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COMPUTER SCIENCE **0478/21**

Paper 2 Algorithms, Programming and Logic **May/June 2026**

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. Do **not** use correction fluid or tape.
- 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.

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1 Tick (✓) **one** box to identify the type of validation check to test whether a number entered into a computer system is between two set values.

A length check ☐

B presence check ☐

C type check ☐

D range check ☐

[1]

2 Identify **four** operators that are **not** arithmetic operators from the list.

```
/          >          <=          +          *
^          AND        DIV         MOD        NOT
```

1 .....

2 .....

3 .....

4 .....

[4]

3 Complete the table by writing the most appropriate data type for each variable described.

variable	description	example data	data type
`Age`	the age of the student	`16`	
`TelephoneNumber`	the telephone number of the student	`+44 7846398573`	
`Teenager`	whether the student is a teenager or not	`TRUE`	

[3]

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4 The following pseudocode algorithm uses a bubble sort to sort the array `Names[50]`

Complete the algorithm.

```
Last ← .....
REPEAT
    Swap ← .....
    FOR ..... ← 1 TO Last - 1
        IF Names[Index] > Names[Index + 1]
          THEN
            Temp ← Names[Index]
            Names[Index] ← Names[Index + 1]
            Names[Index + 1] ← Temp
            Swap ← TRUE
        ENDIF
    NEXT Index
    Last ← Last - 1
UNTIL ..... Swap OR Last = 1
```

[4]

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5 A computer system automatically creates usernames for new users. A new user enters their first name and their last name.

The system:

- takes the first letter of the first name
- takes the first two letters of the last name
- converts all the letters to upper case
- generates a random whole number between 1 and 1000 inclusive.

For the following example:

The first name is `Muhammed`

The last name is `Hann`

The generated number is `492`

The username will be `MHA492`

(a) Write the pseudocode to generate a whole random number between 1 and 1000 inclusive and store it in the variable `GeneratedNumber`

.....

.....

..... [2]

(b) The last name is input into the variable `LastName`

Write the pseudocode to:

- take the first two letters from `LastName`
- convert the letters to upper case
- store the result in the variable `Temp`

.....

.....

..... [3]

(c) The new username is stored in the variable `NewUsername`

Write the pseudocode to store `NewUsername` to the file `Username.txt`

.....

.....

.....

..... [3]

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(d) Identify and describe verification checks that could be applied to the inputs of the first name and the last name of the user.

.....

.....

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..... [4]

6 Give programming examples for a count-controlled loop and a post-condition loop. Describe each of the loops.

count-controlled loop example .....

description .....

.....

.....

post-condition loop example .....

description .....

.....

.....

[4]

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7 An algorithm has been written in pseudocode for a user to repeatedly input positive whole numbers and store them in an array called `Values[]` until –1 is input or until the array is full. The algorithm outputs the average of the numbers to 2 decimal places.

```
01  DECLARE Counter : INTEGER
02  DECLARE Total : INTEGER
03  DECLARE Average : INTEGER
04  DECLARE Values : ARRAY[1:100] OF INTEGER
05  Counter ← 1
06  Total ← 0
07  OUTPUT "Please enter a positive whole number or -1 "
08  INPUT Number
09  WHILE Number = -1 AND Counter <= 100 DO
10      Values[Counter] ← Number
11      Total ← Total + 1
12      Counter ← Counter + 1
13      INPUT Number
14  ENDWHILE
15  Counter ← Counter - 1
16  Average ← Counter / Total
17  OUTPUT "The average is ", ROUND(Average, 2)
```

Identify the line numbers of **four** 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 .....

.....

