Cambridge Assessment International Education

# Cambridge O Level

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| CANDIDATE NAME | | | | | | | | | |
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*9181538378*

**COMPUTER SCIENCE** **2210/23**

Paper 2 Problem-solving and Programming **October/November 2022**

**1 hour 45 minutes**

You must answer on the question paper.

No additional materials are needed.

**INSTRUCTIONS**

- Answer **all** questions.
- **Do not attempt Tasks 1, 2 and 3** in the copy of the pre-release material on page 2; these are for information only.
- 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 50.
- 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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## Section A

**You are advised to spend no longer than 40 minutes answering this section.**

**Here is a copy of the pre-release material.**

**DO NOT** attempt Tasks 1, 2 and 3 now.

Use the pre-release material and your experience from attempting the following tasks before the examination to answer Question 1.

**Pre-release Material**

A program is needed for a window cleaning company to store details of the services provided to their customers for each cleaning job.

The data stored will be used to show the customers exactly what services they are paying for (provide an itemised bill). The data will allow the company to find out which services are used most often and least often.

The services available to customers are:

| Service | Cost |
|---|---|
| basic window clean outside, only one floor, up to five windows | $10.00 |
| additional windows up to and including five | $5.00 |
| two floors | 10% extra |
| three floors | 15% extra |
| inside as well | 25% extra |
| polish all windows cleaned | 5% extra |
| special solar panel clean | $20.00 |

The total cost of the customer's bill is calculated in the same order as the rows of the table.
For example, a customer who has six windows over three floors is charged $10 + $5 with 15% extra, giving a total bill of $17.25.

Write and test a program or programs for the window cleaning company:

- Your program or programs must include appropriate prompts for the entry of data. Data must be validated on entry.
- All outputs, including error messages, need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

**Task 1** – setting up the system to store the customer and service details

Set up your program to:
- store a customer name and address in a single dimensional array at the next position
- use the array index of this position as the unique number of the itemised bill
- store any service required at the same position in the appropriate service array; use an array for each service.

**Task 2** – storing the services for a customer and displaying the itemised bill

Extend your program to:
- display the services and the cost of each one
- input and store a customer's details and the services they require
- calculate the total cost
- display the itemised bill including the total cost and the unique number of the bill
- repeat as required.

**Task 3** – providing statistics about the services

Excluding the basic window clean and the additional windows, find the most popular service and the least popular service. For these two services, display the service name, whether it was the most or least popular and the number of times each service was used as a percentage of the total bills stored.

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**1** All variables, constants and other identifiers must have meaningful names.

**(a) (i)** Identify **one** constant that you could have used for **Task 1**.

State the value that would be assigned to the constant.

Give a reason why a constant was used rather than a variable.

Constant name .....

Value .....

Reason .....

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[3]

**(ii)** Describe the array that you set up in **Task 1** to record the customer details.

Include the name, data type and sample data for the array in your description.

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**(b)** Explain how your program allowed only two floors or three floors to be chosen but **not** both.

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**(c)** Write an algorithm for the part of **Task 2** that calculates the total cost of the bill.
Assume that the customer details and services required have already been input.

Use pseudocode, programming statements or a flowchart.

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**(d)** Explain how your program completed **Task 3**.

Any programming statements that you include in your answer must be fully explained.

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**Section B starts on page 8.**

## Section B

**2** An algorithm has been written to:
- set all 50 elements of the array `Reading[1:50]` to zero
- input values between 35 and 50 inclusive
- end the process when an input of –1 is made or 50 valid numbers have been entered
- reject all other values
- count the number of times each valid value is input
- output the number of times each value has been input, starting with the lowest value.

**(a)** Complete the pseudocode algorithm:

```
01  FOR Count ← 1 TO .....
02    Reading[Count] ← 0
03  NEXT Count
04  Count ← 1
05  OUTPUT "Please enter next reading "
06  INPUT Value
07  REPEAT
08    IF Value < 35 OR .....
09      THEN
10        OUTPUT "Reading out of range"
11      ELSE
12        Reading[Value] ← .....
13    Count = Count + 1
14    ENDIF
15    IF Count <= 50
16      THEN
17        OUTPUT "Please enter next reading "
18       .....
19    ENDIF
20  UNTIL Value = -1 OR Count > 50
21  Count ← 35
22  REPEAT
23    OUTPUT "There are ", .....,
             " readings of ", Count
24    Count ← .....
25  UNTIL Count > 50
```

[6]

**(b)** Describe how the algorithm could be changed to output the number of times each value has been input, starting with the highest value.

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**3** A check digit is to be used to validate an identification number on input. The identification number contains five digits and the check digit.
The check digit is calculated by adding up the first five digits, dividing by 10 and taking the remainder.
For example, `5 + 1 + 2 + 4 + 3` divided by `10` gives a remainder of `5` so the six-digit identification number would be `512435`

**(a) (i)** Calculate the check digit for `69321`

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..... [1]

Working space .....

