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Cambridge Assessment International Education

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COMPUTER SCIENCE **0478/21**

Paper 2 Algorithms, Programming and Logic **October/November 2025**

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 **20** pages. Any blank pages are indicated.

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1 **Four** descriptions of structured query language (SQL) keywords and **five** SQL keywords are given.

Draw **one** line from each description to its matching keyword.
Not all SQL keywords will be used.

Description	SQL keywords
identifies the database table	ORDER BY
sets the condition	COUNT
sorts the results	WHERE
returns the number of records	SUM
	FROM

[4]

2 Identify **three** different types of test data that can be used to test a program.

1 .....

2 .....

3 .....

[3]

3 Tick (✓) **one** box to identify the operator that returns the quotient of a calculation with the fractional part discarded.

A /

B DIV

C ^

D MOD

[1]

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4 **(a)** A restaurant offers a fixed priced menu. A meal for an adult costs $9.99 and a meal for a child costs $6.99.

If there are 6 or more people at a table, a 15% discount is applied to the total cost of the order.

Write an algorithm in pseudocode to:

- input the number of adults and the number of children at a table
- calculate the total cost of the order with the discount, if this applies
- output the final cost of the order.

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..... [5]

(b) The final cost of the order after the discount may have more than 2 decimal places.

Write a pseudocode statement to set the final cost of the order to 2 decimal places.
You do **not** need to rewrite the whole algorithm.

.....

..... [2]

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(c) The restaurant offers a discount on a meal if the person ordering is either a student or is 65 years or older. The discount (**X** = 1) can only be given if the amount of the order is $20.00 or over.

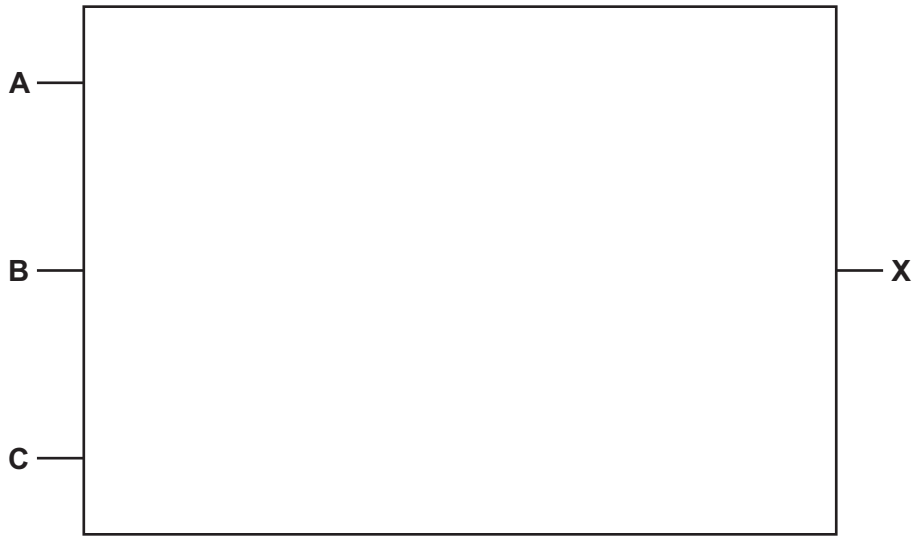
rule **A**	a student	0
	not a student	1
rule **B**	under 65 years old	0
	65 years or older	1
rule **C**	under $20.00	0
	$20.00 or over	1

(i) Write the logic expression for this problem.

..... [2]

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

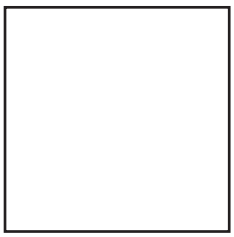
Each logic gate must have a maximum of **two** inputs.
Do **not** simplify this logic expression.



[3]

(d) Draw the NAND logic gate symbol **and** complete the truth table for it.

NAND logic gate symbol:



Truth table:

A	B	X
0	0	
0	1	
1	0	
1	1	

[2]

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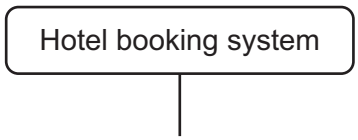
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5 A hotel booking system is an example of a computer system that is made up of sub-systems.

The booking system:

- allows the user to select the room type and the number of nights required
- displays the types of rooms available to the user as pictures or as a list.

Complete the structure diagram for the given parts of the hotel booking system.