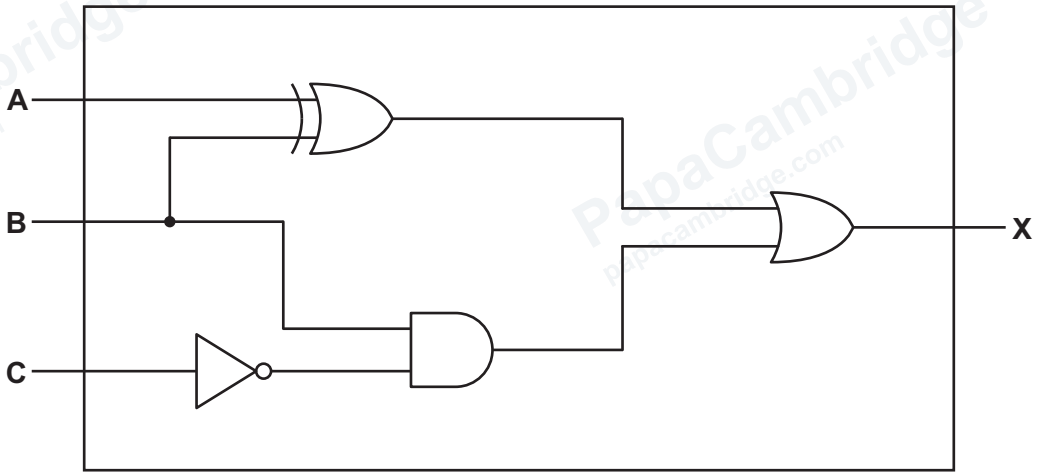
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8 Consider the logic circuit:



(a) Write the logic expression for the given logic circuit.

.....

..... [3]

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

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]

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9 A swimming club wants to set up a new database table to store details of the members of the club and the maximum distance each member swam in metres.

The table is called `SWIMMERS` and will contain these fields:

- `Distance` – distance the member swam, for example 1500
- `Date` – date the member swam the distance
- `Time` – time taken to swim the distance
- `MemberID` – the code to identify a member, for example TH749
- `MemberName` – name of the member.

(a) (i) State why `MemberName` would **not** be appropriate for a primary key.

.....

..... [1]

(ii) Give the name of the most appropriate field for the primary key.

.....

..... [1]

(b) Complete the table to identify the most appropriate data type for these fields in the table `SWIMMERS`. Each data type must be different.

field	data type
`Distance`	
`Date`	
`MemberID`	

[2]

(c) Complete the structured query language (SQL) statement to display only the names of the members who swam a distance of 1500 metres or more.

```
SELECT .....
FROM .....
WHERE .....
..... ;
```
[3]

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10 (a) Draw a flowchart to input six whole numbers and output the highest. You do **not** need to validate the inputs.

START

[6]

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(b) Describe how the flowchart could be changed to only accept positive whole numbers.

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..... [3]

11 The function `Power(FirstNumber, SecondNumber)` returns the value of `FirstNumber` raised to the power of `SecondNumber`. `FirstNumber` and `SecondNumber` are integers.

Write pseudocode statements to:

- define the function
- call the function with the variables `A` and `B` and store the return value in the variable `Value`

function definition

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function call

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..... [5]

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12 A weather monitoring station records the number of minutes of sunshine for each day of a month.

The one-dimensional (1D) array `Sunshine[]` is used to store the number of minutes of sunshine for each day. The index of the array represents the day.

The one-dimensional (1D) array `MonthDays[]` contains the number of days in each month. The index of the array represents the month. In this array, 28 is stored in index 2 for the month of February. However, there are 29 days in February in a leap year.

In this program, a leap year is a year that divides by 4 with no remainder. For example, 2026 is **not** a leap year but 2028 will be a leap year.

Write a program that meets the following requirements:

- allows the user to input a year, calculates whether it is a leap year and updates the number of days in February as appropriate
- allows a user to input the name of one of the first three months of the year: January, February or March
- allows a user to input the number of minutes of sunshine for each day of the month and validates the input
- calculates the total amount of sunshine for the month in hours and minutes
- finds the highest amount of daily sunshine for the month
- outputs the:
  - year
  - month
  - total amount of sunshine for the month in hours and minutes
  - the highest amount of daily sunshine for the month.

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

Do **not** declare any arrays or variables; assume that this has already been done.

All inputs and outputs must contain suitable messages.

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