Rewarding Learning

General Certificate of Secondary Education
2024

Centre Number

Candidate Number

Digital Technology

Unit 4

Digital Development Concepts

MV24

[GDG41]

THURSDAY 6 JUNE, AFTERNOON

Time

1 hour 30 minutes, plus your additional time allowance

Instructions to Candidates

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

You must answer the questions in the spaces provided.

Do not write on blank pages.

Complete in black ink only.

Answer **all nine** questions.

Information for Candidates

The total mark for this paper is 120.
Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Question **6**.

1 Consider the following algorithm.

```
IF (string1 = "AREA") THEN
    IF (LENGTH = BREADTH) THEN
            OUTPUT ("This is a square,")
    ELSE
            OUTPUT ("This is a rectangle,")
    ENDIF
    X = LENGTH * BREADTH
    OUTPUT (X)
ELSEIF (string1 = "PERIMETER") THEN
    OUTPUT ("Shape Perimeter,")
    Y = 2 * (LENGTH + BREADTH)
    OUTPUT (Y)
ELSE
    OUTPUT ("No result")
ENDIF
```

(a) Which letter gives the correct output for the above algorithm when string1 = "CIRCUMFERENCE", LENGTH=7 and BREADTH=8? Circle the correct answer. [1 mark]

A This is a square, 56

B This is a rectangle, 56

C Shape Perimeter, 56

D No result

(b) Which letter gives the correct output for the algorithm when string1 = "AREA", LENGTH=12 and BREADTH=12? Circle the correct answer. [1 mark]

A This is a square, 144

B This is a square, 48

C Shape Perimeter, 48

D No result

(c) Which letter gives the correct output for the algorithm when string1 = "RADIUS", LENGTH=2 and BREADTH=10? Circle the correct answer. [1 mark]

A This is a square, 20

B This is a rectangle, 20

C Shape Perimeter, 24

D No result

(d) Which letter gives the correct output for the algorithm when string1 = "PERIMETER", LENGTH=5 and BREADTH=5? Circle the correct answer. [1 mark]

A This is a square, 25

B Shape Perimeter, 25

C Shape Perimeter, 20

D No result

2 Which letter gives the correct output for each of the following algorithms? Circle the correct answer in each case.
[1 mark for each]

(a)
```
FOR Y = 20 TO 25
    OUTPUT (Y-2)
END FOR
```

A 22 24 26 28 30 32

B 20 22 24 26 28 30

C 20 18 16 14 12 10

D 18 19 20 21 22 23

(b) X=2, Y=10

```
WHILE (X < Y)
    OUTPUT (X)
    X=X+2
END WHILE
```

A 2 4 6 8 10

B 2 4 6 8

C 2 6 10 14

D 2 3 4 5

(c)
```
X=0, Y=20
WHILE (X < Y)
    IF (X*2 > Y)
        OUTPUT (X)
    ENDIF
    X=X+2
END WHILE
```

A 2 4 6 8 10 12 14 16 18 20

B 10 12 14 16 18

C 12 14 16 18

D 10 12 14 16 18 20

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(Questions continue overleaf)

3 School Travel Insurance provide travel insurance for school trips. The company needs a program to calculate the cost to schools.

The insurance costs are based on group size as follows:

Group Size	**Cost per pupil(£)**
Up to 20	20.00
21 – 50	15.00
More than 50	10.00

(a) Complete the algorithm which will allow a user to input the group size and calculate and output the total cost of the insurance for the group. [6 marks]

All IF statements **should contain only one condition**.

```
OUTPUT ("Enter the group size")

INPUT groupSize

IF groupSize > 50
```

(b) The company have decided that when calculating costs the program should include a facility to allow the user to input the school's name.