[4]

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6 A check digit is one method to validate a 5-digit number.

The check digit for a 5-digit number is calculated as follows:

- Each digit is multiplied by its position (the first digit on the left is in position 1).
- The result of each multiplication is totalled.
- `MOD(Total, 11)` is used to calculate the check digit.
- If the result of the MOD function is 10, the check digit is 'X'.

For example:

The calculation of the check digit for the 5-digit number 30475 is as follows:

Multiply each digit by its position and total the results:

(3 * 1) + (0 * 2) + (4 * 3) + (7 * 4) + (5 * 5) = 68

Calculate the check digit with `MOD(Total, 11)`

`MOD(68, 11) = 2`

The check digit for 30475 is 2

This pseudocode algorithm should calculate and output the check digit of a 5-digit number:

```
01  DECLARE Total : INTEGER
02  DECLARE Digit : INTEGER
03  DECLARE CheckDigit : CHAR
04  Total ← 0
05  FOR Count ← 1 TO 10
06      OUTPUT "Please enter digit ", Count
07      INPUT Digit
08      Total ← Total + (Digit / Count)
09  NEXT Count
10  CheckDigit ← MOD(Total, 11)
11  IF CheckDigit = 10
12    THEN
13      OUTPUT "The check digit is X"
14    ELSE
15      OUTPUT "The check digit is ", Count
16  ENDIF
```

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(a) Identify the line numbers of the **four** errors in the pseudocode and suggest a correction for each error.

Error 1 line number .....

Correction .....

.....

Error 2 line number .....

Correction .....

.....

Error 3 line number .....

Correction .....

.....

Error 4 line number .....

Correction .....

.....

[4]

(b) Explain how you could modify the pseudocode to validate that each input is a single digit.

Any code must be fully explained.

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..... [3]

(c) The 5-digit number needs to be entered as a single input.

Describe **one** verification method that could be applied to the input of the 5-digit number.

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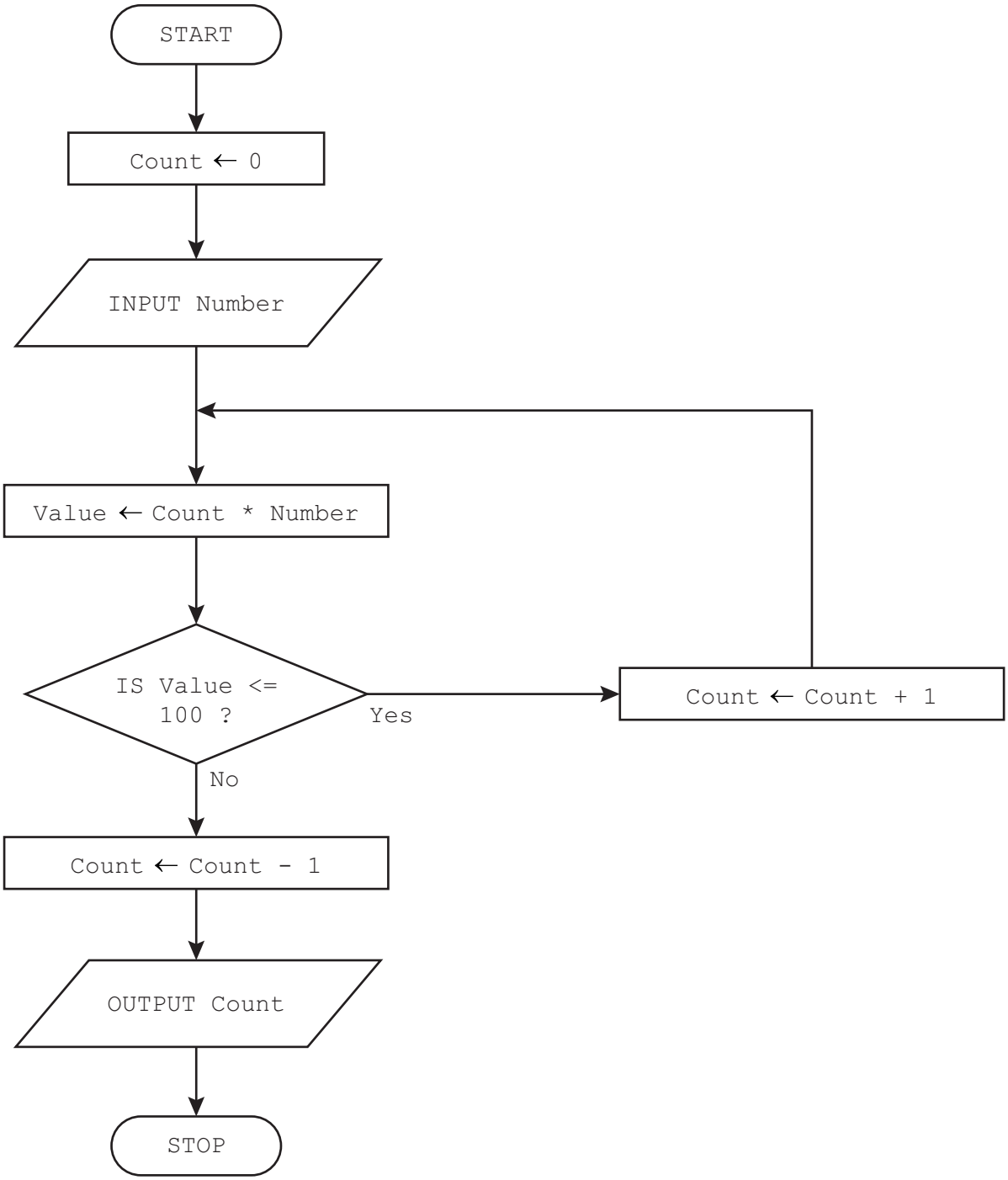
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7 The flowchart represents an algorithm.



