* 0019655533401 *

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 4 5 6 7 6 0 4 2 2 6 *

COMPUTER SCIENCE **0478/22**

Paper 2 Algorithms, Programming and Logic **May/June 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.

DC (LK/CB) 329121/3
© UCLES 2024

[Turn over

1 Tick (✓) **one** box to identify a method used to design and construct a solution to a computing problem.

A analysis ☐

B coding ☐

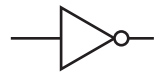
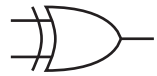
C flowchart ☐

D testing ☐

[1]

2 **Four** logic functions and **five** standard symbols for logic gates are shown.

Draw **one** line to link each logic function to its standard symbol. **Not** all standard symbols will be used.

Logic function	Standard symbol
AND	
XOR	
NAND	
OR	
	

[4]

3 Identify **three** different tasks in the analysis stage of the program development life cycle.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

DO NOT WRITE IN THIS MARGIN

4 A program needs to make sure the characters input for a product code meet these rules:

- The product code is six characters in length.
- The first two characters must be "PD".
- The last four characters must be a number in the range 1000 to 9999 inclusive.

(a) Identify **three** validation checks and state how each check would make sure the product code met one of these rules.

Check 1 .....

.....

.....

Check 2 .....

.....

.....

Check 3 .....

.....

..... [6]

(b) The program design will include a pseudocode algorithm. Assume that the product code is stored in the variable `Product`

(i) Write the pseudocode to make sure that the product code is six characters in length.

.....

.....

.....

.....

..... [2]

(ii) Write the pseudocode to make sure that the first two characters of the product code are "PD".

.....

.....

.....

.....

..... [2]

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

5 A high-level programming language makes use of arithmetic, Boolean and logical operators.

State how each type of operator is used.
Give an example statement, in pseudocode, for each one.

Arithmetic .....

.....

Example .....

.....

Boolean .....

.....

Example .....

.....

Logical .....

.....

Example .....

.....

[6]

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

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

6 Totalling and counting are standard methods of solution.

Numbers are input. The number 9999.9 is the last number to be input and is ignored.

(a) Write an algorithm in pseudocode to total the numbers input and to output the total. You do **not** need to validate the input.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) Write an algorithm in pseudocode to count and output the number of input values that are greater than 100. You do **not** need to validate the input.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

7 An algorithm has been written in pseudocode to find and display the maximum and minimum values in an array of 1000 positive numbers. The array `List[]` starts at index `1`

```
01 Max ← List[1]
02 Min ← List[1]
03 FOR Counter ← 2 TO 1000
04     IF List[Counter] < Max
05       THEN
06         Max ← List[Counter]
07     ENDIF
08     IF List[Count] < Min
09       THEN
10         Min ← List[Counter]
11     ENDWHILE
12 NEXT Counter
13 OUTPUT "Maximum value is ", Max
14 OUTPUT "Minimum value is ", Min
```

(a) Give a line number for each of these types of statement:

Assignment statement .....

Selection statement .....

Iteration statement .....

[3]

(b) Identify the line numbers of the **three** 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 .....

.....

[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

8 A logic circuit is to be built to control the opening of a safe used to store money. There are two keys, **A** and **B**, and a time switch **C**. The safe can only open if both keys are used and the time switch is off.

key **A**	not used	0
	used	1
key **B**	not used	0
	used	1
time switch **C**	switch off	0
	switch on	1
safe **X**	safe cannot open	0
	safe can open	1

(a) Write the logic expression for this problem.

..... [3]

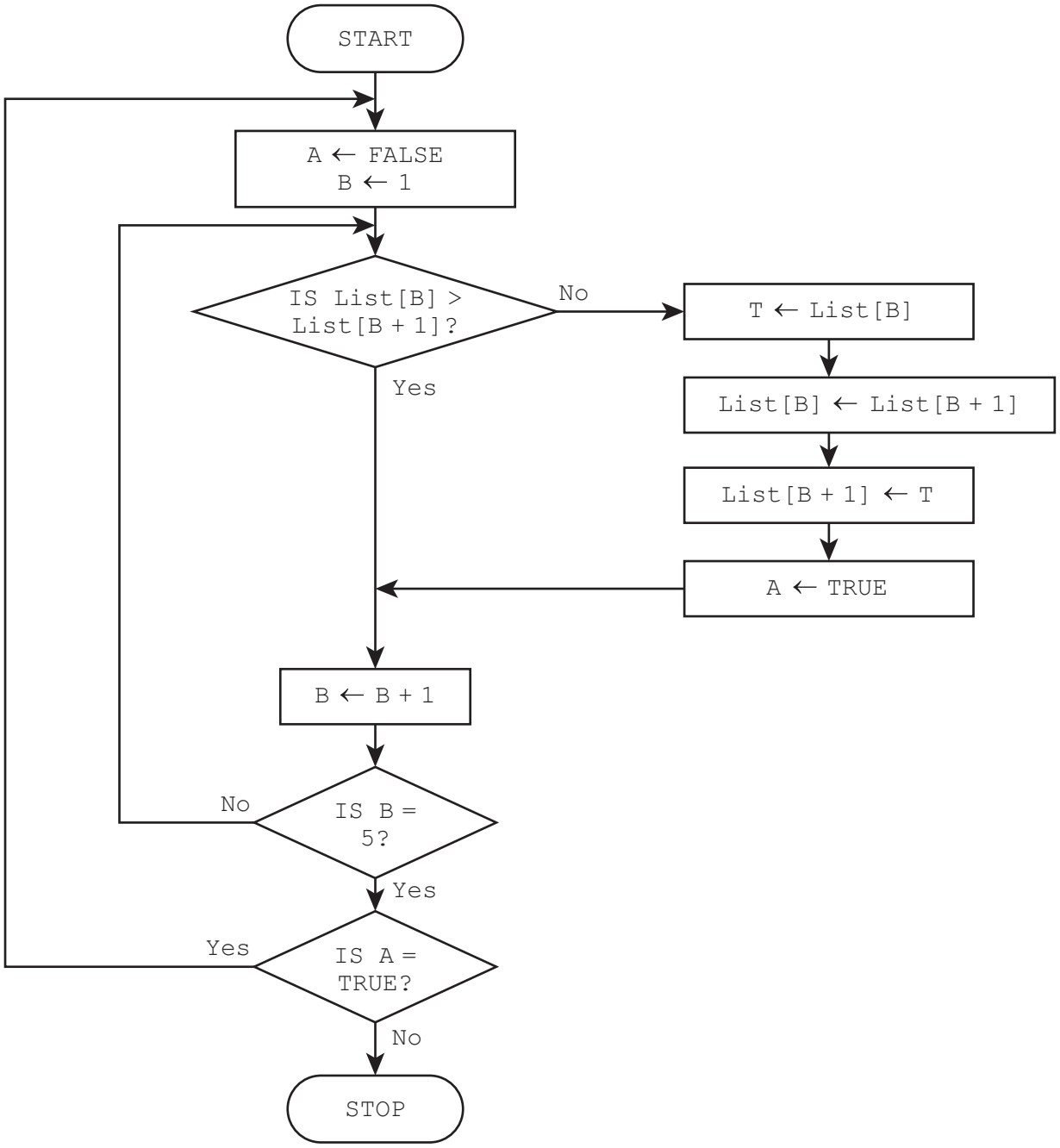
(b) Complete the truth table for this problem.

