



Cambridge O Level

CANDIDATE
NAME



CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

COMPUTER SCIENCE

2210/22

Paper 2 Algorithms, Programming and Logic

October/November 2024

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.

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



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

A solution to a problem may be represented using pseudocode, flowcharts or

A procedures.

☐

B processes.

☐

C structure diagrams.

☐

D sub-systems.

☐

[1]

2 Tick (✓) **one** box to complete this sentence.

A pseudocode example of a selection statement is

A CALL Sorting(Value1, Value2)

☐

B DECLARE Count : INTEGER

☐

C IF X = 7 THEN Y ← 21 ENDIF

☐

D WHILE X <> -1 DO

☐

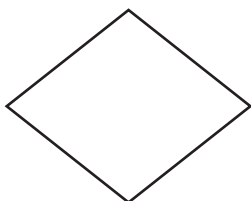
[1]

3 Four flowchart symbols and five purposes are shown.

(a) Draw **one** line to link each flowchart symbol to its correct purpose.

Not all purposes will be used.

Flowchart symbol



Purpose

subroutine

process

flow

decision

terminator

[4]





(b) An algorithm needs to total 50 numbers between 1 and 100 inclusive.

Draw a flowchart that:

- uses a count-controlled loop from 1 to 50
- uses an appropriate prompt to ask for a number between 1 and 100
- totals the numbers as they are entered
- outputs the total after the loop has completed with an appropriate message.





- 4 This pseudocode algorithm is intended to sort a pre-populated one-dimensional (1D) array named `ItemList` into alphabetical order using a bubble sort.

```

01 DECLARE ItemList : ARRAY[1:100] OF STRING
02 DECLARE Counter : STRING
03 DECLARE Limit : INTEGER
04 DECLARE Pass : INTEGER
05 DECLARE Swapped : BOOLEAN
06 DECLARE Temp : STRING
07 Limit ← 100
08 Pass ← 1
09 Temp ← TRUE
10 WHILE Swapped = TRUE OR Pass <= Limit - 1 DO
11     Swapped ← FALSE
12     FOR Counter ← 1 TO Limit - Pass
13         IF ItemList[Counter] > ItemList[Counter + 1]
14             THEN
15                 Temp ← ItemList[Counter]
16                 ItemList[Counter] ← ItemList[Counter + 1]
17                 ItemList[Counter + 1] ← Temp
18                 Swapped ← TRUE
19             ENDCASE
20         Pass ← Pass + 1
21     NEXT Counter
22 ENDWHILE

```

- (a) Identify the line numbers of **five** errors in the pseudocode and suggest a correction for each error.

Error 1 line number

Correction

.....

Error 2 line number

Correction

.....

Error 3 line number

Correction

.....

Error 4 line number

Correction

.....





Error 5 line number

Correction

.....

[5]

(b) A bubble sort algorithm can be written to include features that make it more efficient.

Explain why the **corrected** bubble sort algorithm is efficient.

.....

.....

.....

.....

.....

..... [3]

5 Analysis is one stage in the program development life cycle.

(a) State **one** other stage in the program development life cycle.

..... [1]

(b) Describe the analysis stage of the program development life cycle.

.....

.....

.....

.....

.....

..... [3]

6 Outline **one** type of verification check that could be used when inputting data.

.....

.....

.....

..... [2]





7 This pseudocode represents an algorithm.

An input of -1 will terminate the algorithm.

```
DECLARE Count : INTEGER
DECLARE Answer : INTEGER
DECLARE Value : INTEGER
REPEAT
  INPUT Value
  IF Value <> -1
    THEN
      Answer  $\leftarrow$  Value
      FOR Count  $\leftarrow$  Value - 1 TO 1 STEP -1
        Answer  $\leftarrow$  Answer * Count
      NEXT Count
      OUTPUT Answer
    ENDIF
  UNTIL Value = -1
```

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

5, 6, -1 , 20, 9, 4

Value	Count	Answer	OUTPUT



DO NOT WRITE IN THIS MARGIN



(b) State the purpose of this algorithm.

.....
..... [1]

(c) Describe the problem that would be caused in this algorithm if a Value of 1, 0 or less than -1 was input.

.....
.....
.....
..... [2]

8 Different types of test data are used during program development to make sure a program works as intended. A program being developed takes as input whole numbers that are **not** greater than 80.

Identify **two** items of test data to test the whole number limit of 80.

Explain the reason for your choice of the data in each case.

Test data 1

Reason for choice

.....

Test data 2

Reason for choice

.....

[4]





9 Consider the logic expression:

$$X = (\text{NOT } P \text{ OR } Q) \text{ NAND } (Q \text{ XOR } R)$$

(a) Draw a logic circuit for this logic expression.

Each logic gate must have a maximum of **two** inputs.

Do **not** simplify the logic expression.



[4]

(b) Complete the truth table for the given logic expression.

P	Q	R	Working space	X
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]





Make sure that any variables used are declared and that both text files are closed after they have been used.

[6]



- 11 A database table called `Booking28` stores details of hotel rooms and bookings for the week beginning Monday 7 July 2025.

RoomNo	Type	Guests	Rate\$	Mon	Tue	Wed	Thu	Fri	Sat	Sun
101D	Double	2	99.99	T	T	T	T	F	T	T
102D	Double	2	99.99	T	T	T	F	T	T	T
103F	Family	4	150.00	T	T	T	T	T	T	T
104S	Single	1	72.50	F	T	T	F	T	T	T
105S	Single	1	72.50	F	T	T	F	T	T	T
106T	Twin	2	120.00	T	T	T	T	F	T	T
201F	Family	4	160.00	F	F	T	T	T	T	T
202D	Double	2	120.00	T	F	T	T	T	T	T
203T	Twin	2	120.00	T	F	T	T	T	T	T
204T	Twin	2	125.00	T	F	T	F	T	T	T
205S	Single	1	79.99	T	F	T	T	F	T	T
301D	Double	2	200.00	F	T	T	F	F	T	T
302T	Twin	2	200.00	T	T	T	T	F	T	T
303P	Suite	4	500.00	T	T	T	T	F	T	T
304P	Suite	6	700.00	F	F	F	F	T	T	T

- (a) State the number of fields and records in this database table.

Fields

Records

[2]

- (b) State the reason why the `Type` field would **not** be suitable as a primary key.

.....

..... [1]





(c) The database uses only the data types:

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

Complete the table to show the fields that could have the given data types.

Only **one** field name is required in each box and each field name must be different.

Field	Data type
	alphanumeric
	Boolean
	real
	integer

[2]

(d) Give the output that would be produced by the structured query language (SQL) statement:

```
SELECT RoomNo, Type, Guests, Rate$  
  
FROM Booking28  
  
WHERE Mon <> T;
```

.....

.....

.....

.....

.....

..... [3]



DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

- DO NOT WRITE IN THIS MARGIN

All inputs and outputs must contain suitable messages.

[illegible]

[illegible]

[15]



BLANK PAGE

DO NOT WRITE IN THIS MARGIN





BLANK PAGE

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

DO NOT WRITE IN THIS MARGIN

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.