(i) Validation will be used to ensure that the school's name is entered. Explain the term validation. [2 marks]

_____

_____

(ii) Explain how a length check could be used when validating that a school name is entered appropriately.
[2 marks]

_____

_____

(iii) State the most appropriate data type for storing the Cost per pupil.
[1 mark]

_____

(c) The company cannot insure group sizes which have more than 100 pupils. Complete the algorithm below which will ensure that users must enter a group size in the range 1 to 100. [6 marks]

```
valid = _____

WHILE valid = _____

    Output ("Enter the group size")

    Input groupSize

    IF _____

        valid = _____

    ELSE

        Output ("Enter a value between 1
        and 100")

    ENDIF

END WHILE
```

4 Computer systems make use of digital data. Binary numbers are digital data.

(a) Complete the table below by matching the bit patterns to the appropriate term. [1 mark for each]

Use the list below to match each term to its bit pattern.

BIT

NIBBLE

BYTE

Bit pattern	Term
0110	
0	
10011001	

(b) Convert the denary number 80 to:

(i) an 8-bit binary pattern. [2 marks]
(Show all working out clearly)

Answer _____

(ii) a hexadecimal number. [2 marks]
(Show all working out clearly)

Answer _____

(c) Convert the binary pattern 10101010 to:

(i) a denary number. [2 marks]
(Show all working out clearly)

Answer _____

(ii) a hexadecimal number. [2 marks]
(Show all working out clearly)

Answer _____

(d) (i) Using binary arithmetic add the following binary patterns together. In your answer circle any overflow that occurs. [3 marks]
(Show all working out clearly)

	1	0	1	0	1	0	1	1
+	1	1	0	0	1	1	0	1

Result _____

(ii) How does overflow affect the result of a calculation? [1 mark]

_____

(e) Complete the following truth table based on the input values A and B.
[1 mark for each]

A	**B**	**C = NOT (A and B)**	**D = C or B**
0	0	1	1
0	1		1
1	0		1
1			

5 (a) Complete the paragraph below using terms from the list provided. (Not all terms will be used.) [1 mark for each]

Object-Oriented
Procedural
Data
Source Code
Step By Step
Information
Sequential
Objects

In _____ programming a programmer specifies _____ what a program must do.
Instructions are carried out in a _____ manner.
_____ programming uses self-contained _____ which contain both programming routines or methods and the _____ being processed.

(b) Write **True** or **False** beside each of the following statements about high-level code translation. [1 mark for each]

Statement	**True / False**
Translators can be either compilers or interpreters	
Interpreters translate the whole program at once whilst compilers translate the program line by line	
A compiler reports all syntax errors after attempting to compile the program	
After a program has been compiled the machine code version of the program is stored in a separate file from the source code	

6 Explain the difference between execution and logic errors during program development. [6 marks]

Quality of written communication will be assessed in this question.

7 Joan is writing a program to count the student council votes for her year group. There are 5 classes in the year group.

(a) She has collected the following data on the number of votes cast by each of the 5 classes.

Joan has decided to store the data, for each of the 5 classes, in an array or list structure called **votes**.

Fig. 1

votes	23	25	25	22	25

(i) Complete the paragraph below using words from the list of terms provided. (Not all terms will be used.)
[1 mark for each]

Terms
array name
votes[4]
name
index
votes[3]
data type
format

An array structure contains data of the same _____.

In order to access the individual value 22 in **votes**, the _____ must be used, followed by the _____ of this element.

This would be written as _____ .

(ii) Suggest a data type for **votes**.
[1 mark]

_____

(b) Joan used pseudo-code when designing the program. What is pseudo-code?
[1 mark]

_____

_____

(c) Complete or write the following sections of the algorithm.

