Rewarding Learning

General Certificate of Secondary Education
2022

Centre Number

Candidate Number

Digital Technology

Unit 4

Digital Development Concepts

MV18

[GDG41]

MONDAY 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 eleven** 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 **5**.

1 (a) Which of the following tables is the correct truth table for NOT(P AND Q)? [1 mark]

A

P	Q	P AND Q	NOT (P AND Q)
0	0	1	1
0	1	1	0
1	0	0	1
1	1	0	0

B

P	Q	P AND Q	NOT (P AND Q)
0	0	0	1
0	1	1	1
1	0	0	0
1	1	1	0

C

P	Q	P AND Q	NOT (P AND Q)
0	0	1	1
0	1	1	1
1	0	1	1
1	1	0	0

D

P	Q	P AND Q	NOT (P AND Q)
0	0	0	1
0	1	0	1
1	0	0	1
1	1	1	0

(b) Which of the following tables gives the correct output for (P OR Q) AND R? [1 mark]

A

P	Q	P OR Q	R	(P OR Q) AND R
0	0	1	1	0
0	1	0	1	1
1	0	0	1	1
1	1	1	1	1

B

P	Q	P OR Q	R	(P OR Q) AND R
0	0	0	1	0
0	1	1	1	1
1	0	1	1	1
1	1	1	1	1

C

P	Q	P OR Q	R	(P OR Q) AND R
0	0	0	1	1
0	1	1	1	1
1	0	1	1	1
1	1	1	1	1

D

P	Q	P OR Q	R	(P OR Q) AND R
0	0	0	1	0
0	1	1	1	0
1	0	1	1	0
1	1	1	1	0

(c) Which letter gives the correct output for each of the following algorithms? [1 mark for each]

For x = 0 To 10 Output x * 2	**A** 0 2 4 6 8 10 12 14 16 18 20 **B** 1 2 3 4 5 6 7 8 9 10 **C** 0 1 2 3 4 5 6 7 8 9 10 **D** 2 4 6 8 10 12 14 16 18 20 _____

X = 7, Y = 12, Z = 20
 	
If X < Y Then
  Output X
Else
  If Y < Z and Y < X Then
  Output Y
Endif
If X < Z Then
  Output Z
	A 7 12 20
	B 7 20
	C 12 20
	D 7 12
	_____

(d) In the table below, place a Tick (✓) beside the correct definition for the term abstraction. [1 mark]

Definition	**Tick** (✓)
The correction of errors in a program whilst it is running	
The filtering out of important information related to the problem to be solved	
The filtering out of information that will not be needed to solve the problem	
The use of error handling techniques to ensure data is correct	

(e) In the table below, place a Tick (✓) beside the correct definition for the term decomposition. [1 mark]

Definition	**Tick** (✓)
Using functions within a program	
Breaking problems down into smaller problems when creating a solution	
Creating a program using only relevant information	
Creating a large problem from several small problems	

(f) Select the statement which is correct about searching techniques. [1 mark]

A The binary search is more efficient than the linear search because it searches all of the items in a list

B The linear search is more efficient than the binary search because it searches all of the items in a list

C The binary search is more efficient than the linear search because it cuts the number of items it searches in half after every search

D The linear search is more efficient than the binary search because it cuts the number of items it searches in half after every search

(g) Select the statement which is correct about ASCII code. [1 mark]

A ASCII stands for American Standard Code for Information Interchange and there are two forms of it, 7 bit and 8 bit

B ASCII stands for American Standard Characters for Information Interchange and there are two forms of it, 7 bit and 8 bit

C ASCII stands for American Standard Code for Information Interchange and there are two forms of it, 7 byte and 8 byte

D ASCII stands for American Standard Characters for Information Interchange and there are two forms of it, 7 byte and 8 byte

2 Jane is writing a program which will output the lowest value from a set of three 100 metre race times. A set of sample race times in seconds would be:

32.9
33.7
31.8

(a) Suggest a suitable data type for a variable called racetime1 which will be used to store a race time in the program. [1 mark]

_____

(b) Complete the following algorithm which will take as input the three race times and output the smallest of race times. [6 marks]

```
Output "Enter race time 1"
Input racetime1
Output "Enter race time 2"
Input racetime2
```

(c) Jane needs to test the program. Each race time must be in the range 30 to 40 seconds.

