Cambridge Assessment International Education

MEM

Cambridge IGCSE™

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CENTRE NUMBER						CANDIDATE NUMBER				

5296223756

COMPUTER SCIENCE **0478/23**

Paper 2 Algorithms, Programming and Logic **May/June 2024**

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.

[Turn over

1 Tick (✓) **one** box to complete this sentence.

This flowchart symbol 

A represents a subroutine. ☐

B represents a decision. ☐

C represents an input/output. ☐

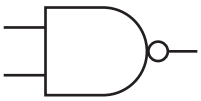
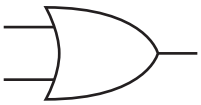
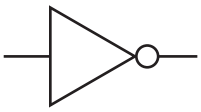
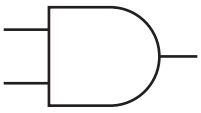
D represents a terminator. ☐

[1]

2 **(a)** **Four** logic gate symbols and **five** logic functions are shown.

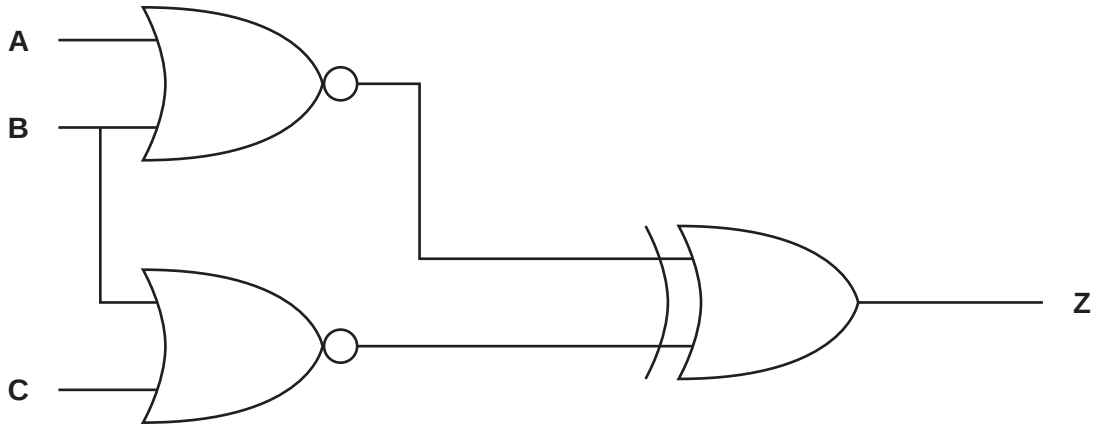
Draw **one** line to link each logic gate symbol to the appropriate logic function.

Not all logic functions will be used.

Logic gate symbol	Logic function
	AND
	XOR
	NOT
	NAND
	OR

[4]

(b) Complete the truth table for this logic circuit.



A	B	C	Working space	Z
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]

3 Describe the characteristics of the string and char data types and give an example of each.

String .....

.....

Example .....

Char .....

.....

Example .....

[4]

4 This pseudocode algorithm is intended to allow data for up to 50 people to be entered and stored in a two-dimensional (2D) array. The data is their last name, first name and the city in which they live.

```
01 DECLARE People : ARRAY[1:50, 1:3] OF REAL
02 DECLARE Count : INTEGER
03 DECLARE Response : CHAR
04 DECLARE Continue : BOOLEAN
05 FOR I ← 1 TO 50
06     FOR J ← 1 TO 3
07         People[I, J] ← ""
08     NEXT J
09 NEXT I
10 Count ← 100
11 Continue ← TRUE
12 CASE OF
13     OUTPUT "Enter the last name"
14     INPUT People[Count, 1]
15     OUTPUT "Enter the first name"
16     INPUT People[Count, 2]
17     OUTPUT "Enter the city"
18     INPUT People[Count, 3]
19     OUTPUT "Do you want to enter another name (Y or N)?"
20     INPUT Response
21     IF Response = 'N'
22       THEN
23         Continue ← FALSE
24       ELSE
25         Count ← Count + 1
26     ENDIF
27 UNTIL NOT Count
```

(a) Identify the line numbers of the **four** errors in the pseudocode and suggest corrections.

