



Monday 9 June 2014 – Afternoon

GCE COMPUTING

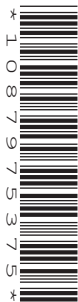
F452/01 Programming Techniques and Logical Methods

Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:
None

Duration: 1 hour 30 minutes



Candidate forename		Candidate surname	
-----------------------	--	----------------------	--

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

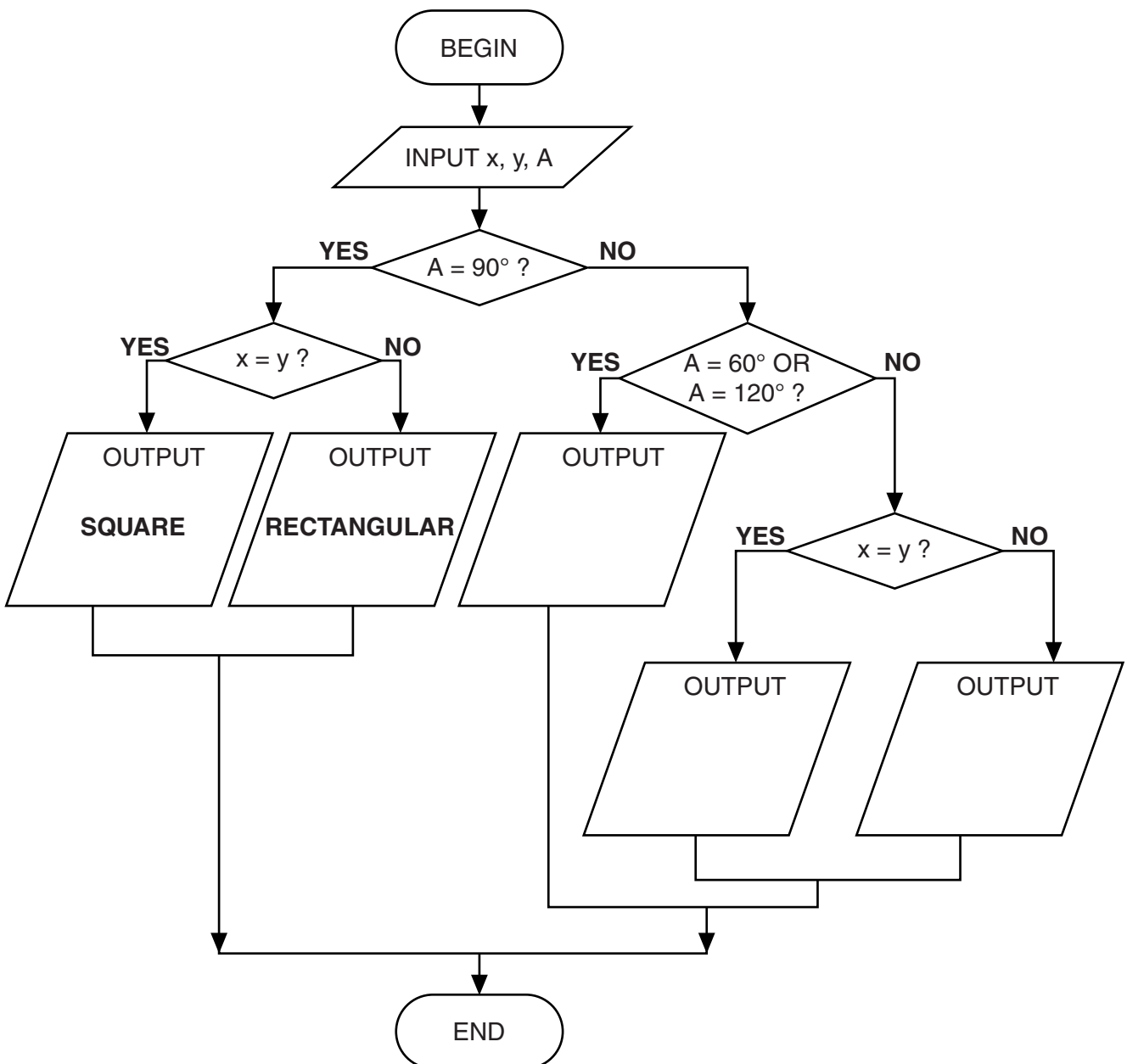
- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **100**, the quality of written communication will be assessed where an answer requires a piece of extended writing.
- This document consists of **20** pages. Any blank pages are indicated.

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 a flow chart.

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 below.

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]

(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.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

- 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]

- 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.

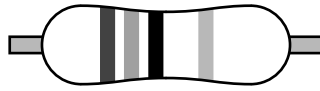
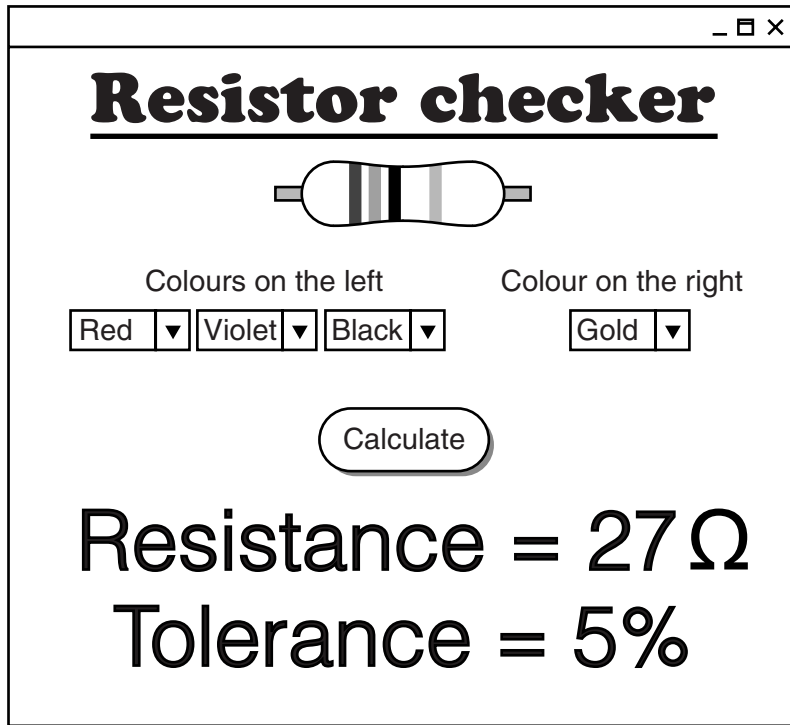


Fig. 1

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.



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

- 1
- 2
- 3

[6]

Turn over

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]

PLEASE DO NOT WRITE ON THIS PAGE



Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.