(i) State **two** ways in which each of the following sets of test data could help Jane decide that the program outputs the lowest value and only accepts values in the range 30 to 40. [2 marks for each set]

	How can these test data sets help test the program?
Test Data Set 1 racetime1 31.0 racetime2 32.0 racetime3 36.6	1. 2.
Test Data Set 2 racetime1 37.9 racetime2 30.0 racetime3 33.9	1. 2.
Test Data Set 3 racetime1 41.0 racetime2 40.0 racetime3 31.9	1. 2.

(ii) Suggest another test data value that would test the program further. [1 mark]

3 **(a)** Complete the paragraph below using words from the list provided. [4 marks]
(Not all words will be used)

Translated
Source
Compiler
Library
Optimised
Machine
Programmer

_____ code must be _____

into _____ code so that it can be

understood by a computer.

This is completed by a _____ .

(b) Tom has created a program using a text editor. List **two** features of a software development environment that would make creating a program easier for Tom.
[2 marks]

1. _____

_____

2. _____

_____

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(Questions continue overleaf)

4 (a) Jennie has a cupcake company. She needs a program to calculate customer charges for orders. The cost of the cupcake is based on the number of cupcakes ordered. The charges are as follows:

Number of cupcakes ordered	Cost per cupcake (£)
1 – 15	0.75
16 – 30	0.65
>30	0.55

Complete the algorithm which will allow a user to input the number of cupcakes and output the total cost of the cupcakes. All IF statements used should contain only one condition. [6 marks]

```
Output “Enter number of cupcakes”

Input numberOfCupcakes

IF numberOfCupcakes>30
```

(b) Jennie can only accept orders of between 1 and 50 cupcakes.

(i) Complete the algorithm below which will ensure that users must enter a value in the range 1 to 50.
[5 marks]

```
ErrorMessage="Error – Enter a value in the range
1 to 50"

Do

        valid = _____

        Output "Enter number of cupcakes"

        Input numberOfCupcakes

        if _____

            valid = _____

            Output ErrorMessage

        end if

WHILE valid = false
```

(ii) Suggest data types for the variables named in the table below. [1 mark for each]

Variable	**Data Type**
valid	
numberOfCupcakes	

(c) ErrorMessage is a string. A second error message, ErrorMessage2 has been created.

ErrorMessage2="An invalid number has been entered"

(i) Name a string function that could be used so that ErrorMessage and ErrorMessage2 are stored in a single string called ErrorMessageAll. [1 mark]

Function Name _____

(ii) Show how the function would be used to create ErrorMessageAll. [2 marks]

_____

_____

_____

(iii) The programmer needs to count the characters in ErrorMessageAll.
What string function could be used to do this?
[1 mark]

_____

5 Sorting can be done using the bubble sort or the insertion sort. Describe how each sort method works and comment on the efficiency of each. [6 marks]

Bubble sort:

Insertion sort:

6 Data is stored on a computer in digital form.

(a) (i) Explain the meaning of the term binary digit.
[2 marks]

_____

_____

(ii) Convert the denary number 54 to an 8-bit binary pattern. [2 marks]

(Show all working out clearly)

Answer _____

(b) A byte of information has the value 11001001.

(i) Using the byte value above explain the term nibble. [2 marks]

_____

_____

(ii) Convert the byte value 11001001 to hexadecimal. [2 marks]

(Show all working out clearly)

Answer _____

(c) Overflow can occur when two bytes are added together.

(i) What is overflow and how can it affect the result of a calculation? [2 marks]

_____

_____

(ii) In the table below, state whether each of the calculations will generate overflow by inserting Yes or No into the "Overflow – Yes or No" column. [1 mark for each]

Calculation	Overflow – Yes or No
11100011 + 00000001	
11100011 + 01101110	
11100001 + 11111000	

(d) John wants to store a large software application on a computer's hard disk.

