Cambridge Assessment International Education

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CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

5626613329

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.

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[Turn over

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]

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]

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]

(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 .....

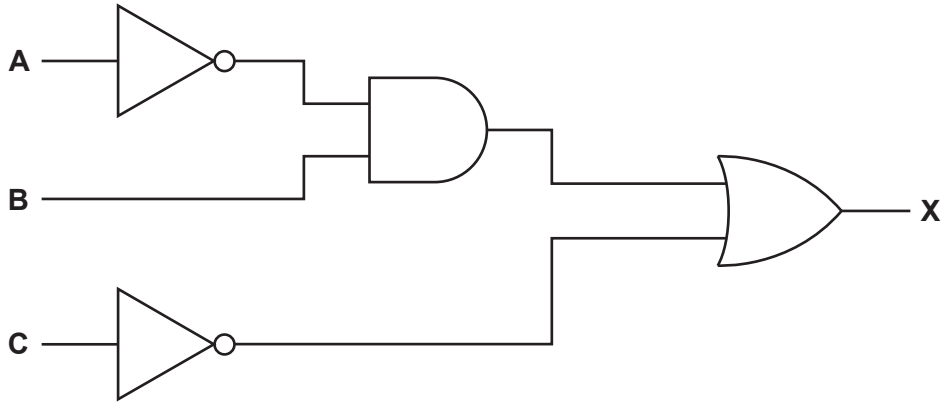
.....

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 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.

[6]

(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]

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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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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