



## ADVANCED SUBSIDIARY GCE COMPUTING

Programming Techniques and Logical Methods

**F452**

\* C U P / T 6 2 2 5 0 \*

Candidates answer on the question paper

**OCR Supplied Materials:**

None

**Other Materials Required:**

None

**Friday 15 May 2009  
Morning**

**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 clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

**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**.
- This document consists of **20** pages. Any blank pages are indicated.

- 1 (a) Programming constructs determine the way in which statements in a program are executed.

Three types of programming constructs are sequence, selection and iteration.

Describe what is meant by each of these.

Sequence .....

.....

.....

..... [2]

Selection .....

.....

.....

..... [2]

Iteration .....

.....

.....

..... [2]

- (b) A computer program contains the following instructions

X = 5  
Y = 7  
X = Y  
OUTPUT X

- (i) State which of the constructs in part (a) has been used.

..... [1]

- (ii) State the value which will be output.

..... [1]

- (c) Another computer program contains the following instructions.

```

INPUT X
INPUT Y
Z = -1
REPEAT
    Z = Z + 1
    Y = Y - X
UNTIL Y < 0
OUTPUT Z

```

- (i) For each of the following sets of input data, complete the table below showing the values of the variables X, Y and Z **after** the instructions have been executed, and the output.

You may use the extra column for rough work.

INPUTS	X	Y	Z	OUTPUT
3, 9				
5, 7				
8, 2				

[12]

- (ii) Explain what this algorithm does.

.....  
 .....  
 .....  
 .....

[2]

- (iii) The program is given the inputs: -4, 12

Explain why this will produce an error and state the type of error it will produce.

.....  
 .....  
 .....  
 .....

Type of error: ..... [3]

- (d) A utilities company provides both gas and electricity. Customers whose bills when added together exceed £10 are given a 5% discount on this total.

The following code has been written to calculate the total bill of customers including the discount, if any.

```
01 INPUT GasBill  
02 INPUT ElectricBill  
03 If GasBill AND ElectricBill > 10 THEN  
04   TotalBill = GasBill + ElectricBill * 0.95  
05 Else  
06   TotalBill = GasBill + ElectricBill  
07 END IF
```

This code contains an error in line 03 and another error in line 04.

- (i) Explain why there is an error in line 03 and state the type of error.

Explanation .....

.....

.....

.....

Type or error ..... [3]

- (ii) Explain why there is an error in line 04 and state the type of error.

Explanation .....

.....

.....

.....

Type of error ..... [3]

- (e) Describe debugging tools and facilities available in programming languages, which can be used to identify and correct errors such as those in parts (c) and (d).

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

[6]

[6]

- 2 A parcel delivery company has a website where customers can arrange for parcels to be collected and delivered.
- (a) Using the table below, state and justify **three** separate items of data which the customer will need to provide. An example has been completed.

Item of data needed	Reason why it is needed
Delivery postcode	So that the driver can arrange the most efficient route

[6]

- (b) Drivers in the company need the postcodes sorted in ascending order. A computer program sorts the postcodes, as strings, in ascending order.

The table below shows a sample of the data entered by customers, the result after the program sorts the data and what the drivers need.

Postcodes entered by customers	Postcodes after the program sorts them	Postcodes in the order that the drivers need them
BF1 3UY	BF1 3UY	BF1 2AJ
BF21 1XX	BF12AJ	BF1 3UY
BF12AJ	BF18 4TZ	BF2 0ED
BF2 0GH	BF2 0GH	BF2 0GH
BF18 4TZ	BF21 1XX	BF18 4TZ
bf2 0ed	bf2 0ed	BF21 1XX

Explain, using examples, why the order of the postcodes sorted by the program is different from the order wanted by the drivers.

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

- (c) One way to prevent the problem described in part (b) is to use validation when the customer inputs the postcode.

- (i) Explain the term validation.

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

- (ii) Describe **three** validation checks that can be used on the postcode.

Validation Check 1 .....

.....  
.....  
.....

Validation Check 2 .....

.....  
.....  
.....

Validation Check 3 .....

.....  
.....  
.....