- The computer has a 2 Terabyte hard disk.
- The disk has 1987 Gigabytes of disk space already used.
- The software application is 50 Gigabytes in size.

Will the software application fit onto the hard disk?
[3 marks]

(Show all working out clearly)

Will the software fit? _____

7 Mark has been asked to monitor the number of cars coming through the school gate from Monday to Friday.

(a) He will store the data collected in an array or list structure called **traffic** and process it in a program.

He has collected the following data for each of the days of the week, Monday to Friday.

traffic	123	150	236	100	145

(i) Explain how the individual value 236 is accessed in **traffic**. [3 marks]

(ii) Write an algorithm which will: [11 marks]

- calculate the total number of cars which has passed through the school gate this week and store it in a variable called **totalCars**
- output a message to alert the Principal if the total number of cars is more than 1000 on any day
- output the value of **totalCars**
- calculate the average daily number of cars and store it in a variable called **averageCars**
- output the value of **averageCars**

(b) Mark is going to write the program to complete the task. He has decided to use functions in his solution.

(i) What is a function? [2 marks]

_____

_____

_____

(ii) State **two** benefits of user-defined functions or procedures in program code. [2 marks]

1. _____

2. _____

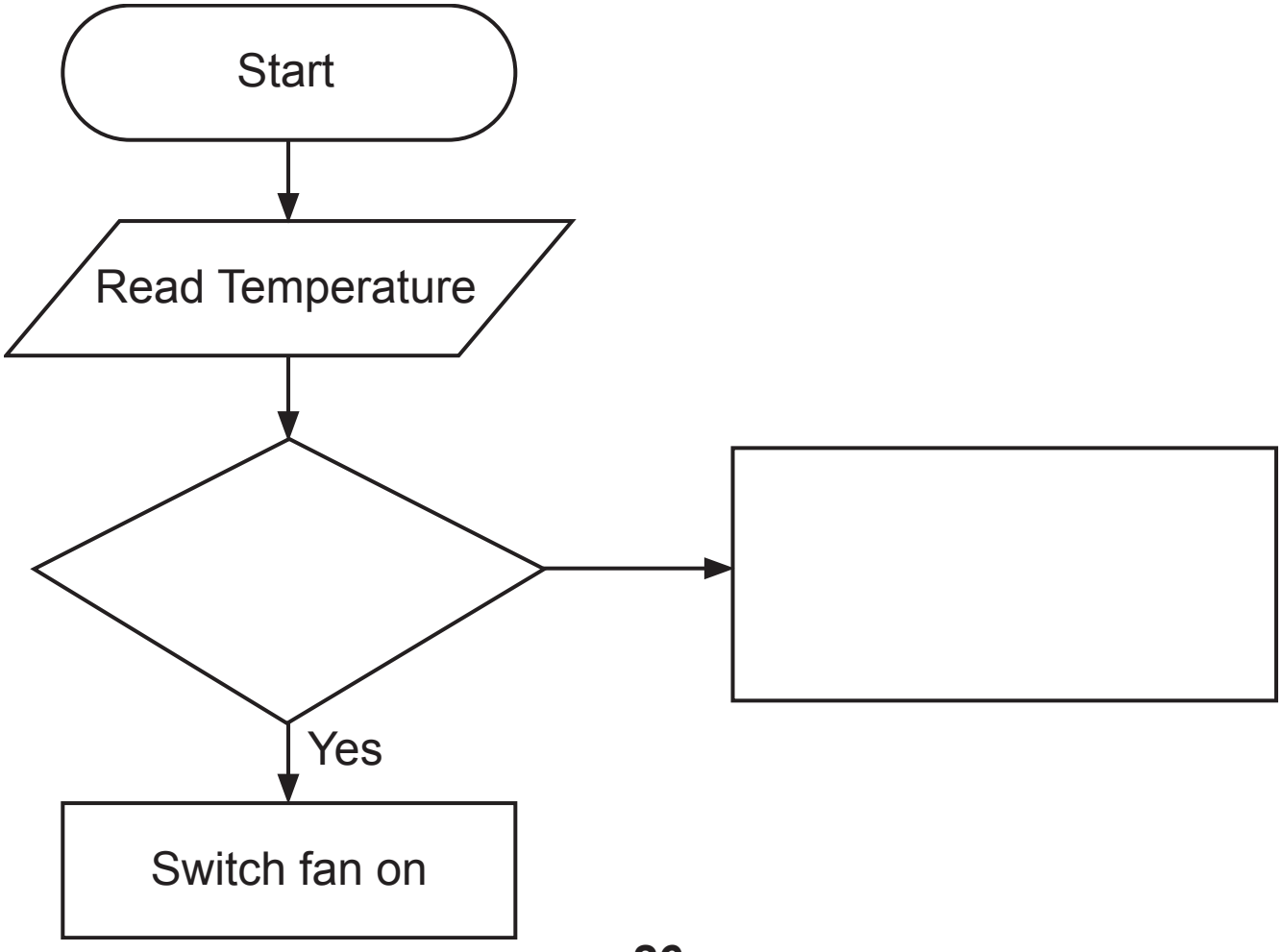
8 Ellie has a large greenhouse. She is having trouble with the temperature in the greenhouse and has employed a programmer to help fix the computerised air-conditioning.