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**(ii)** State which of these identification numbers have incorrect check digits.

A `123455`
B `691400`
C `722855`
D `231200`

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..... [2]

Working space .....

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**(b) (i)** Describe an input error that would **not** be found using this check digit.

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**(ii)** Describe a more suitable algorithm to calculate the check digit for this identification number.

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**(c)** Identify **two** other validation checks that could be used when inputting this identification number.

1 .....

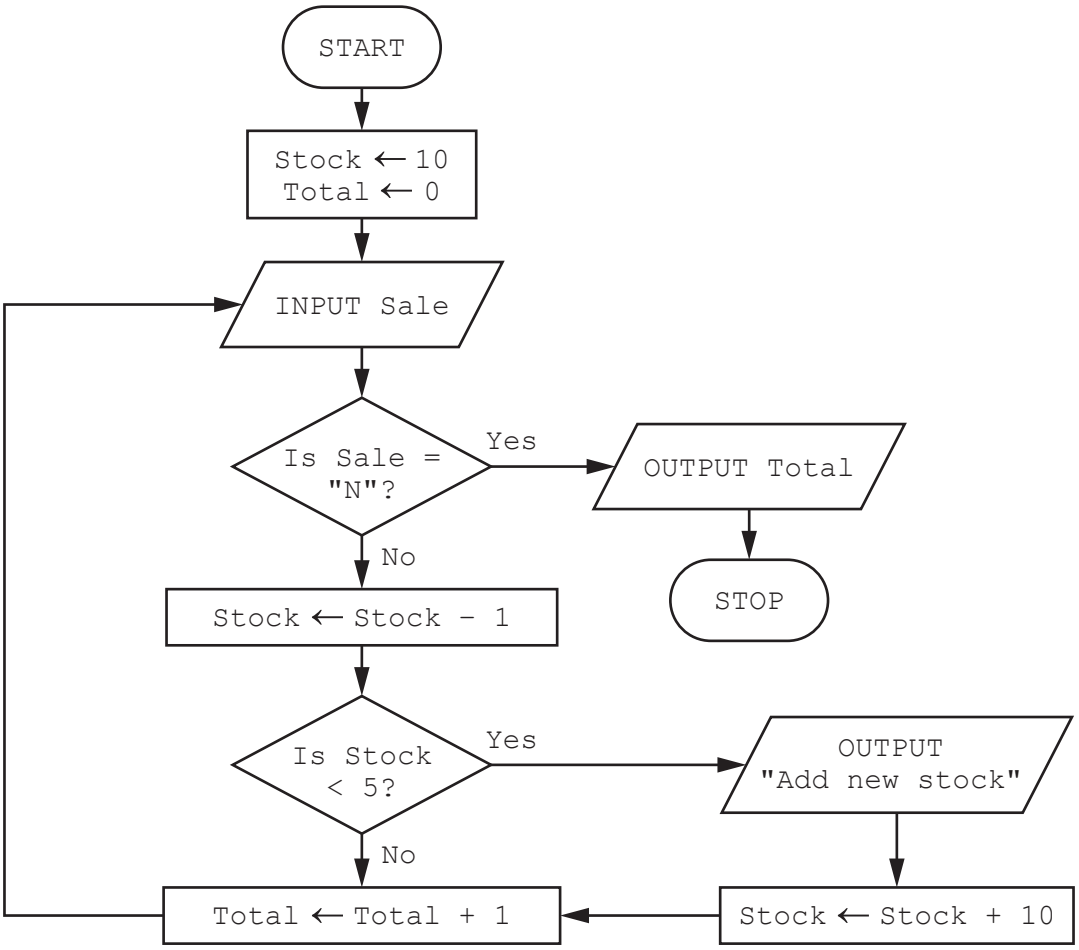
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[2]

**4** This algorithm makes sure that there are enough wheelbarrows in stock.



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

"Y", "Y", "Y", "Y", "Y", "Y", "N"

| Stock | Total | Sale | OUTPUT |
|---|---|---|---|
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**(b)** Explain how you could extend the algorithm to allow for the sale of more than one wheelbarrow at a time.

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**5** A database table, MUSEUM, is used to keep a record of items in the museum. The table has these fields:

- ItemCode – code for each type of item, for example ART0005
- Description – brief description of each item, for example gold coin
- InStore – whether the item is in store or **not**, for example Y
- Century – century when item made, for example 18
- Country – country of origin, for example China.

**(a)** Identify which field you would choose for the primary key.

State a reason for your choice.

Field .....

Reason .....

.....

[2]

**(b)** Complete the query-by-example grid to display only the description and the country of origin for those items **not** in store.

| | | | | |
|---|---|---|---|---|
| Field: | | | | |
| Table: | | | | |
| Sort: | | | | |
| Show: | ☐ | ☐ | ☐ | ☐ |
| Criteria: | | | | |
| or: | | | | |

[3]

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