Cambridge Assessment International Education

CS BY AQIB KHAN

# Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*8030710069*

**COMPUTER SCIENCE** **2210/22**

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.

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This document has **16** pages. Any blank pages are indicated.

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

Verification is used to make sure that a value entered

**A** has **not** changed during input. ☐

**B** is an integer. ☐

**C** is correct. ☐

**D** is **not** a string. ☐

[1]

**2** A type of validation check is a length check. Another type of validation check is used to make sure that any date entered is in the dd/mm/yyyy style:
dd means day, mm means month and yyyy means year.

**(a)** State the type of validation check used.

..... [1]

**(b)** Give **one** example of normal test data and **one** example of abnormal test data you should use to make sure the check **in part (a)** is working properly.

State a reason for each of your choices of test data.

Normal .....

Reason .....

.....

Abnormal .....

Reason .....

.....

[4]

**(c)** Describe how a length check could be used with the date entered.

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..... [2]

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3 **Four** pseudocode statements and **five** pseudocode uses are shown.

**(a)** Draw **one** line to link each pseudocode statement to the most appropriate pseudocode use.

**Not** all pseudocode uses will be required.

| **Pseudocode statement** | **Pseudocode use** |
|---|---|
| `CALL Colour(NewColour)` | counting |
| | finding an average |
| `Value ← (A1 + A2 + A3) / 3` | totalling |
| `Loop1 ← Loop1 + 1` | using a conditional statement |
| `IF Count > 7 THEN X1 ← 0` | using a procedure |

[4]

**(b)** A one-dimensional (1D) array called `Temperatures[]` has 25 elements beginning at index 1. It holds values that range between –20 and 100 inclusive.

Write a pseudocode algorithm using a single loop to find the lowest value in this array and output the result only once.

You do **not** need to declare or populate this array.

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**4** An algorithm has been written in pseudocode to allow the names of 50 cities and their countries to be entered and stored in a two-dimensional (2D) array. The contents of the array are then output.

```
01 DECLARE City ARRAY[1:50, 1:2] OF BOOLEAN
02 DECLARE Count : INTEGER
03 DECLARE Out : INTEGER
04 Count ← 1
05 IF
06     OUTPUT "Enter the name of the city"
07     INPUT City[Count, 2]
08     OUTPUT "Enter the name of the country"
09     INPUT City[Count, 2]
10     Count ← Count + 1
11 UNTIL Count = 50
12 FOR Out ← 1 TO 1
13     OUTPUT "The city ", City[Out, 1], " is in ", City[Out, 2]
14 NEXT Out
```

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

Error 1 .....

Correction .....

.....

Error 2 .....

Correction .....

.....

Error 3 .....

Correction .....

.....

Error 4 .....

Correction .....

.....

[4]

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**(b)** Describe the changes you should make to the corrected algorithm to allow the name of a country to be input and to display only the stored cities from that country.

You do **not** need to rewrite the algorithm.

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..... [5]