The air-conditioning is set to come on when the temperature in the greenhouse reaches 20 degrees Celsius.

(a) The programmer has started to draw a flowchart of how the system should operate.

Complete the part of the flowchart below so that it:

- shows how the air-conditioning fan should work [3 marks]
- includes a loop so that the air-conditioning will work continuously [2 marks]



(b) The programmer wants to create a dry run to test the program for the air-conditioning.

(i) What is a dry run? [2 marks]

(ii) Explain how a programmer could create a dry run to test a solution. [2 marks]

9 Data used in programs is lost when the program ends. To access data when a program is closed, files can be used.

(a) Apart from read/write functions, name and describe **two** other file handling functions that could be used.
[4 marks]

1. _____

_____

_____

2. _____

_____

_____

(b) Programs sometimes result in errors occurring. Give **one** example of each of the following errors.
[1 mark for each]

Syntax Error	
Run-time Error	
Logical Error	

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(Questions continue overleaf)

10 Testing applications is an important part of the development process.

(a) Complete the table below which contains descriptions of the tests carried out by Alice when she completed a Digital Technology project which included a program to manage a school trip to London.

Use the list below to match each test type to its description. [5 marks]
(All words will be used)

White box
Black box
System
Unit
Integration

Description	Test Type
Alice needs to test a function REGISTER PUPIL which records pupil details	
Alice wants to check that when pupils are registered in REGISTER PUPIL they appear in the reports produced	
Alice wants to test the system as a whole to ensure that it meets the user requirements	
Alice wants to test the inputs and outputs of her system to ensure they work correctly and produce the correct results	
Alice wants to test each line of code to ensure it works correctly	

(b) (i) What is meant by the term 'error trapping'?
[2 marks]

(ii) Explain **one** way in which Alice could use error trapping to improve the quality of her program.
[2 marks]

11 (a) Complete the table below by stating whether each statement about evaluation is **True** or **False**.
[4 marks]

Statement	**True or False**
Evaluation of a system happens only when the system is complete.	
The end user is never involved in the evaluation process, only the programmers are involved in this process.	
To ensure that a system meets its original design criteria an evaluation must be linked to the user requirements.	
Evaluation occurs throughout the development process and is used to improve the system being developed.	

(b) Jack is creating a program for a surfing school which gives lessons on a local beach. The system must allow the staff at the sales stand to:

- register new customers
- make bookings for lessons
- process payments for lessons
- produce a list of all bookings and payments made each day

The system should be reliable, easy to use and should provide the information required quickly.

Jack will need to evaluate the system.

Complete the table below to help Jack understand what he must do during the evaluation process.
[1 mark for each]

Jack wants to ensure that…	**Why is this important?**	**Give an example from the information provided above**
The system is a full and complete solution		
The system is a robust solution		
The system is an efficient solution		

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	
10	
11	
Total Marks	

Examiner Number