Cambridge
O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

2143143116

COMPUTER SCIENCE **2210/23**

Paper 2 Problem-solving and Programming **October/November 2019**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

DO NOT ATTEMPT TASKS 1, 2 AND 3 in the pre-release material; these are for information only.

You are advised to spend no more than **40 minutes** on **Section A** (Question 1).

No marks will be awarded for using brand names of software packages or hardware.

Any businesses described in this paper are entirely fictitious.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 50.

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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 tasks before the examination to answer Question 1.

Pre-release material

You have been asked to write a program to calculate the area of a wall and the cost of the tiles needed to cover it. The program should work for any room with up to four walls being tiled. Tiles are sold in boxes; each box covers one square metre.

Tile description	Price per box
Small black granite	$19.50
Small grey marble	$25.95
Small powder blue	$35.75
Medium sunset yellow	$12.50
Medium berry red	$11.00
Medium glitter purple	$52.95
Large oak wood effect	$65.00
Large black granite	$58.98
Large bamboo effect	$85.00
Extra-large white marble	$62.75

Write and test a program or programs to calculate the area of the walls and the cost of tiles needed to tile a room.

- Your program or programs must include appropriate prompts for the entry of data; data must be validated on entry.
- Error messages and other output need to be set out clearly and understandably.
- All arrays, 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 and using the system for a single wall.
Set up your program to:
- Store the tile description, price per box and an identification code using a suitable programming technique.
- Display the list of tiles including the identification code, description and price per box.
- Prompt the user to input the height and width of the wall, and the identification code of the tiles they would like.
- Calculate and display the area of the wall, the number of boxes of tiles required (tiles are sold in boxes of complete square metres) and the total cost of the tiles.

Task 2 – Adding additional walls.
Extend your program to:
- Enter the number of walls to be tiled and the identification code of the tiles to be used. Only one identification code to be used for all walls.
- Enter the dimensions for each wall to be tiled.
- Calculate and display the total area of all walls, the number of boxes of tiles required (tiles are sold in boxes of complete square metres) and the total cost of the tiles.

Task 3 – Allowing for waste.
It is likely that some of the tiles will not be useable so it is sensible to allow a percentage for wastage, for example 10%. Alter your program to allow the user to input a percentage to calculate wastage and add this to the total area to be tiled. Calculate and display the revised number of boxes of tiles to be purchased (tiles are sold in boxes of complete square metres) and the total cost of the tiles.

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

Name **two** arrays you could use for **Task 1**. State the data type and purpose of each one.

Array 1 .....

Data type 1 .....

Purpose .....

.....

Array 2 .....

Data type 2 .....

Purpose .....

.....

[4]

(b) Name a variable that you used for **Task 2**. State the data type and purpose of this variable. Explain why you chose to use a variable rather than a constant.

Variable .....

Data type .....

Purpose .....

.....

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Reason for use of a variable .....

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.....

[4]

(c) Write an algorithm for **Task 1**, using **either** pseudocode, programming statements **or** a flowchart. Assume that the first part of **Task 1**, the storage and display of tile descriptions, prices per box and identification codes has already been done.

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[6]

(d) Explain how you extended your program to complete **Task 2**. Any programming statements you use in your answer must be fully explained.

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..... [3]

(e) Explain how you could validate the input for percentage waste allowance in **Task 3**.

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..... [3]

Section B

2 Describe the use of a subroutine in a program.

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..... [2]

3 Name the **three** types of loop structure used in pseudocode.

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..... [3]

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4 The following pseudocode algorithm uses nested IF statements.

```
IF Response = 1
  THEN
    X ← X + Y
  ELSE
    IF Response = 2
      THEN
        X ← X - Y
      ELSE
        IF Response = 3
          THEN
            X ← X * Y
          ELSE
            IF Response = 4
              THEN
                X ← X / Y
              ELSE
                OUTPUT "No response"
            ENDIF
        ENDIF
    ENDIF
ENDIF
```

(a) Name the type of statement demonstrated by the use of `IF … THEN … ELSE … ENDIF`

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..... [1]

(b) Re-write the pseudocode algorithm using a `CASE` statement.

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..... [4]

5 The algorithm performs an operation on the array named `MyData`

`DIV` means integer division, so only the whole number part of the result is returned
e.g. `7 DIV 2` returns a value of `3`

```
First ← 0
Last ← 16
Found ← FALSE
INPUT UserIn
WHILE (First <= Last) AND (Found = FALSE) DO
  Middle ← (First + Last) DIV 2
  IF MyData[Middle] = UserIn
    THEN
      Found ← TRUE
    ELSE
      IF UserIn < MyData[Middle]
        THEN
          Last ← Middle - 1
        ELSE
          First ← Middle + 1
      ENDIF
  ENDIF
ENDWHILE
OUTPUT Found
```

This table shows the contents of the array: `MyData` e.g. `MyData[2]` stores the value `5`

	MyData																
Index	**[0]**	**[1]**	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**	**[7]**	**[8]**	**[9]**	**[10]**	**[11]**	**[12]**	**[13]**	**[14]**	**[15]**	**[16]**
Value	2	3	5	6	8	10	12	13	14	16	18	20	25	27	29	34	36

(a) Complete the trace table for the input data: 10

First	**Last**	**UserIn**	**Middle**	**Found**	**OUTPUT**

[6]

(b) Describe the function being performed by the algorithm.

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..... [2]

6 Draw **four** different flowchart symbols and describe how they are used in a program flowchart.

Flowchart symbol	Description of use

[4]

7 A teacher has decided to use a database table as her mark book for her Computer Science class, which she has called MARKBOOK. For each student, the following data will be recorded: first name, last name, their year 10 test score and their year 11 test score. The class has 32 students.

(a) State the number of fields and records required for this database.

Number of Fields .....

Number of Records .....
[2]

(b) The data in MARKBOOK is stored under category headings: LastName, FirstName, Y10TestScore and Y11TestScore.

State, with a reason, whether any of these headings would be suitable as a primary key.

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..... [2]

(c) Complete the query-by-example grid to only display the first name, last name and year 10 test score of each student who achieved 50 or more in their year 10 test. The output should be in test score order with the highest marks at the top of the list.

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

[4]

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