**5** Explain how variables and constants should be used when creating and running a program.

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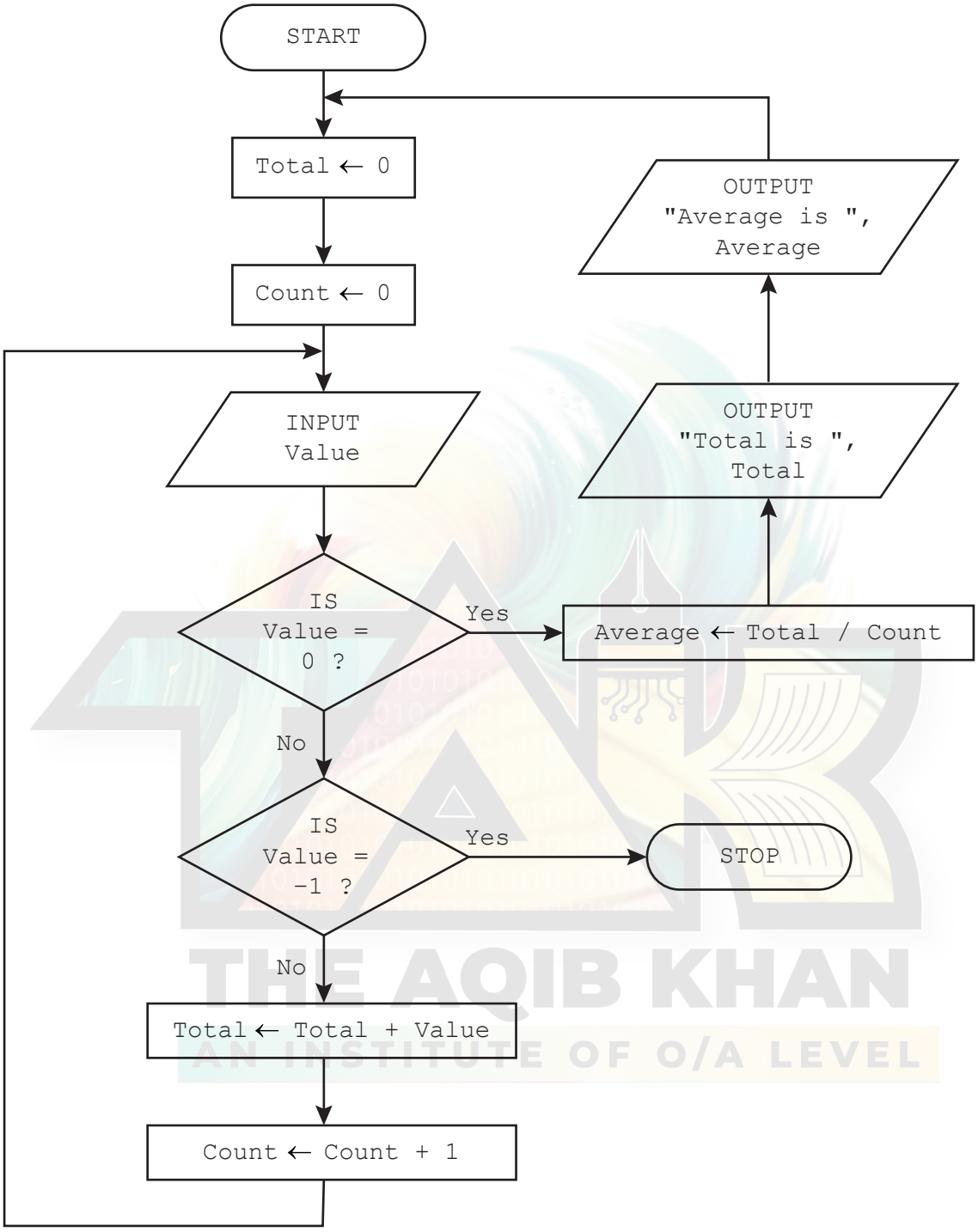
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..... [3]

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6 The flowchart represents an algorithm that performs a process on groups of values that are input. The algorithm will fail if the first value of any group is 0.

An input of –1 will terminate the algorithm.




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

25, 35, 3, 0, 57, 20, 25, 18, 0, –1, 307, 40, 0

| Value | Average | Total | Count | OUTPUT |
|---|---|---|---|---|
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[5]

**(b)** Describe the purpose of the algorithm.

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..... [2]

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7 The string operation `SUBSTRING(Quote, Start, Number)` returns a string from `Quote` beginning at position `Start` that is `Number` characters long. The first character in `Quote` is in position 1.

Write pseudocode statements to:

- store the string `"Learning Never Exhausts The Mind"` in `Quote`
- extract and display the words `"The Mind"` from the string
- output the original string in lower case.