A	B	C	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]

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

9 This flowchart represents an algorithm.



(a) The array `List[1:5]` used in the flowchart contains this data:

List[1]	List[2]	List[3]	List[4]	List[5]
15	17	20	5	9

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

Complete the trace table using the data given in the array.

A	B	List[1]	List[2]	List[3]	List[4]	List[5]	T
		15	17	20	5	9	

[5]

(b) Describe what the algorithm represented by the flowchart is doing.

.....

.....

.....

..... [2]

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

10 A television subscription service has a new database table named `Contract` to store details of their subscribers' contracts. The table contains these fields:

- `ContractNumber` – the contract number, for example CT567
- `Months` – the length of the contract in months, for example 6
- `EndDate` – the date the contract finishes, for example 30 November 2024
- `News` – the news service, yes or no
- `Movie` – the movie service, yes or no
- `Sport` – the sports service, yes or no
- `Junior` – the children's service, yes or no.

(a) Identify the field that will be the most appropriate primary key for this table.

..... [1]

(b) Complete the table to identify the most appropriate data type for these fields in `Contract`

Field	Data type
`ContractNumber`	
`Months`	
`EndDate`	
`Sport`	

[2]

(c) Explain the purpose of these structured query language (SQL) statements.

Statement 1: `SELECT SUM (Months) FROM Contract;`

Statement 2: `SELECT COUNT (News) FROM Contract WHERE News;`

Statement 1 .....

.....

.....

Statement 2 .....

.....

.....

[3]

DO NOT WRITE IN THIS MARGIN

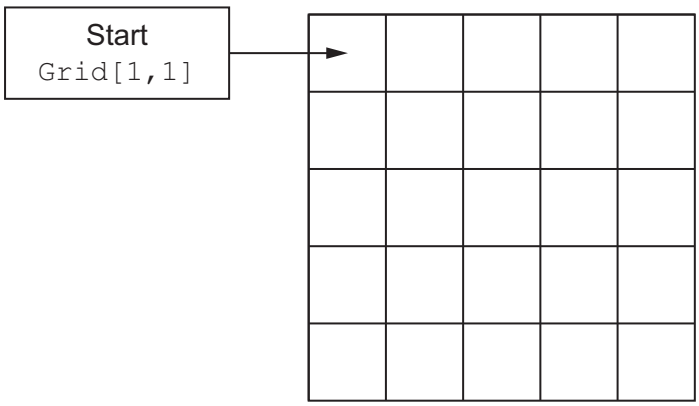
(d) Complete this SQL statement to find the contract numbers of the subscribers that take both the news and sports services.

```
SELECT .....

FROM Contract

WHERE ..... AND ..... ;
```

[2]

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

11 A one-player game uses the two-dimensional (2D) array `Grid[]` to store the location of a secret cell to be found by the player in 10 moves. Each row and column has 5 cells.



At the start of the game:

- The program places an 'X' in a random cell (**not** in `Grid[1,1]`) and empties all the other cells in the grid.
- The player starts at the top left of the grid.
- The player has 10 moves.

During the game:

- The player can move left, right, up or down by one cell and the move must be within the grid.
- "You Win" is displayed if the player moves to the cell with 'X' and has played 10 moves or less.
- "You Lose" is displayed if the player has made 10 moves without finding the 'X'.

Write a program that meets these requirements.

You must use pseudocode or program code **and** add comments to explain how your code works.

You do **not** need to declare any arrays or variables; you may assume that this has already been done.

All inputs and outputs must contain suitable messages.

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

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

[15]

© UCLES 2024

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

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

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.