

**Algorithm design and problem-solving – 2021/20 O Level 2210**

1. Nov/2021/Paper2/Paper\_22/No.1a,b,d

All variables, constants and other identifiers must have meaningful names.

(a) (i) Identify **one** variable you could have used for **Task 2** and state its use.

Variable .....

Use .....

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.....

[2]

(ii) Describe the arrays you could have used in **Task 1**. Include the name, data type, use and sample data for each array.

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..... [5]

(b) Describe how you could validate the data entry for the input of the codes for the different stages of the journey in **Task 2**.

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..... [3]



2. Nov/2021/Paper2/Paper\_22/No.2

Tick (✓) one box in each row to identify if the statement is about validation, verification or neither.

Statement	Validation (✓)	Verification (✓)	Neither (✓)
a check where data is re-entered to make sure no errors have been introduced during data entry			
an automatic check to make sure the data entered has the correct number of characters			
a check to make sure the data entered is sensible			
a check to make sure the data entered is correct			

[3]

3. Nov/2021/Paper2/Paper\_22/No.3

A program checks that the data entered is between 1 and 100 inclusive.

Identify **one** piece of normal, extreme and erroneous test data for this program, and give a reason for each.

Normal test data .....

Reason .....

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Extreme test data .....

Reason .....

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Erroneous test data .....

Reason .....

.....

.....

[6]

**4. Nov/2021/Paper2/Paper\_22/No.4a**

The pseudocode algorithm should work as a calculator and output the result.

```
1  Continue ← 1
2  WHILE Continue = 0
3    OUTPUT "Enter 1 for +, 2 for -, 3 for * or 4 for /"
4    INPUT Operator
5    OUTPUT "Enter the first value"
6    INPUT Value1
7    OUTPUT "Enter the second value"
8    OUTPUT Value2
9    IF Operator
10     1: Answer ← Value1 + Value2
11     2: Answer ← Value1 - Value2
12     3: Answer ← Value1 * Value2
13     4: Answer ← Value1 / Value2
14  ENDCASE
15  OUTPUT "The answer is ", Value1
16  OUTPUT "Do you wish to enter more values (Yes or No)?"
17  INPUT MoreValues
18  IF MoreValues = "No"
19    THEN
20      Continue ← 1
21  ENDIF
22 UNTIL Continue = 0
```

(a) Find the **five** errors in the pseudocode and suggest a correction for each error.

Error 1 .....

Correction .....

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Error 2 .....

Correction .....

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Error 3 .....

Correction .....

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Error 4 .....

Correction .....

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Error 5 .....

Correction .....