(i) Write a section of the algorithm which will initialise the values in **votes** to the numbers shown in **Fig. 1**.
[2 marks]

_____

_____

_____

_____

_____

(ii) Complete the following section of the algorithm which will calculate the number of classes in which every student voted and store it in a variable called **allVotes**. Each class has 25 members. [4 marks]

```
FOR X = 0 TO _____

    IF votes[ _____ ] =
_____

        allVotes = _____ + 1
```

(iii) Write a section of the algorithm which will: [5 marks]

- use a **While Loop** to process the contents of **votes**
- calculate the total number of votes cast by all students and store it in a variable called **totalVotes**
- output the value of the variable **totalVotes**

(iv) Complete the following section of the algorithm which will: [6 marks]

- initialise a variable called **lowestVotes** to 100
- find the lowest number of votes cast by any class and store it in the variable called **lowestVotes**
- output the value of the variable **lowestVotes**

```
lowestVotes = 100
X=0
DO
    IF_____ < _____ THEN

    lowestVotes = _____

    X = _____

WHILE _____

OUTPUT _____
```

(d) Joan needs to sort the data. She is going to use the bubble sort.

(i) In the table below, place a tick (✓) beside **three** statements that are true about the bubble sort when sorting numbers from **smallest to largest**. [3 marks]

Statement	**Tick (✓)**
The bubble sort compares adjacent elements and swaps them if necessary	
The bubble sort takes each element and places it in the correct place in a sorted sub-list	
After the first pass the largest number is in the correct position in the array or list	
The bubble sort completes only one pass and compares adjacent elements once	
The data in the array or list will be fully sorted after n-1 passes. Where n is the number of elements in the array or list	

(ii) A new set of data in **votes** needs to be sorted, largest first. Using the Bubble Sort, demonstrate how the data would be organised from **largest to smallest** during the sorting process. [4 marks]

Show the array or list content after each pass, using the data shown below.

votes

19	22	23	24	25

PASS 1

votes

PASS 2

votes

PASS 3

votes

PASS 4

votes

(e) After a few weeks Joan has collected the data for the whole school. She has sorted the data and needs to search through it.

(i) Explain to Joan what a linear search is. [2 marks]

(ii) Joan decides to use a binary search. Explain how this search works. [2 marks]

(iii) State **one** reason why Joan's data is more suited to a binary search. [1 mark]

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(Questions continue overleaf)

8 MyBikes is a local company which hires bikes to young people aged 14 to 18 years. John manages the shop. He is testing a new computer-based system to record hires and calculate charges.

When a new customer registers:

- the system generates a new customer number automatically
- the customer must be between 14 and 18 years of age
- the customer must provide a valid form of identification

The customer register screen is shown opposite, * indicates that data **must** be entered.

Register A New Customer

Customer Number: 1219

*Name :[Andrew Walsh]

*Address1 :[35 Long Road]

Address2 :[Ballymore]

Town :[Newtown]

*Postcode :[BT11 9ZZ]

*Age :[18]

*Identification provided? [Y]

(a) Suggest appropriate data types for storing the following data:
[1 mark for each]

Data	**Data type**
Postcode	
Identification provided?	

(b) John has created a test plan to test the Customer Registration part of the system.

(i) Explain the type of testing that John is carrying out when he tests only the Customer Registration part of the system. [2 marks]

(ii) A section of John's test plan for the Customer Registration part of the system is shown below. Complete the test plan. [1 mark for each]

Test Number	Item to be tested	Reason for test	Test data	Expected outcome
1.	Name			Value Accepted
2.	Name		Press Enter Key	Value Rejected
3.	Age	Extreme Data		Value Accepted
4.	Age		35	
5.	Age			Value accepted

(c) Black box and white box testing can be used to test a computer-based system. Complete the table below to explain how these forms of testing are used.

Test type	**Who should carry out the testing?** [1 mark for each]	**What does it test?** [2 marks for each]
Black Box		
White Box		

9 **(a)** Complete the paragraph below, about evaluation, using terms from the list provided. (Not all terms will be used.) [1 mark for each]

Continuously

Solution

User Requirements

Design

Development Process

User Interface

When evaluating a system it is important to ensure that the _____ meets its original _____ criteria.

This can be done by comparing it with the _____ .

Evaluation should occur _____ during the _____ .

(b) How can a system's robustness be evaluated? [2 marks]

This is the end of the question paper

For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

Examiner Number