



General Certificate of Secondary Education
2024

Centre Number

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Candidate Number

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Digital Technology

Unit 4

Digital Development
Concepts



[GDG41]

GDG41

THURSDAY 6 JUNE, AFTERNOON

TIME

1 hour 30 minutes.

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 outside the boxed area on each page or on blank pages.

Complete in black ink only. **Do not write with a gel pen.**

Answer **all nine** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 120.

Figures in brackets printed down the right-hand side of pages 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.

- A This is a square, 56
- B This is a rectangle, 56
- C Shape Perimeter, 56
- D No result

[1]



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

- A This is a square, 144
- B This is a square, 48
- C Shape Perimeter, 48
- D No result

[1]

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

- A This is a square, 20
- B This is a rectangle, 20
- C Shape Perimeter, 24
- D No result

[1]

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

- A This is a square, 25
- B Shape Perimeter, 25
- C Shape Perimeter, 20
- D No result

[1]

[Turn over

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28GDG4103

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

(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

[1]

(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

[1]



(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

[1]

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28GDG4105

- 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.

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

OUTPUT ("Enter the group size")

INPUT groupSize

IF groupSize > 50

[6]



(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]

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

[2]

(iii) State the most appropriate data type for storing the Cost per pupil.

[1]

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28GDG4107

(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.

valid = _____

WHILE valid = _____

 Output ("Enter the group size")

 Input groupSize

 IF _____

 valid = _____

 ELSE

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

 ENDIF

END WHILE

[6]





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28GDG4109

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.

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

BIT

NIBBLE

BYTE

Bit pattern	Term
0110	[1]
0	[1]
10011001	[1]

(b) Convert the denary number 80 to:

(i) an 8-bit binary pattern.

(Show all working out clearly)

Answer _____ [2]



(ii) a hexadecimal number.

(Show all working out clearly)

Answer _____ [2]

(c) Convert the binary pattern 10101010 to:

(i) a denary number.

(Show all working out clearly)

Answer _____ [2]

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28GDG4111

(ii) a hexadecimal number.

(Show all working out clearly)

Answer _____ [2]

(d) (i) Using binary arithmetic add the following binary patterns together. In your answer circle any overflow that occurs.

(Show all working out clearly)

$$\begin{array}{r} 1\ 0\ 1\ 0\ 1\ 0\ 1\ 1 \\ +\ 1\ 1\ 0\ 0\ 1\ 1\ 0\ 1 \\ \hline \end{array}$$

RESULT _____

[3]



(ii) How does overflow affect the result of a calculation?

[1]

(e) Complete the following truth table based on the input values A and B.

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

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28GDG4113

- 5 (a) Complete the paragraph below using terms from the list provided.
(Not all terms will be used.)

OBJECT-ORIENTED **PROCEDURAL** **DATA** **SOURCE CODE**
STEP BY STEP **INFORMATION** **SEQUENTIAL** **OBJECTS**

In _____ [1] programming a programmer specifies _____ [1] what a program must do. Instructions are carried out in a _____ [1] manner. _____ [1] programming uses self-contained _____ [1] which contain both programming routines or methods and the _____ [1] being processed.

- (b) Write **TRUE** or **FALSE** beside each of the following statements about high-level code translation.

Statement	TRUE / FALSE
Translators can be either compilers or interpreters	[1]
Interpreters translate the whole program at once whilst compilers translate the program line by line	[1]
A compiler reports all syntax errors after attempting to compile the program	[1]
After a program has been compiled the machine code version of the program is stored in a separate file from the source code	[1]





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

Quality of written communication will be assessed in this question.

[6]

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28GDG4115

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**.

votes	23	25	25	22	25
--------------	----	----	----	----	----

Fig. 1

(i) Complete the paragraph below using words from the list of terms provided. (Not all terms will be used.)

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

An array structure contains data of the same _____ [1]

In order to access the individual value 22 in **votes**, the

_____ [1] must be used, followed by the

_____ [1] of this element. This would be written

as _____ . [1]



(ii) Suggest a data type for **votes**.

_____ [1]

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

_____ [1]

(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]

(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.

FOR X = 0 TO _____

IF votes[_____] = _____

allVotes = _____ + 1 [4]

[Turn over



(iii) Write a section of the algorithm which will:

- 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**

[5]

(iv) Complete the following section of the algorithm which will:

- 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 _____

[6]



(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.

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	

[3]

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- (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.
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

--	--	--	--	--

[4]



(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]

(ii) Joan decides to use a binary search. Explain how this search works.

[2]

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

[1]



- 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 below, * 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:

Data	Data type
Postcode	[1]
Identification provided?	[1]



(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]

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

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

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(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?	What does it test?
Black Box	[1]	[2]
White Box	[1]	[2]



9 (a) Complete the paragraph below, about evaluation, using terms from the list provided. (Not all terms will be used.)

CONTINUOUSLY **SOLUTION** **USER REQUIREMENTS**
DESIGN **DEVELOPMENT PROCESS** **USER INTERFACE**

When evaluating a system it is important to ensure that the _____ [1] meets its original _____ [1] criteria.

This can be done by comparing it with the _____ [1].

Evaluation should occur _____ [1] during the _____ [1].

(b) How can a system's robustness be evaluated?

_____ [2]

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Question Number	Marks
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