[6]

- (d) A different solution to the problem in part (b) is to write a program to reformat the postcode entered by the customer before it is sorted.

Describe the operations that the program will have to do in order to convert the postcodes to a format which will be sorted correctly. You should refer to string manipulation functions and operations in a high level language you have studied.

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

[6]

[6]

- 3 A company is writing a program to control the lift in a 5-storey building.

The program uses an array called LiftCalled( ) to store whether the lift has been called on each floor.

- (a) Explain what is meant by an array.

.....  
 .....  
 .....  
 .....

[2]

The structure of the array used is shown in the table below.

Each row represents a floor of the building. The first column stores whether a lift is wanted to go UP from that floor, and the second column stores whether the lift is wanted to go DOWN from that floor.

	1(UP)	2(DOWN)
1	FALSE	FALSE
2	TRUE	FALSE
3	TRUE	FALSE
4	FALSE	TRUE
5	FALSE	FALSE

LiftCalled(4, 2)

- (b) In the table above the value of LiftCalled(4,2) is TRUE. This means that the lift has been called to go DOWN from the fourth floor.

State the value of LiftCalled(2,1) and explain what it means.

Value .....

Explanation .....

.....  
 .....  
 .....

[3]

- (c) When the lift is called from a floor (by pressing either UP or DOWN outside the lift door) the program executes a subroutine ButtonPressed. This subroutine updates the contents of the array LiftCalled by inserting TRUE in the cell which corresponds to the floor on which the lift is called and the direction wanted.

The algorithm for this subroutine is given below in pseudocode.

SubRoutine ButtonPressed (Floor : Integer, Direction : String)

    IF Direction = "UP" THEN

        LiftCalled(Floor, ..... ) = TRUE

    ELSE

        LiftCalled(..... , 2 ) = .....

END IF

End SubRoutine ButtonPressed

- (i) Fill in the **three** spaces in the algorithm. [3]

- (ii) State the names of the parameters of the subroutine.

.....

..... [2]

- (d) Supervisors can call the lift using an override facility.

This uses a subroutine call SupervisorCall.

This subroutine has one parameter, Floor (the number of the floor where the supervisor is.)

The subroutine sets the UP and DOWN values for the designated floor to TRUE, and all other values in the array to FALSE.

Write the code for the subroutine SupervisorCall in a high level language. You should state the name of the language you have used and use good program writing techniques to ensure that your code can be understood by another programmer.

Name of Language .....

## Code

[6]

[6]

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**PLEASE TURN OVER FOR THE NEXT QUESTION**

- 4 A programmer is producing a computer program which allocates seats to customers in a small theatre.

(a) The code for the program uses variables and constants.

(i) Describe what is meant by a variable.

.....  
.....  
.....  
.....

[2]

(ii) State how a constant is different from a variable.

.....  
.....

[1]

(iii) Describe how using constants can help improve the maintainability of the code.

.....  
.....  
.....  
.....

[2]

- (b) Some variables used by the program are given below.  
For each variable, state its data type and give **one** reason why this data type is suitable.

- (i) Variable: NoTickets (The number of tickets wanted)

Data Type .....

Reason.....

[2]

- (ii) Variable: SeatAvailable (Whether a seat can be booked)

Data Type .....

Reason.....

[2]

- (iii) Variable: SeatNumber (For example F7, meaning the seat is in row F, number 7)

Data Type .....

Reason.....

[2]

- (iv) Variable: TotalPrice (The cost of the tickets booked by the customer)

Data Type .....

Reason.....

[2]

**16**

- (c) The theatre has 10 rows, labelled A to J from front to back, and 15 seats in each row, numbered 1 to 15 from left to right.

J	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	J
I	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	I
H	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	H
G	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	G
F	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	F
E	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	E
D	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	D
C	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	C
B	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	B
A	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	A

ORCHESTRA

STAGE

The program uses the following rules to choose the best seats.

Rule 1: All seats in one booking must be in the same row, next to each other.

Rule 2: The seats must be as close to the front as possible.

Write an algorithm which takes the number of tickets wanted as an input, and outputs the best seats available.

[8]

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