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(a) Complete the tables, using the flowchart, for the given data:

Input data: 20

Count	Number	Value	Output

Input data: 110

Count	Number	Value	Output

[4]

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(b) State the purpose of the algorithm on page 8. A copy of the algorithm is provided for you on page 11.

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..... [1]

(c) State a suitable data type for the variable `Count`

..... [1]

(d) Write the algorithm in pseudocode. A copy of the algorithm is provided for you on page 11.

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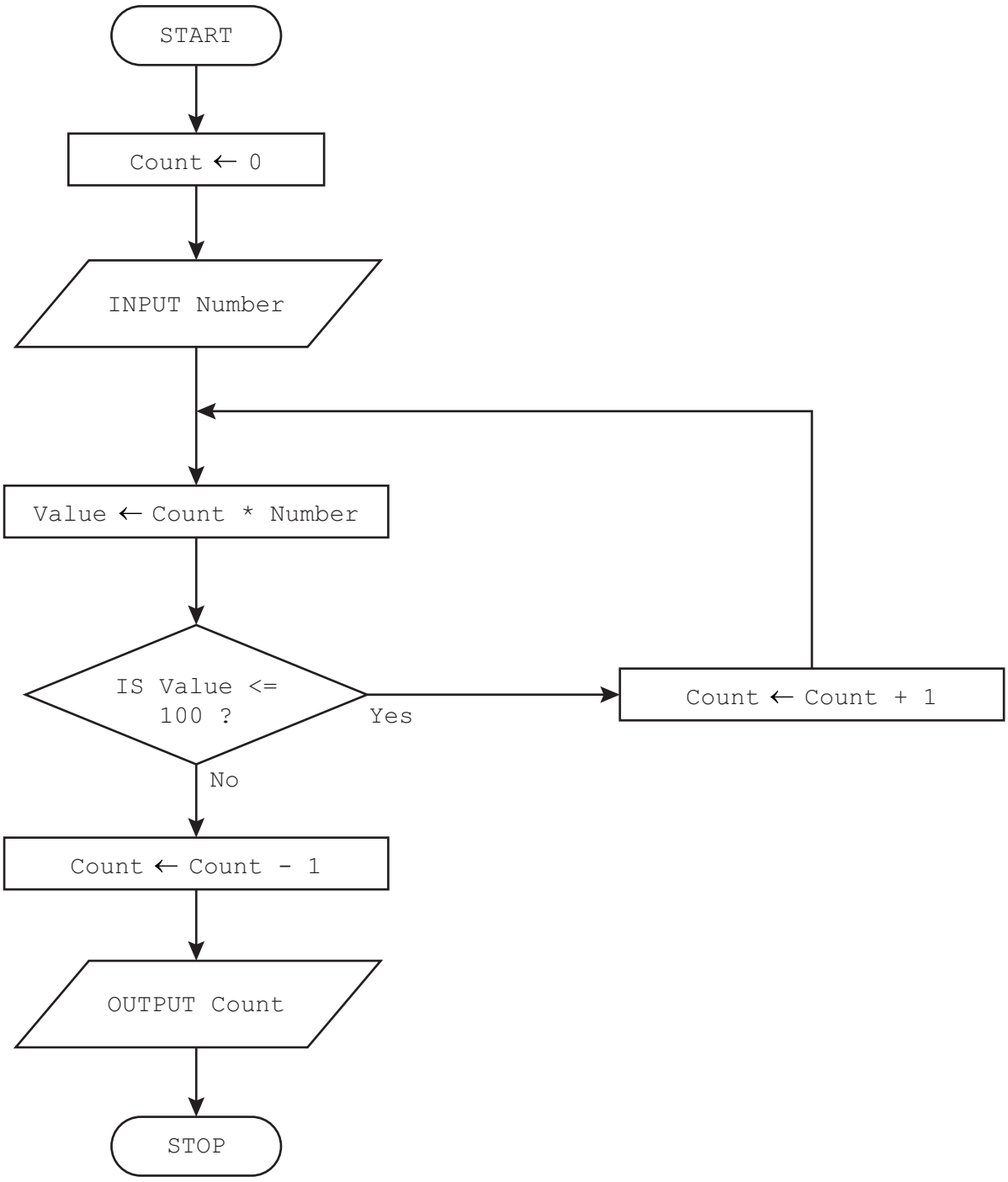
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8 A school has set up a database table `SchoolTrip` to record details of students that will go on a school trip.

