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COMPUTER SCIENCE **0478/21**

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.

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[Turn over

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

A validation check to make sure that an email address contains an '@' sign is a

A range check. ☐

B visual check. ☐

C presence check. ☐

D format check. ☐

[1]

2 **Four** descriptions of programming concepts and **five** programming concepts are shown.

(a) Draw **one** line to link each description to the most appropriate programming concept.

Not all programming concepts will be used.

Description	Programming concept
a subroutine that may **not** return a value	function
a value that is declared and used within a specific procedure	procedure
a value that a procedure expects you to supply when it is called	parameter
a subroutine that will always return a value	global variable
	local variable

[4]

(b) Write the pseudocode to use a procedure named `Average` that passes the values `25` and `50` to the procedure.

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..... [2]

(c) Outline the role of procedures and functions in creating a program that is easier to maintain.

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..... [3]

3 State what is meant by the data types integer and real.
Give an example of each.

Integer .....

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Example .....

Real .....

.....

Example .....
[4]

4 This pseudocode algorithm is intended to allow, at random, between 1 and 20 values to be entered and totalled. The total and average of the entered values are output at the end of the algorithm.

```
01 DECLARE Loop : STRING
02 DECLARE Limit : INTEGER
03 DECLARE Value : REAL
04 DECLARE Total : REAL
05 Total ← 0
06 Limit ← ROUND(RANDOM() * 19,0) + 1
07 IF Loop ← 1 TO Limit
08     OUTPUT "Enter a number"
09     INPUT Loop
10     Total ← Total * Value
11 NEXT Loop
12 OUTPUT "The total of the numbers entered is ", Total
13 OUTPUT "The average of the numbers entered is ", Total / Limit
```

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

Error 1 line number .....

Correction .....

.....

Error 2 line number .....

Correction .....

.....

Error 3 line number .....

Correction .....

.....

Error 4 line number .....

Correction .....

.....

[4]

(b) Write the pseudocode statement that would output the average calculated in line 13 of the algorithm rounded to **one** decimal place.

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..... [2]

(c) Explain how you should alter the original corrected algorithm to make sure that all the numbers entered are between 1 and 500 inclusive. If any numbers fall outside these limits, a replacement value is requested and entered.

You do **not** need to re-write the algorithm.

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..... [4]

5 Write the pseudocode statements to perform this task:

- accept the input of a whole number from 1 to 4 inclusive
- use a `CASE` statement to:
  - output the number (1 to 4 inclusive) that was entered
  - output the word “ERROR” if a 1 to 4 inclusive number was **not** entered.

