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CANDIDATE NAME

CENTRE NUMBER

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9040223225

COMPUTER SCIENCE **0478/22**

Paper 2 Algorithms, Programming and Logic **February/March 2026**

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. Do **not** use correction fluid or tape.
- 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 **20** pages. Any blank pages are indicated.

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1 Tick (✓) **one** box to identify the reason for applying a verification check to input data.

A To make sure that all the data is in the correct range. ☐

B To make sure that all the data is accurate. ☐

C To make sure that no errors have been introduced during input. ☐

D To make sure that all the data is of the correct length. ☐

[1]

2 **(a)** Identify the type of validation check in each description. Each check must be different.

(i) A check to make sure that data input follows a set pattern such as two letters followed by three numbers.

..... [1]

(ii) A check to make sure that only whole numbers can be input.

..... [1]

(b) Explain the reasons why validation checks are necessary when data is input.

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..... [3]

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(c) Write the pseudocode for an algorithm to perform a validation check on each number as it is input to meet the following criteria:

- Input 20 numbers, one at a time.
- If a number is negative, store it in the current element of array `NegNumbers[]`
- If a number is **not** negative, ask for it to be input again until a negative number is input.
- When all 20 negative numbers have been stored, output a message to state the check has been completed.

Use appropriate input prompts and output messages to make the requirements clear to the user.

Do **not** declare any arrays or variables for this algorithm.

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..... [6]

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3 The program development life cycle is split into a number of stages.

Describe what happens during the analysis and design stages of the program development life cycle.

analysis .....

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design .....

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[6]

4 Tick (✓) **one** box to identify which of the following does **not** help to create a maintainable program.

A Use meaningful identifiers for variable names. ☐

B Remove blank lines to make the program code shorter. ☐

C Use procedures and functions. ☐

D Use the commenting feature provided by the programming languages. ☐

[1]

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5 This pseudocode algorithm is intended to sort 200 names in ascending order, using a bubble sort. The last names and first names are stored in separate columns of a two-dimensional (2D) array. The last names are stored in column 1 of the array.

```
01 // The array Names[] has already been declared as
02 // ARRAY[1:200, 1:2] OF STRING and it is already populated
03 DECLARE Row : STRING
04 DECLARE Temp1 : STRING
05 DECLARE Temp2 : STRING
06 DECLARE Swap : BOOLEAN
07 Swap ← FALSE
08 WHILE NOT Swap DO
09     Swap ← FALSE
10     FOR Row ← 2 TO 199
11         IF Names[Row, 1] > Names[Row + 1, 1]
12           THEN
13             Temp1 ← Names[Row, 1]
14             Temp2 ← Names[Row, 2]
15             Names[Row, 1] ← Names[Row + 1, 1]
16             Names[Row, 1] ← Names[Row + 1, 2]
17             Names[Row + 1, 1] ← Temp1
18             Names[Row + 1, 2] ← Temp2
19             Swap ← FALSE
20         ENDIF
21     NEXT Column
22 ENDWHILE
```

(a) Identify the line numbers of **five** 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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error 5 line number .....

correction .....

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[5]

(b) Write the pseudocode for an algorithm, using nested iteration, to output the contents of `Names[]`

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..... [4]

(c) Describe a possible problem with the algorithm that could mean the names are **not** sorted accurately.