StudentID	StudentName	ParentName	Permission	DateReceived
STU147	Amir	Mr Akar	True	03/03/2025
STU348	Filip	Mrs Johnson	True	04/03/2025
STU274	Matthew	Mr Smith	False	
STU873	Jafar	Mr Al-Saigh	True	21/03/2025
STU221	Hussein	Mr Alkasab	True	28/02/2025
STU553	Julie	Mrs Jones	True	25/02/2025
STU213	Julie	Mr Smith	False	

(a) State the reason why `ParentName` is **not** appropriate as the primary key.

..... [1]

(b) Give the name of the field that should be the primary key.

..... [1]

(c) The database only uses these data types:

- text
- character
- Boolean
- integer
- real
- date/time.

Complete the table to show the most appropriate data type for each field.
Each data type must be different.

Field	Data type
`ParentName`	
`Permission`	
`DateReceived`	

[2]

(d) Complete the structured query language (SQL) statement to display only the names of the students who do **not** have permission to go on the trip.

```
SELECT .....

FROM .....

WHERE .....
```

[2]

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9 A school stores all the students' attendance data in a file called `Attendance.txt`

Write an algorithm in pseudocode to read a line of text from the file and store this line in the variable `StudentAttendance`

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..... [4]

10 The variables `Seconds` and `Minutes` are used in a program. `Seconds` holds the number of seconds as a whole number and `Minutes` holds the number of minutes as a whole number.

(a) Write pseudocode statements to declare the variables `Seconds` and `Minutes`

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..... [1]

(b) The procedure `Time(TotalSeconds)` takes the number of seconds as a parameter. The procedure converts the value held in the parameter into minutes and seconds and outputs the result.

Write this procedure in pseudocode.

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..... [4]

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11 The scores for each competitor in an archery competition are recorded.

The one-dimensional (1D) array `CompetitorName[]` is used to store the names of the competitors.

The maximum number of competitors is 30.

There are 10 rounds in the competition with a maximum score of 30 per round.

The two-dimensional (2D) array `CompetitorScore[]` stores the score in each of the 10 rounds for each competitor.

The first index of the array `CompetitorScore[]` is the same as the index of the competitor in `CompetitorName[]`

After the 10 rounds have been completed, the highest score and the lowest score for each competitor are discarded.

The overall score for each competitor is the total of the remaining 8 scores (after discarding the highest and lowest scores) .

A competitor with an overall score of 210 or more moves onto the next competition. A competitor with an overall score between 180 and 209 inclusive becomes a reserve competitor. A competitor with an overall score below 180 does not qualify.

Write a program that meets the following requirements:

- inputs the total score (out of 30) for each competitor in each round
- validates each input is between 0 and 30 inclusive
- calculates the overall score for each competitor discarding the highest and lowest scores
- outputs the name of each competitor and if they move onto the next competition, are a reserve or do not qualify
- calculates and outputs the number of competitors who:
  - have qualified for the next competition
  - are reserve competitors
  - do **not** qualify.

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; assume that this has already been done.

All inputs and outputs must contain suitable messages.

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