the letter at that position.

If a letter in the player's guess does NOT match the letter in the same position in the correct word, the return string contains a question mark at that position.

For example, if the correct word is "DINNER", then **CheckAnswer**("DANGER") would return "D?N?ER".

- (i) State the value returned if the correct word is "DINNER" in the following

CheckAnswer("RINGER") _____

CheckAnswer("CARROT") _____

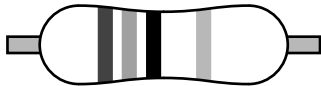
[2]

- (ii) Write an algorithm for the subroutine CheckAnswer described above. (The correct word is stored in a variable called CorrectWord.)**

[illegible]

- 4 Resistors are small components of electronic circuits. The value of a resistor is printed on the resistor using colour bands. Three bands on the left show the resistance. A gold or silver band on the right shows the tolerance, as in Fig. 1 below.


FIG. 1



Mr Johnson teaches Electronics to year 7. He is worried that pupils sometimes use a resistor with the wrong value. He writes a program that pupils can use to check the value of a resistor.

- (a) Mr Johnson has designed the following interface for his program.

Resistor checker



Colours on the left

Red

Violet

Black

Colour on the right

Gold

Calculate

Resistance = $27\ \Omega$

Tolerance = 5%

Describe THREE ways that the design of this interface helps to make the program effective.

1 _____

2 _____

3 _____

[6]

If the band on the right of the resistor is gold the tolerance is 5%. If the band is silver the tolerance is 10%.

Here is an extract from Mr Johnson's code.

```
21 IF ColourBand4 = "Gold" THEN
22 Line2 = "Tolerance = 5 %"
23 ELSE
24 Line2 = "Tolerance = 10 %"
25 END IF
```

(b) State the name of the control structure used in this extract.

_____ [1]

(c) Mr Johnson has NOT used indentation.

(i) State what is meant by indentation.

_____ [1]

(ii) Explain, using an example, why Mr Johnson should use indentation in this code.

_____ [2]

(d) When the band on the right is missing, the value of ColourBand4 is the empty string and the tolerance is 20%. Mr Johnson's code does NOT work correctly for this type of resistor.

(i) State the output from Mr Johnson's code when the value of ColourBand4 is the empty string.

_____ **[1]**

(ii) Rewrite Mr Johnson's code so that it also works correctly for this type of resistor.

You should use nested IF statements and indent the code correctly.

_____ **[4]**

- (e) Resistance is measured in Ohms using the symbol Ω . This symbol cannot be entered into the program using Mr Johnson's keyboard.

Describe how Mr Johnson can output the symbol Ω using a string function of the programming language he is using.

[2]

The three bands on the left of the resistor use a colour code to represent the digits from 0 to 9.

Mr Johnson has written the following function to convert each colour to its value.

```
81  FUNCTION ValueOf(Colour :  
    STRING) : Integer  
82  SELECT CASE Colour  
83  CASE "Black" : RETURN 0  
84  CASE "Brown" : RETURN 1  
85  CASE "Red" : RETURN 2  
86  CASE "Orange" : RETURN 3  
87  CASE "Yellow" : RETURN 4  
88  CASE "Green" : RETURN 5  
89  CASE "Blue" : RETURN 6  
90  CASE "Violet" : RETURN 7  
91  CASE "Grey" : RETURN 8  
92  CASE "White" : RETURN 9  
93  END FUNCTION  
94  END SELECT
```

- (f) This function uses SELECT CASE instead of IF statements.**

Explain why SELECT CASE is more appropriate than IF statements in this function.

[3]

- (g) The function above contains a syntax error.**

- (i) State what is meant by a syntax error.**

[1]

- (ii) Identify the syntax error in the function.**

[1]

- (iii) State the name of a different type of program error, other than a syntax error.**

_____ [1]

- (h) The variables ColourBand1, ColourBand2 and ColourBand3 contain the colours of the three bands on the left of the resistor.

The value represented by ColourBand1 is the first digit of the resistance.

The value represented by ColourBand2 is the second digit of the resistance.

The value represented by ColourBand3 is the number of zeros to be concatenated. However, if there are three or more zeros, the last three zeros should be replaced by the letter k.

Write an algorithm that will output the resistance of a resistor as a string in the form
“Resistance = 27 Ω ”

[8]

END OF QUESTION PAPER

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