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COMPUTER SCIENCE**0478/23**

Paper 2 Algorithms, Programming and Logic

October/November 2023**1 hour 45 minutes**

You must answer on the question paper.

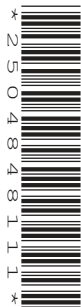
No additional materials are needed.

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.

2

1 Tick (✓) **one** box to show which term is an example of a verification check.

A Double entry check

☐

B Format check

☐

C Length check

☐

D Presence check

☐

[1]

2 Tick (✓) **one** box to show which library routine returns the remainder of a division.

A DIV

☐

B MOD

☐

C RANDOM

☐

D ROUND

☐

[1]

3

- 3 (a) Four pseudocode descriptions and five pseudocode keywords are shown.

Draw **one** line to link each pseudocode description to the most appropriate pseudocode keyword. **Not** all pseudocode keywords will be used.

Pseudocode description	Pseudocode keyword
stores data in a file	OUTPUT
retrieves data from a file	WRITE
displays data on a screen	READ
enters data from a keyboard	OPEN
	INPUT

[4]

- (b) Give **two** reasons for storing data in a file.

1

.....

2

.....

[2]

[2]

[5]

[2]

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- 5 An algorithm has been written in pseudocode to check if a new password is in a list of previously used passwords `OldList[]`.
If the password is **not** found, the new password will be stored at the end of the list to replace "XXXX" already stored there.

```

01 OUTPUT "Enter your new password "
02 INPUT NewPassword
03 Posn ← 1
04 Found ← FALSE
05 REPEAT
06     IF Password = OldList[Posn]
07     THEN
08         Found ← TRUE
09     ELSE Posn ← Posn + 1
10     ENDIF
11 UNTIL Found AND OldList[Posn] = "XXXX"
12 IF Found
13     THEN
14         OUTPUT "Password has been used before"
15     ELSE
16         INPUT "New password accepted"
17         OldList[Posn] ← NewPassword
18     ENDIF

```

- (a) Identify the **three** errors in the pseudocode and suggest corrections.

Error 1

Correction

.....

Error 2

Correction

.....

Error 3

Correction

.....

[3]

7

(b) Complete this flowchart for the corrected algorithm:



[6]

[Turn over

- 6 There are **three** descriptions of logic gates. Each logic gate has two inputs **A** and **B** with one output **X**.
Identify each logic gate.
Complete a truth table for each logic gate.

(a) The only time the output is 1 is when both inputs are 1.

Logic gate

Complete the truth table for this description.

A	B	X
0	0	
0	1	
1	0	
1	1	

[2]

(b) The output is 1 when both inputs are different.

Logic gate

Complete the truth table for this description.

A	B	X
0	0	
0	1	
1	0	
1	1	

[2]

(c) The only time the output is 1 is when both inputs are 0.

Logic gate

Complete the truth table for this description.

A	B	X
0	0	
0	1	
1	0	
1	1	

[2]

9

(d) Consider this logic expression:

$$X = (\text{NOT } A \text{ OR NOT } B) \text{ OR NOT } C$$

Draw a logic circuit for this logic expression. Each logic gate must have a maximum of **two** inputs. Do **not** attempt to simplify this logic expression.



[5]

7 A program uses both local variables and global variables.

Describe **two** differences between local variables and global variables.

Difference 1

.....

.....

.....

Difference 2

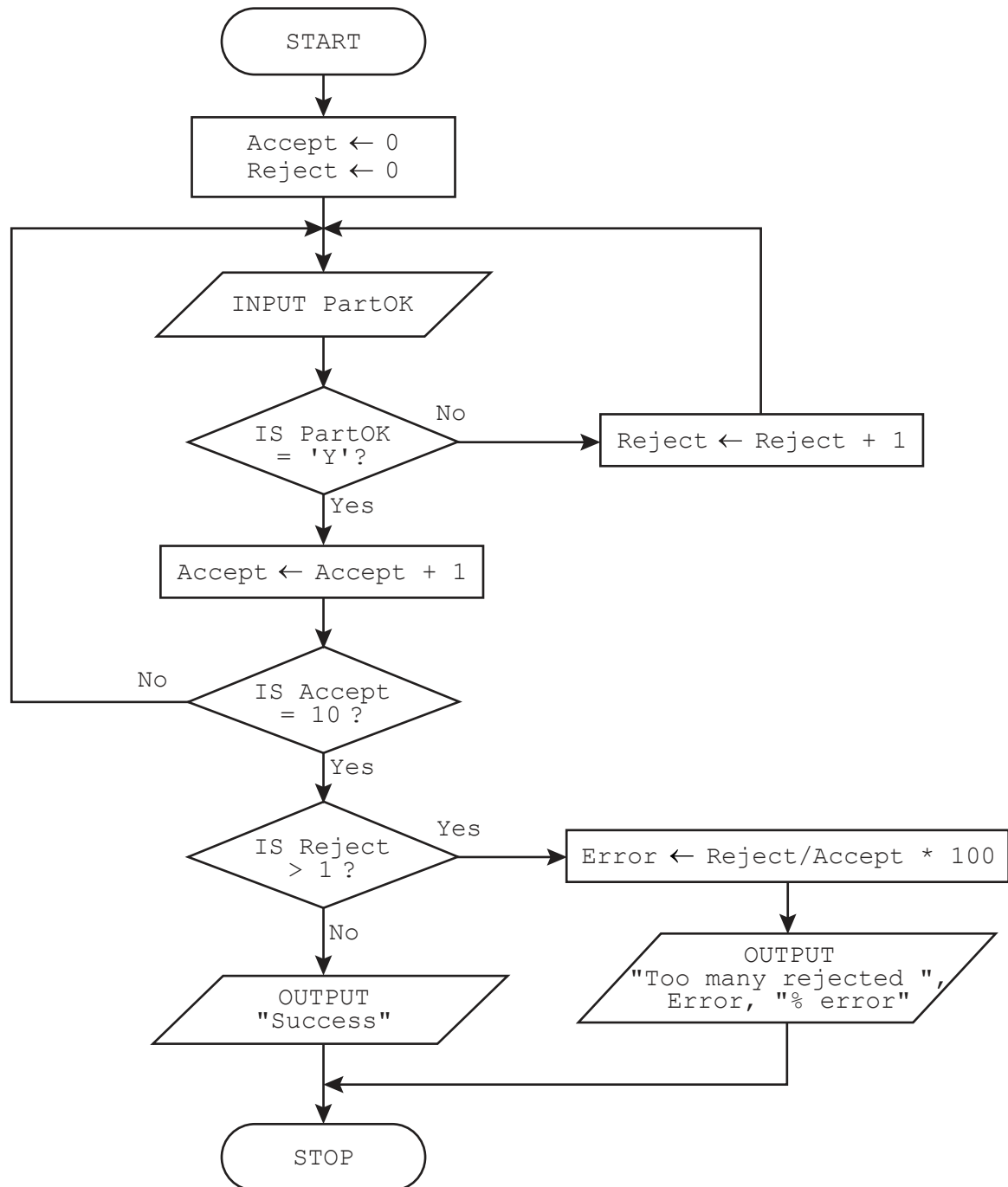
.....

