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COMPUTER SCIENCE**0478/21**

Paper 2 Algorithms, Programming and Logic

October/November 2023**1 hour 45 minutes**

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- Calculators must **not** be used in this paper.

INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **16** pages. Any blank pages are indicated.

2

1 Tick (✓) **one** box to show which operator means less than or equal to.

- | | | |
|----------|----|--------------------------|
| A | OR | ☐ |
| B | < | ☐ |
| C | <= | ☐ |
| D | >= | ☐ |

[1]

2 Tick (✓) **one** box to show how a value can be passed to a procedure.

- | | | |
|----------|------------|--------------------------|
| A | function | ☐ |
| B | parameter | ☐ |
| C | return | ☐ |
| D | subroutine | ☐ |

[1]

3 **Four** descriptions of data and **five** data types are shown.

Draw **one** line to link each description to the most appropriate data type.

Not all data types will be used.

Description	Data type
a whole number	BOOLEAN
a single letter	CHAR
a word or phrase	INTEGER
a number with two decimal places	REAL
	STRING

[4]

3

- 4 Circle the **three** words representing places where data may be stored.

array constant dimension input
output procedure variable

[3]

- 5 The first stage of the program development life cycle is analysis. Two of the tasks in analysis are abstraction and decomposition.

- (a) Describe what is meant by abstraction.

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

- (b) Identify **three** of the component parts when a problem has been decomposed at the analysis stage.

1
2
3 [3]

- (c) Identify and describe **one** other stage of the program development life cycle.

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

4

6 An algorithm has been written in pseudocode.

```
01 DECLARE A[1:10] : STRING
02 DECLARE T : STRING
03 DECLARE C, L : INTEGER
04 L ← 10
05 FOR C ← 1 TO L
06     OUTPUT "Please enter name "
07     INPUT A[C]
08 NEXT C
09 FOR C ← 1 TO L
10     FOR L ← 1 TO 9
11         IF A[L] > A[L + 1]
12             THEN
13                 T ← A[L]
14                 A[L] ← A[L + 1]
15                 A[L + 1] ← T
16             ENDIF
17     NEXT L
18 NEXT C
19 FOR C ← 1 TO L
20     OUTPUT "Name ", C, " is ", A[C]
21 NEXT C
```

(a) State the purpose of this pseudocode algorithm.

.....
..... [1]

5

(b) State **four** processes in this algorithm.

- 1
-
- 2
-
- 3
-
- 4
-
- [4]

(c) Meaningful identifiers have **not** been used in this algorithm.
Suggest suitable meaningful identifiers for:

The array:

A

The variables:

T

C

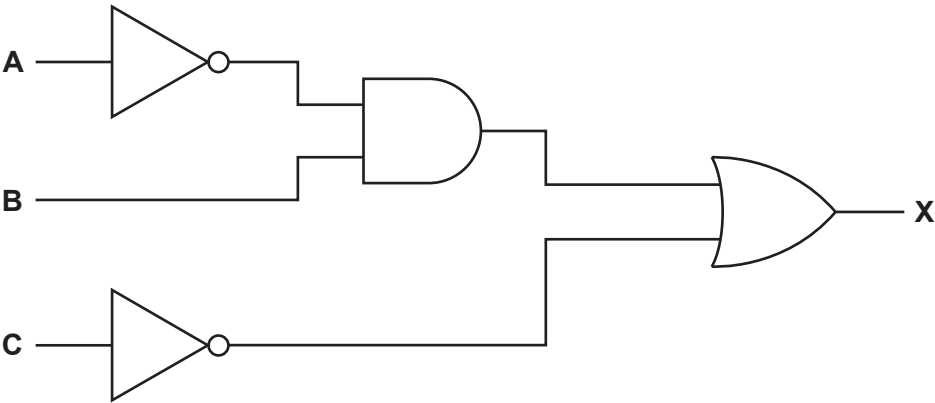
L

[3]

(d) State **two** other ways the algorithm can be made easier to understand and maintain.

- 1
-
- 2
-
- [2]

7 Consider this logic circuit.



(a) Write a logic expression for this logic circuit. Do **not** attempt to simplify this logic expression.

X =
..... [4]

(b) Complete the truth table from the given logic circuit.

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

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8

8 A programmer is designing an algorithm to calculate the cost of a length of rope.

The program requirements are:

- input two values: the length of rope in metres `Length` and the cost of one metre `Cost`
- perform a validation check on the length to ensure that the value is between `0.5` and `6.0` inclusive
- calculate the price `Price`
- output the price rounded to two decimal places.

Use the variable names given.

(a) State the name of the validation check.

..... [1]

(b) Complete the flowchart for this algorithm.

START

STOP

- (c) Give **two** different sets of test data for this algorithm and state the purpose of each set.

Set 1

Purpose

.....

.....

Set 2

Purpose

.....

.....

[4]

- (d) Complete the headings for the trace table to show a dry-run for this algorithm.
You do **not** need to trace the algorithm.

.....			
-------	-------	-------	-------

[3]

- (e) Describe an improvement that should be made to the requirements for this algorithm.

.....

.....

.....

..... [2]

10

- 9 A model shop wants to set up a database to help with stock control of the model figures available for sale. The shop wants to store this information about the model figures:

Field 1 – catalogue number, for example MD1234

Field 2 – description, for example 'small white dog'

Field 3 – number in stock, for example 5

Field 4 – the price of each model, for example 7.40

Field 5 – if the model has already been painted, yes or no.

- (a) The shop needs **five** fields for each record.
Give a suitable name and data type for each field.

Field 1 name

Data type

Field 2 name

Data type

Field 3 name

Data type

Field 4 name

Data type

Field 5 name

Data type

[5]

- (b) (i) Give the name of the field that should be used for the primary key.

..... [1]

- (ii) State why this field is used as the primary key.

..... [1]

- (c) Structured query language (SQL) is used to query data stored in this database.
State what these SQL commands are used for.

SELECT

.....

FROM

.....

WHERE

.....

[3]

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12

- 10 Drama students put on a performance of a play for one evening. Seats in a small theatre can be booked for this performance.

The theatre has 10 rows of 20 seats. The status of the seat bookings for the evening is held in the two-dimensional (2D) Boolean array `Evening[]`

Each element contains `FALSE` if the seat is available and `TRUE` if the seat is booked.

Up to and including four seats can be booked at one time. Seats are allocated in order from those available. A row or seat number cannot be requested.

The array `Evening[]` has already been set up and some data stored.

Write a program that meets the following requirements:

- counts and outputs the number of seats already booked for the evening
- allows the user to input the number of seats required
- validates the input
- checks if enough seats are available:
 - if they are available
 - changes the status of the seats
 - outputs the row number and seat number for each seat booked
 - if they are **not** available:
 - outputs a message giving the number of seats left or 'House full' if the theatre is fully booked.

You must use pseudocode or program code **and** add comments to explain how your code works. You do **not** need to declare any arrays or variables; you may assume that this has already been done.

You do **not** need to initialise the data in the array `Evening[]`

All inputs and outputs must contain suitable messages.

.....

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.....

.....

[15]

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