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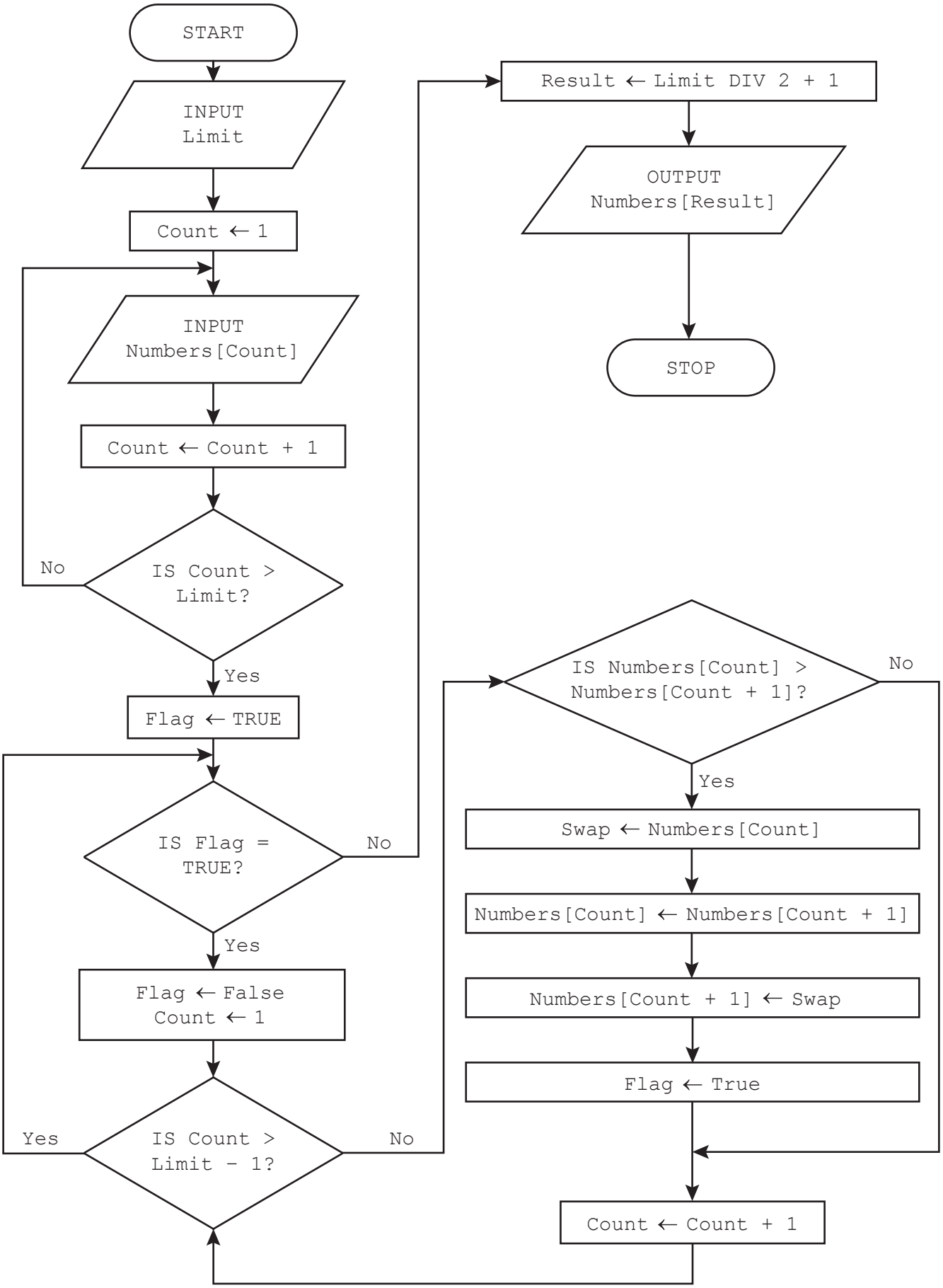
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..... [5]

6 The flowchart represents an algorithm.



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

7, 47, 50, 52, 60, 80, 63, 70

		Numbers										
Limit	Count	[1]	[2]	[3]	[4]	[5]	[6]	[7]	Flag	Swap	Result	OUTPUT

[7]

(b) Outline the processes involved in the algorithm shown in the flowchart on **page 6**.

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..... [3]

7 **(a)** Outline why it is useful to store data in a file.

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..... [2]

(b) The function `LENGTH(X)` calculates the length of a string `X`

Write the pseudocode statements to:

- read the contents of the text file `Quotation.txt` into an appropriate string variable that has been declared
- output the string in upper case and the length of the string.