Error 1 line number .....

Correction .....

.....

Error 2 line number .....

Correction .....

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Error 3 line number .....

Correction .....

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Error 4 line number .....

Correction .....

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[4]

(b) Write the pseudocode that you could add to the end of this algorithm to output the contents of the array. Make sure that the output ends when the data in the array ends.

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..... [4]

(c) Explain how you could alter the original corrected algorithm to make sure that the number of elements being added to the array does not exceed the maximum size of the array (50 elements).

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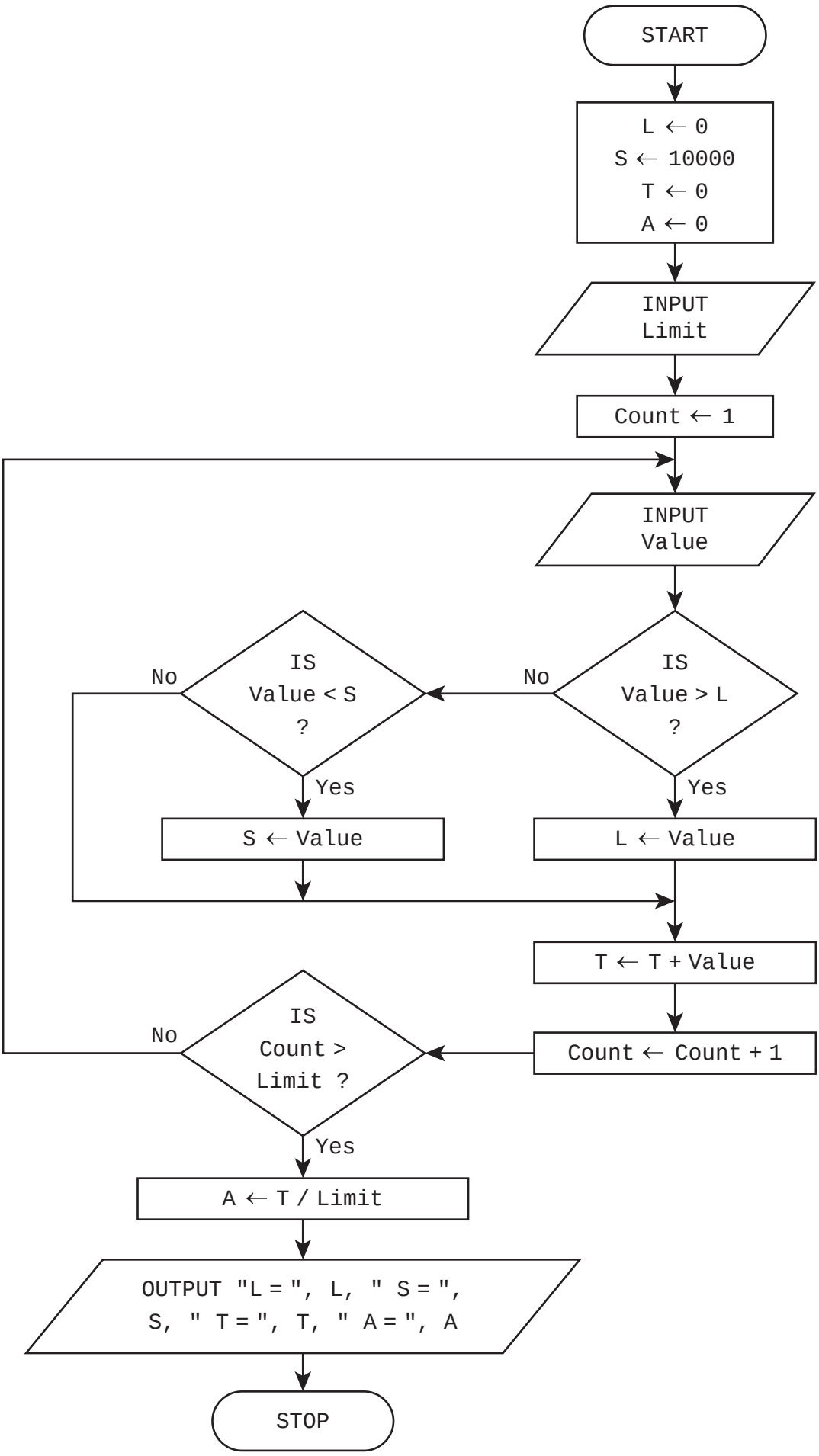
..... [4]

5 The flowchart represents an algorithm.



(a) Complete the trace table for the input data:

10, 30, 18, 8, 25, 12, 17, 2, 50, 15, 5

L	S	T	A	Limit	Count	Value	OUTPUT

[6]

(b) Outline the purpose of the algorithm.

