Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

9119756575

COMPUTER SCIENCE **2210/21**

Paper 2 Problem-solving and Programming **May/June 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 **12** pages.

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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

Friends of Seaview Pier is an organisation devoted to the restoration and upkeep of a pier in the town. A pier is a wooden structure that provides a walkway over the sea. The pier requires regular maintenance and the friends of the pier need to raise money for this purpose.

Members of Friends of Seaview Pier each pay $75 per year, as a contribution to the pier's running costs. This entitles them to free admission to the pier throughout the year. They can also volunteer to help run the pier, by working at the pier entrance gate, working in the gift shop, or painting and decorating.

To provide additional income, the pier's wooden planks can be sponsored. A brass plaque, which contains a short message of the sponsor's choice, is fitted to a plank on the pier, for a donation of $200.

Write and test a program or programs for the Friends of Seaview Pier:
- 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 – becoming a member of Friends of Seaview Pier

Set up a system to enable people to become members of Friends of Seaview Pier and for each new member enter:
- their first name and last name
- whether or **not** they wish to work as a volunteer
  - if they choose to volunteer, identify the area from:
    - the pier entrance gate
    - the gift shop
    - painting and decorating
- the date of joining
- whether or **not** they have paid the $75 fee.

All of this information needs to be stored using suitable data structures.

Task 2 – using the membership data

Extend the program in **Task 1** so that a list of the first and last names of members can be output in any of the following categories:
- Members who have chosen to work as volunteers.
- Volunteers who would like to work at the pier entrance gate.
- Volunteers who would like to work in the gift shop.
- Volunteers who would like to help with painting and decorating tasks.
- Members whose membership has expired (they have **not** re-joined this year).
- Members who have **not** yet paid their $75 fee.

Task 3 – sponsoring a wooden plank

Add an additional option to the program in **Task 1** to enable the pier's wooden planks to be sponsored. Separate data structures should be used to store the names of the individuals and the short messages they would like to have written on their brass plaque. An output would display everything that was input for the sponsor to confirm. If errors are found, the program should allow data to be re-entered. Once complete, the data is stored and the sponsor is charged $200.

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1 **(a)** Describe the data structures you could have used in **Task 1**. Your description should include types of data structure, names used for data structures, their uses and examples of sample data.

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..... [5]

(b) Explain how you could change your program in **Task 1** to total all the money collected from new members who have paid.

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(c) Describe how data input in **Task 1** could be validated to find out if a new member wants to work as a volunteer.

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..... [3]

(d) Write an algorithm to show how your program completes **Task 3** assuming the option to sponsor a wooden plank has been chosen, using pseudocode, programming statements or a flowchart. Details completed in **Task 1** are **not** required.

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[5]

(e) Explain how your program allows any one of the member or volunteer lists to be selected and displayed (part of **Task 2**). Any programming statements used in your answer must be fully explained.

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..... [4]

Section B

2 Tick (✓) **one** box in each row to identify the most appropriate data type for each description. Only **one** tick (✓) per column.

Description	Data type				
	Boolean	**Char**	**Integer**	**Real**	**String**
a single character from the keyboard					
multiple characters from the keyboard					
only one of two possible values					
only whole numbers					
any number					

[4]

3 Give **one** piece of normal test data and **one** piece of erroneous test data that could be used to validate the input of an email address.

State the reason for your choice in each case.

Normal test data .....

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Reason .....

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Erroneous test data .....

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Reason .....