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..... [5]

8 Explain why a programmer would use procedures and parameters when writing a program.

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..... [4]

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9 Consider the logic expression:

**Z** = (**A** NAND **B**) OR NOT (**B** XOR **C**)

**(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.




[4]

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

| 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]

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**10** A database table called `Horses` stores details about the horses kept at a horse sanctuary.

| Code | Breed | BreedOrigin | Gender | Age | Arrived |
|---|---|---|---|---|---|
| H002 | Arabian | Saudi Arabia | M | 5 | 28/09/2022 |
| H004 | Percheron | France | M | 5 | 30/10/2022 |
| H010 | Friesian | Netherlands | M | 6 | 15/11/2022 |
| H011 | Fjord | Norway | F | 4 | 17/11/2022 |
| H012 | Clydesdale | Scotland | M | 10 | 18/11/2022 |
| H015 | Arabian | Saudi Arabia | F | 5 | 15/12/2022 |
| H016 | Arabian | Saudi Arabia | F | 5 | 15/12/2022 |
| H017 | Clydesdale | Scotland | F | 4 | 16/01/2023 |
| H019 | Percheron | France | M | 3 | 16/01/2023 |
| H025 | Percheron | France | M | 7 | 16/01/2023 |
| H026 | Clydesdale | Scotland | F | 9 | 20/01/2023 |
| H030 | Clydesdale | Scotland | M | 12 | 20/01/2023 |
| H032 | Fjord | Norway | M | 3 | 24/03/2023 |
| H033 | Arabian | Saudi Arabia | F | 15 | 27/04/2023 |
| H034 | Clydesdale | Scotland | F | 4 | 14/06/2023 |
| H035 | Fjord | Norway | M | 7 | 15/06/2023 |
| H036 | Friesian | Netherlands | F | 15 | 20/07/2023 |
| H037 | Friesian | Netherlands | M | 12 | 20/07/2023 |

**(a)** State the number of records in this database table.

..... [1]

**(b)** Give the name of the field that is most suitable to be the primary key.

State the reason for this choice.

Field .....

Reason .....

.....

[2]

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**(c)** The database only allows the data types:

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

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

| Field | Data type |
|---|---|
| Breed | |
| Gender | |
| Age | |
| Arrived | |

[2]

**(d)** Complete the structured query language (SQL) to return the code and breed of all the horses whose breed originated in Scotland.

```
..... Code, Breed,

FROM .....

WHERE ..... = "Scotland";
```

[3]

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**11** A wood flooring company stores the names of up to 100 customers in a one-dimensional (1D) array `Customers[]`. A two-dimensional (2D) array `Quotations[]` stores details of each customer's quotation:

- length of room (one decimal place)
- width of room (one decimal place)
- area of wood required (rounded up to next whole number)
- choice of wood index (whole number)
- price of wood required in dollars (two decimal places).

The floor measurements (room length and room width) are taken in metres. All floors are rectangles and room measurements must be between 1.5 and 10.0 inclusive.

The index of any customer's data is the same in both arrays. For example, a customer named in index 4 of `Customers[]` corresponds to the data in index 4 of `Quotations[]`

The wood choices available are:

| Index | Wood type | Price per square metre ($) |
|---|---|---|
| 1 | Laminate | 29.99 |
| 2 | Pine | 39.99 |
| 3 | Oak | 54.99 |

The data are stored in two 1D arrays named `WoodType[]` and `Price[]`. The index of the wood type and price in their arrays share the same index number.

Write a program that meets the following requirements:

- input a new customer's name, room length and room width
- check that each measurement is valid
- output an error message and require the measurement to be re-entered until it is valid
- calculate the area of the room by multiplying together the length of the room and the width of the room
- input the choice of wood and find its price per square metre
- calculate the price of the wood needed
- store all data in the relevant array
- output the customer's quotation to include: the name of the customer, the choice of wood and the calculated price of the wood required
- continue to accept the next customer.

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 will need to initialise `WoodType[]` and `Price[]`

All inputs and outputs must contain suitable messages.

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[15]

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