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..... [2]

(c) Explain why the identifiers L, S, T and A may **not** be appropriate to use as identifiers and how they could be improved.

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..... [3]

(d) State a more appropriate identifier for each of the variables L, S, T and A

Original identifier	Improved identifier
L	
S	
T	
A	

[2]

6 A program is to be written that will accept integers that are between the values of 1 and 80 inclusive.

(a) Give examples of normal, abnormal and extreme test data that could be used to make sure the program only accepts valid data.

Normal test data .....

Abnormal test data .....

Extreme test data .....

[3]

(b) Describe what is meant by extreme test data.

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..... [2]

7 **(a)** The string operation `SUBSTRING(FullText, X, Y)` returns a string from `FullText` beginning at position `X` that is `Y` characters long. The first character in `FullText` is in position 1.

Write the pseudocode statements to:

- store the string “IGCSE Computer Science at Cambridge” in `FullText`
- extract and display the words “Computer Science” from the string and store it in a suitable variable
- output the original string in upper case.

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..... [4]

(b) Write the pseudocode statements to:

- store the content of the variable you created in part **(a)** to a text file named `"Subjects.txt"`
- close the text file at the end of the algorithm.

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..... [3]

[Turn over

8 A database table called `Hangar1` stores details of a collection of historic aircraft at a museum.

ID	Make	Model	Year	Engines	Airworthy
JM1	Hawker Siddeley	Nimrod	1966	4	Y
JM2	Douglas	DC-10	1970	3	Y
JM3	Aérospatiale-BAC	Concorde	1973	4	N
PB1	De Havilland	DH-9	1918	1	Y
PB2	Hawker	Fury	1935	1	Y
PB3	Hawker	Nimrod	1934	1	Y
PM1	Fieseler	Storch	1942	1	N
PM2	Hawker	Hurricane	1942	1	Y
PM3	Supermarine	Spitfire	1942	1	N
PM4	Douglas	C-47 Dakota	1942	2	N
PS1	Boeing	314 Clipper	1936	4	N

(a) State the number of fields and records in the database table.

Fields .....

Records .....

[2]

(b) Give the output that would be produced by the structured query language (SQL) statement:

```
SELECT Model, Year, Engines
FROM Hangar1
WHERE Engines > 1
ORDER BY Year;
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..... [4]

(c) Complete the SQL statement to display only the ID and model of all the aircraft that are airworthy.

```
SELECT ID, .....
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..... ;
```

[4]

9 A one-dimensional (1D) array `Teams[]` contains the names of 10 football teams in a local league. A two-dimensional (2D) array `Results[]` stores, for each team, the total number of:

- games won
- games drawn
- games lost
- points.

The position of any team's data is the same in both arrays. For example the data in index 3 of `Results[]` belongs to the team in index 3 of `Teams[]`

The array data will be used to find the current leader of the league.

The variable `Played` stores the number of games played by each team. Each team plays the same number of games.

Write a program that meets the following requirements:

- allows the number of games played to be input and stored, with a maximum of 18 games
- allows the names of the teams to be input and stored
- allows the number of games won, drawn and lost to be input and stored for each team
- validates the number of games played and the number of games won, drawn or lost against the number of games played
- calculates and stores the number of points for each team using three points for a win and one point for a draw; there are no points for a loss
- sorts the array `Results[]` into descending order of number of points, ensuring the corresponding parallel array `Teams[]` is kept in the same order
- determines how many teams have the highest number of points
- outputs the name(s) of the winning team(s) along with the number of points achieved.

You must use pseudocode or program code **and** add comments to explain how your code works.

You do **not** need to declare any arrays, variables or constants; you may assume that this has already been done.

All inputs and outputs must contain suitable messages.

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