Cambridge
O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4050284988

COMPUTER SCIENCE **2210/21**

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

This document consists of **13** printed pages and **3** blank 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 tasks before the examination to answer Question 1.

Pre-release material

The local high school uses buses to transport students to school. There are six bus routes labelled A to F. You have conducted a survey to analyse the punctuality statistics of these buses over a four-week period. The data from the survey are shown in the table:

	Punctuality table					
Day	**Bus A**	**Bus B**	**Bus C**	**Bus D**	**Bus E**	**Bus F**
Mon1	0	0	2	1	–1	0
Tue1	0	1	0	0	–1	–5
Wed1	0	0	–1	0	–1	–5
Thu1	2	0	–1	0	–2	–5
Fri1	2	1	–2	0	–4	–4
Mon2	4	2	–2	0	–10	–3
Tue2	0	0	–3	0	–2	–5
Wed2	3	0	–1	0	0	0
Thu2	4	0	0	0	0	0
Fri2	–2	0	0	0	0	0
Mon3	–5	1	–2	2	0	0
Tue3	0	0	0	0	1	–2
Wed3	0	0	1	0	2	–3
Thu3	3	0	1	0	–3	1
Fri3	4	2	1	0	1	1
Mon4	–1	0	1	0	1	1
Tue4	8	0	–1	0	3	0
Wed4	1	1	–1	0	–1	0
Thu4	1	0	2	0	0	–2
Fri4	–2	0	–2	0	0	–5

Positive numbers represent minutes early, negative numbers represent minutes late and 0 represents the bus having been on time.

Write and test a program or programs for the local high school.

- 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 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 data storage.
Using arrays set up a system to enable data for each bus route to be entered covering each day of a four-week period. It must be possible to enter the data supplied or your own set of data, using suitable prompts as necessary.

Task 2 – Working out the statistics.
Extend your program so that the following statistics for the four-week period may be calculated and output:
- the number of late arrivals for each bus route
- the average number of minutes late for each bus route
- the bus route with the highest number of days on which it was late
- the average number of minutes late for each bus route, using only data from days on which it was late

All the results should be displayed with appropriate annotation.

Task 3 – Checking specific days.
Extend the program as follows:
- Allow the user to input a specific day, for example Fri3, to be used for analysis of data.
- Find and display how many buses were late on this particular day.
- For each late bus, display the route label and how late the bus was on this particular day.

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

(i) State **one** array you used for **Task 1**. State the data type and purpose of this array.

Array .....

Data type .....

Purpose .....

.....

.....

[3]

(ii) State **one** variable you used for **Task 2** and **one** variable you used for **Task 3**. In each case, state the data type and purpose of the variable.

Task 2 variable name .....

Data type .....

Purpose .....

.....

.....

Task 3 variable name .....

Data type .....

Purpose .....

.....

.....

[6]

(b) Write an algorithm to show how you calculated and output the number of late arrivals and the average number of minutes late for each bus route (part of **Task 2**), using **either** pseudocode, programming statements **or** a flowchart.

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.... [6]

(c) Explain how your program uses the input in **Task 3** to only find the data for that specific day (part of Task 3). Any programming statements used in your answer must be fully explained.

.... [3]

(d) Explain how you would alter your program in **Task 1** to allow you to choose the number of weeks to enter data on bus arrival times.

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..... [2]

Section B

2 Describe each of the following data types used in programming. In each case, give an example of a piece of data to illustrate your answer. Each example must be different.

Char

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String

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Boolean

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[6]

3 **(a)** Give an example of a conditional statement using pseudocode.

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..... [2]

(b) Describe the purpose of a conditional statement.

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..... [2]

Question 4 starts on page 10.

4 This section of program code may be used as a validation check.

```
1   PRINT "Input a value between 0 and 100 inclusive"
2   INPUT Value
3   WHILE Value < 0 OR Value > 100
4     PRINT "Invalid value, try again"
5     INPUT Value
6   ENDWHILE
7   PRINT "Accepted: ", Value
```

(a) Give a name for this type of validation check.

..... [1]

(b) Describe what is happening in this validation check.

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..... [2]

(c) Complete the trace table for this program code using the test data: 200, 300, –1, 50, 60

Value	OUTPUT

[3]

(d) Draw a flowchart to represent this section of program code.

[5]

5 The table, BEVERAGES, shows the number of calories in 100 ml of a range of popular beverages. It also shows the availability of these drinks in a can, a small bottle and a large bottle.

BevNo	BevName	Calories	Can	Small Bottle	Large Bottle
Bev01	Cola	40	Yes	Yes	Yes
Bev02	Lime	45	Yes	No	Yes
Bev03	Energy Drink 1	52	Yes	Yes	No
Bev04	Energy Drink 2	43	Yes	No	No
Bev05	Mango	47	Yes	No	Yes
Bev06	Lemon Iced Tea	38	Yes	No	Yes
Bev07	Lemonade	58	Yes	Yes	Yes
Bev08	Orange Juice	46	Yes	Yes	No
Bev12	Apple Juice	50	Yes	Yes	No
Bev15	Chocolate Milk	83	Yes	Yes	No

(a) Give a reason for choosing BevNo as the primary key for this table.

.....

..... [1]

(b) State the number of records shown in the table BEVERAGES.

..... [1]

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(c) List the output that would be given by this query-by-example.

Field:	BevNo	BevName	Can	Small Bottle	Large Bottle	
Table:	BEVERAGES	BEVERAGES	BEVERAGES	BEVERAGES	BEVERAGES	
Sort:		Descending				
Show:	☑	☑	☐	☐	☐	☐
Criteria:			= "Yes"	= "Yes"	= "Yes"	
or:						

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..... [3]

(d) Complete the query-by-example grid to output a list showing just the names and primary keys of all the beverages with a calorie count greater than 45. The list should be in alphabetical order of names.

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

[4]

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