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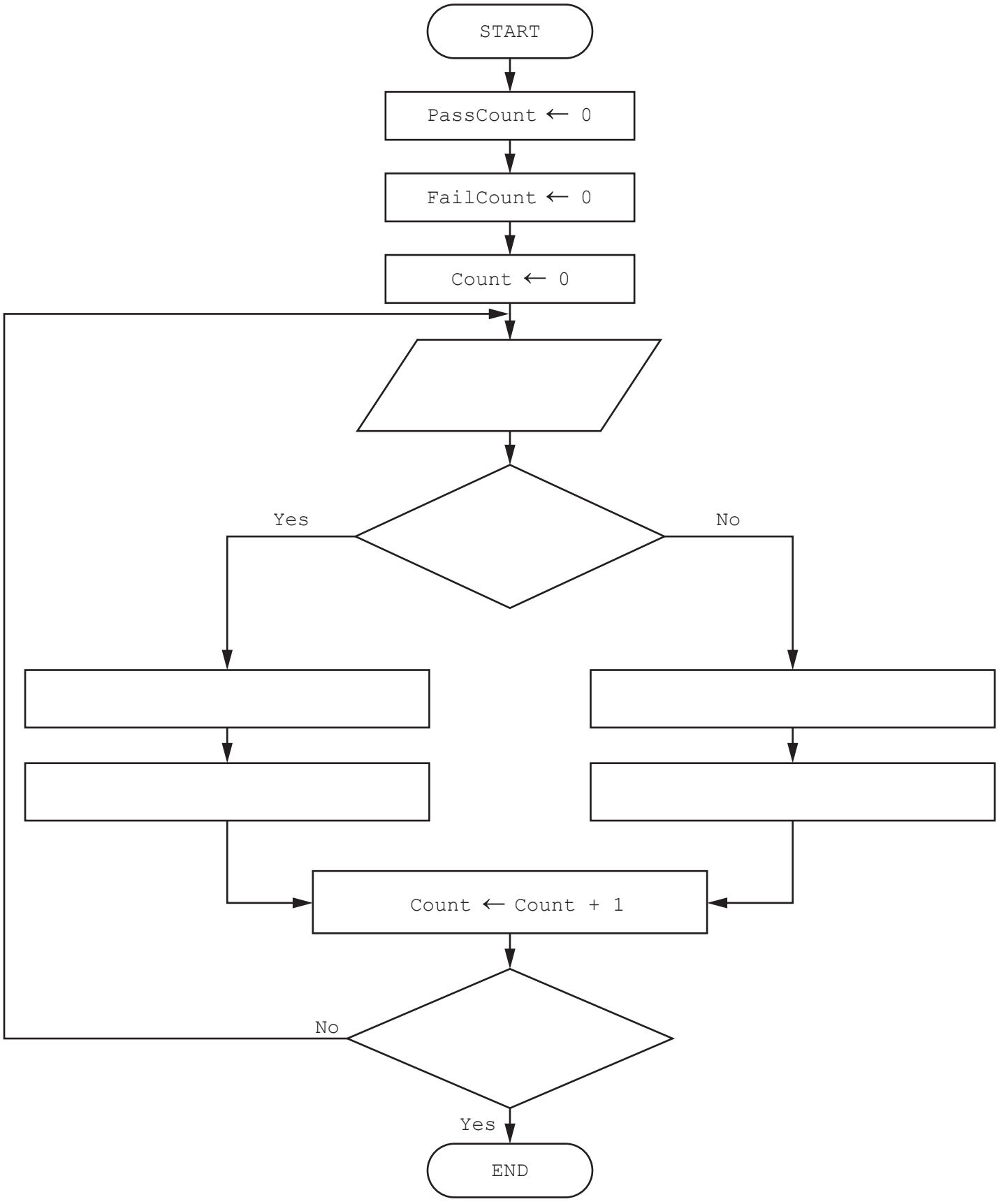
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[4]

4 The flowchart shows an algorithm that should allow 60 test results to be entered into the variable `Score`. Each test result is checked to see if it is 50 or more. If it is, the test result is assigned to the `Pass` array. Otherwise, it is assigned to the `Fail` array.

(a) Complete this flowchart:



[6]

(b) Write a pseudocode routine that will check that each test result entered into the algorithm is between 0 and 100 inclusive.

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..... [4]

5 The pseudocode represents an algorithm.

The pre-defined function `DIV` gives the value of the result of integer division.
For example, `Y = 9 DIV 4` gives the value `Y = 2`

The pre-defined function `MOD` gives the value of the remainder of integer division.
For example, `R = 9 MOD 4` gives the value `R = 1`

```
First ← 0
Last ← 0
INPUT Limit
FOR Counter ← 1 TO Limit
  INPUT Value
  IF Value >= 100
    THEN
      IF Value < 1000
        THEN
          First ← Value DIV 100
          Last ← Value MOD 10
            IF First = Last
              THEN
                OUTPUT Value
            ENDIF
      ENDIF
  ENDIF
NEXT Counter
```

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

8, 66, 606, 6226, 8448, 642, 747, 77, 121

Counter	Value	First	Last	Limit	OUTPUT

[5]

(b) Describe the purpose of the algorithm.

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..... [2]

6 A computer game shop records its stock levels in a database table called GAMES. The fields used in the stock table are shown.

Name	Description
GameID	primary key
GameName	the name of each game
AgeRestriction	the minimum age at which a person is allowed to play each game
GamePrice	the selling price for each game
NumberStock	the quantity of each game currently in stock
OnOrder	whether or **not** each game is on order from the suppliers
DateLastOrdered	the date the most recent order for each game was placed
GameDescription	a summary of the contents and purpose of each game

(a) State the number of fields that are in the table GAMES.

..... [1]

(b) State **one** important fact that must be true for a field to be a primary key.

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..... [1]

(c) Complete the query-by-example grid to output all the games that have no stock and that are on order with the supplier. Display only the GameID, GameName and GamePrice fields in alphabetical order of the name of the game.

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

[3]

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