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..... [4]

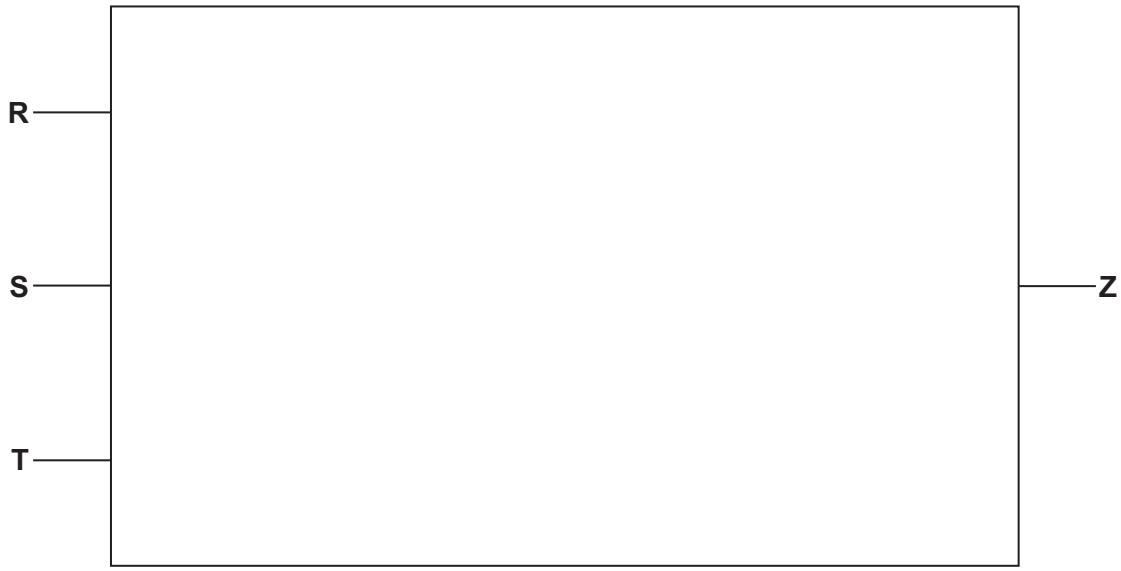
8 Consider the logic expression:

Z = (**R** OR NOT **T**) XOR (NOT **S** AND **T**)

(a) Draw a logic circuit for this logic expression.

Each logic gate must have a maximum of **two** inputs.

Do **not** simplify this logic expression.



[5]

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

R	S	T	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]

9 A database table called `SoftDrinks` stores details of the soft drinks sold by a small shop.

Field	Example data
`Name`	Cola
`Supplier`	Cambridge Beverages
`Container`	Can
`SizeCl`	330
`NumberInStock`	30
`ReorderLevel`	15
`Reordered`	Yes

(a) State whether any of the given fields would be suitable as a primary key and give a reason for your answer.

.....

..... [1]

(b) Complete the structured query language (SQL) statement to return the number of cans the shop has in stock.

```
SELECT ..... (.....)

FROM .....

WHERE ..... = ..... ;
```

[5]

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10 The one-dimensional (1D) array `Clubs[]` is used to store the names of 12 cricket clubs in a local sports league.

The two-dimensional (2D) array `Statistics[]` is used to store, for each cricket club, the number of:
- matches won
- matches drawn
- matches lost.

The 1D array `Points[]` is used to store the total number of points each cricket club has been awarded.

The position of any cricket club's data is the same in all three arrays. For example, the data in index 2 of `Statistics[]` and index 2 of `Points[]` belongs to the cricket club in index 2 of `Clubs[]`

The variable `Matches` stores the number of matches played by each team. Each team plays the same number of matches.

Points are awarded for:
- a win – 12 points
- a draw – 5 points
- a loss – 0 points.

Write a program that meets the following requirements:
- allows the number of matches played to be input and stored, with a maximum of 22 matches
- validates the number of matches played
- allows the names of the cricket clubs to be input and stored
- allows the number of matches won, drawn and lost to be input and stored for each team
- validates the number of matches won, drawn or lost against the number of matches played
- asks the user to re-enter the number of matches won, drawn or lost if the total does not match the number of matches played
- calculates and stores the total number of points for each club
- finds the cricket club or clubs with the highest number of points
- outputs the name or names of the winning club or clubs, the number of wins and the total number of points awarded.

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.

All inputs and outputs must contain suitable messages.

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[15]

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