.....

.....

[4]

- 8 This is an algorithm to find if a batch of parts has been manufactured successfully.



(a) Complete the trace table using this data:
Y, Y, Y, N, Y, Y, Y, Y, N, Y, Y, Y, Y

Accept	Reject	PartOK	Error	OUTPUT

[5]

(b) Describe how the algorithm should be changed to accept 'Y' or 'y' for a successfully manufactured part.

.....

.....

.....

.....

.....

..... [3]

- 9 A sanctuary for pheasants has set up a new database table called `PheasantList` to store details of the different species of bird at the sanctuary. Part of this table is given, showing: species, description, number of birds at the sanctuary, if the birds are breeding or **not**, and number of young born this year.

Species	Description	NumberBirds	Breeding	Young
Edwards	blue-black with white tail	5	Yes	0
Japanese green	dark green with pale grey tail	2	Yes	2
Reeves	golden, white and red scaled plumage	4	Yes	1
Crawfords Kalij	glossy blue-black plumage	4	No	0
Crested fireback	blue-black with black tail	3	No	0
True silver	white laced top half and black lower half	7	Yes	1
Siamese fireback	grey plumage with crimson legs and feet	5	No	0
Mikado	iridescent plumage with white striped wings	3	Yes	4
Red junglefowl	many colours	2	Yes	0
Himalayan monal	many colours with metallic green crest	3	Yes	2
White eared	white with ear tufts	5	Yes	3
Brown eared	brown with ear tufts	9	Yes	1
Ring necked	long tail with white ring neck	2	Yes	2
Golden	rainbow coloured	3	Yes	4

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

Records

Fields

[2]

- (b) (i) Give the name of a field that could be used for the primary key.

..... [1]

- (ii) Explain why the sanctuary might decide **not** to use the field in (b)(i) as the primary key.

.....

..... [1]

- (iii) A new field `SpeciesID` is added to the database table.
This field contains a six-character code, for example Ph0001.

Give a reason why this field would be a better primary key.

.....

..... [1]

13

- (c) Write the output that would be given by this structured query language (SQL) statement:

```
SELECT Species, Description
```

```
FROM PheasantList
```

```
WHERE NumberBirds > 6;
```

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

- (d) Complete this SQL statement to display all the species of pheasant where the birds are breeding and there were no young born this year:

```
SELECT .....
```

```
FROM .....
```

```
WHERE .....
```

..... ;
[4]

14

- 10** A weather station takes temperature readings once an hour for a week. These temperatures are stored in a two-dimensional (2D) array `Temperatures[]`. Each column contains 24 readings for a single day. The first temperature is recorded at 00:00 and the final temperature at 23:00. There are seven columns, one for each day of the week, starting with Monday and ending with Sunday.

The variables `MaxDay`, `MinDay` and `AvDay` are used to store the maximum, minimum, and average temperatures for a day. The variables `MaxWeek`, `MinWeek` and `AvWeek` are used to store the maximum, minimum, and average temperatures for the week.

The array has already been set up and the data stored.

Write a program that meets the following requirements:

- finds the maximum and minimum temperatures for each day
- calculates the average temperature for each day
- outputs for each day:
 - name of the day, for example Monday
 - maximum temperature
 - minimum temperature
 - average temperature
- finds the maximum and minimum temperatures for the week
- calculates the average temperature for the week
- outputs:
 - maximum temperature for the week
 - minimum temperature for the week
 - average temperature for the week.

All temperatures output must be rounded to two decimal places.

You must use pseudocode or program code **and** add comments to explain how your code works. All inputs and outputs must contain suitable messages.

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

You do **not** need to initialise the data in the array `Temperatures[]`

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