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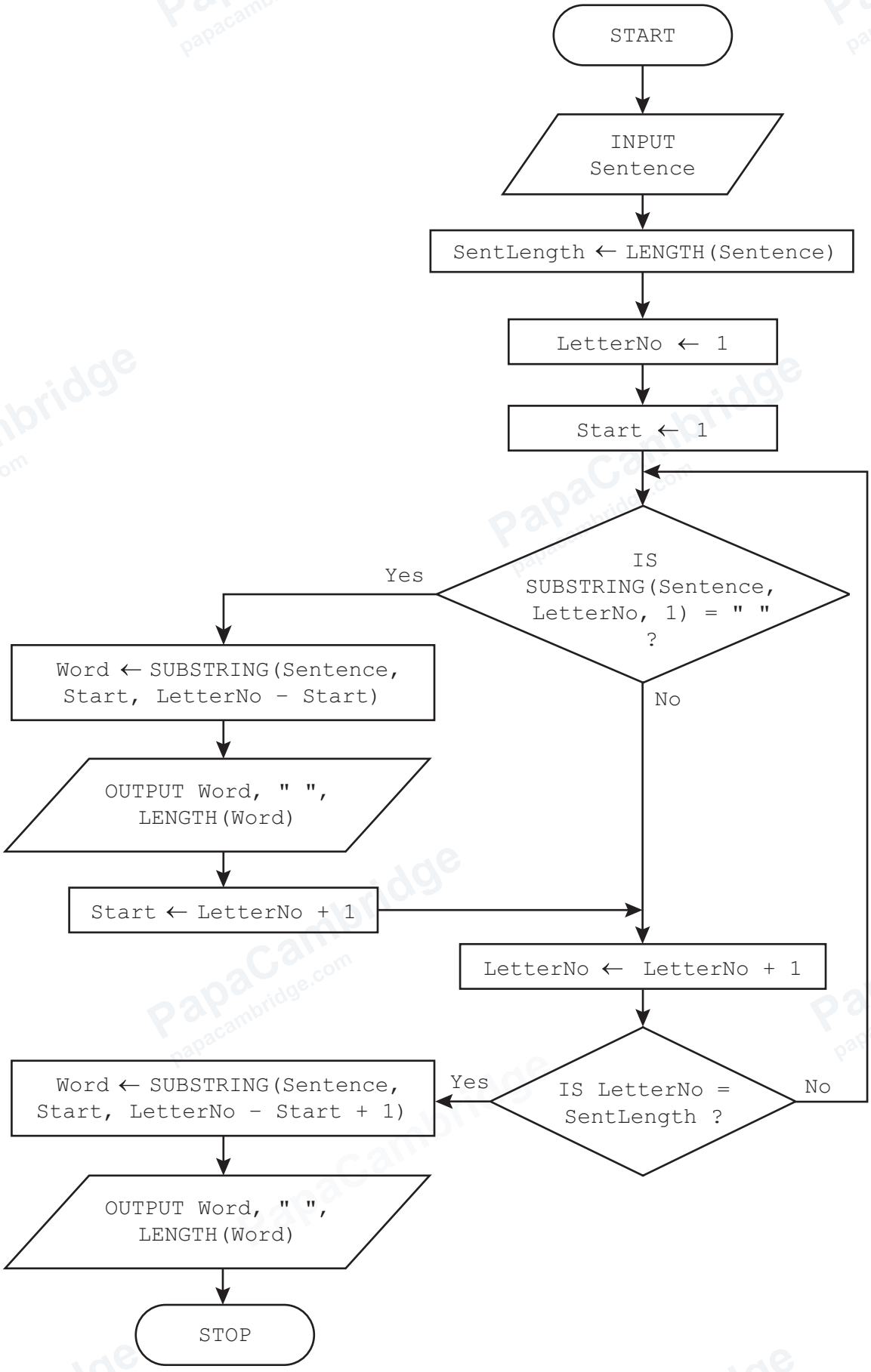
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6 This flowchart represents an algorithm.



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(a) Complete the trace table for the algorithm, using the given sentence.

Note: the start position of the sentence is index 1.

Sentence	SentLength	LetterNo	Start	Word	OUTPUT
Computing is fun	16				

[5]

(b) Explain the purpose of the algorithm shown by the flowchart.

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..... [3]

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(c) As currently written, the algorithm may be difficult to understand if it was used as a program.

Identify **three** improvements that could be made to the algorithm to make it more user friendly.

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7 Consider the logic expression:

X = (**A** NAND NOT **B**) XOR (**A** NOR **C**)

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

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

Do **not** simplify the logic expression.



[4]

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

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 database table `NATIONAL_TREES` stores details of the national trees of some countries from around the world.

IDCode	Country	Continent	CommonName	ScientificName
EU121	Albania	Europe	Olive	Olea europaea
OC235	Australia	Oceania	Golden wattle	Acacia pycnantha
NO126	The Bahamas	North America	Lignum vitae	Guaiacum sanctum
AS534	Bangladesh	Asia	Mango tree	Mangifera indica
SO326	Brazil	South America	Brazilwood	Caesalpinia echinata
NO124	Canada	North America	Maple	Acer
EU321	Cyprus	Europe	Golden oak	Quercus alnifolia
NA456	Dominican Republic	North America	West Indian mahogany	Swietenia mahagoni
EU652	Finland	Europe	Silver birch	Betula pendula
AS222	India	Asia	Indian banyan	Ficus benghalensis
NO232	Jamaica	North America	Blue mahoe	Taliparitiparitipariti

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

```
SELECT IDCode, Country, CommonName
FROM NATIONAL_TREES
WHERE Continent = "Europe";
```

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..... [3]

(d) Complete the SQL statement to list only the country, common name and scientific name of the national trees listed for North America, in alphabetical order of their common names.

```
SELECT .....

FROM .....

WHERE .....

..... ;
```

[5]

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9 A program is required to enable voting in class surveys, for example to find the most popular smartphone.

The one-dimensional (1D) array `Options[]` is used to store between 2 and 12 options on which users can vote.

The one-dimensional (1D) array `Votes[]` is used to store the votes of between 2 and 1000 users.

The one-dimensional (1D) array `VoteCount[]` is used to store the number of votes for each of the options. The array index represents the option number.

Write a program for the following requirements:

- Initialise all the arrays before they are used.
- Input and validate the number of options and the number of voters.
- Input each of the required options and store them in the array `Options[]`
- Display the list of options for each voter and allow each voter to input their preferred option. Validate this input and store it in the array `Votes[]`
- Once all the votes have been input, count the number of voters who chose each option and find the most and least popular options.
- Output the most and least popular options as well as the number of voters who selected each of these options.

The program does **not** need to identify if two or more options are the equal most or least popular.

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

Do **not** declare arrays, variables or constants for this algorithm; assume this has been done. Initialisation must be carried out as appropriate.

All inputs and outputs must contain suitable messages.

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