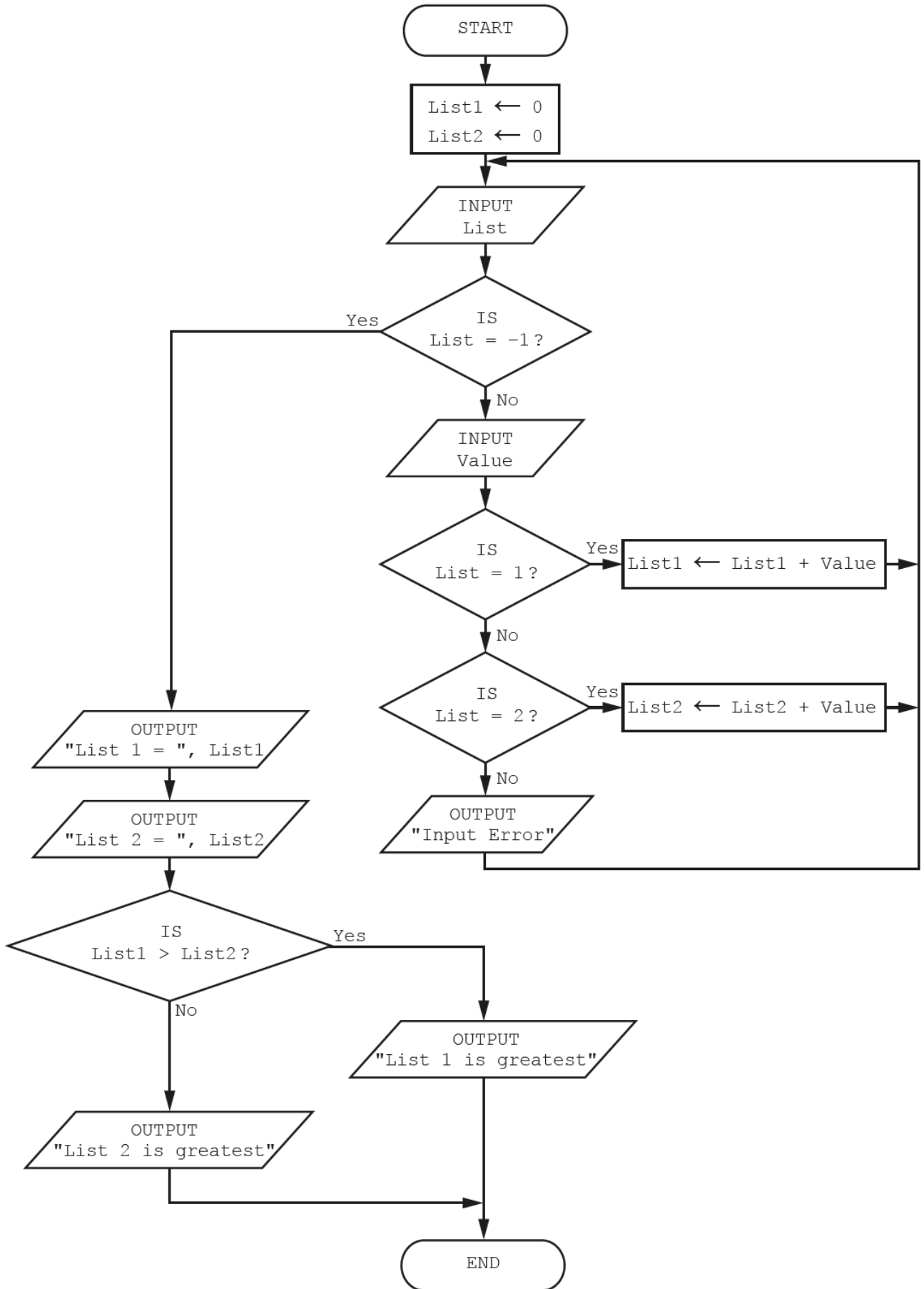
.....

[5]

5. [Nov/2021/Paper2/Paper\\_22/No.5](#)

The flowchart represents an algorithm.

The algorithm will terminate if  $-1$  is entered at the `List` input.







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

(i) Identify **one** constant you could have used for **Task 1**, give the value that would be assigned to it and its use.

Constant .....

Value .....

Use .....

.....

.....

[3]

- (ii) Identify **one** variable and **one** array you could have used for **Task 1**. Explain the use of each one.

Variable .....

Use .....

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Array .....

Use .....

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[4]

- (b) Explain how you should change your program in **Task 1** to allow a tutor to enter up to eight candidates for the election.

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[4]



## 7. June/2021/Paper2/Paper\_21/No.2

Tick (✓) **one** box in each row to identify if the statement is about **validation**, **verification** or **both**.

<b>Statement</b>	<b>Validation (✓)</b>	<b>Verification (✓)</b>	<b>Both (✓)</b>
Entering the data twice to check if both entries are the same.			
Automatically checking that only numeric data has been entered.			
Checking data entered into a computer system before it is stored or processed.			
Visually checking that no errors have been introduced during data entry.			

[3]

8. June/2021/Paper2/Paper\_21/No.3

Name and describe the most appropriate programming data type for each of the examples of data given. Each data type must be different.

Data: 37

Data type name .....

Data type description .....

.....

.....

Data: Cambridge2021

Data type name .....

Data type description .....

.....

.....

Data: 47.86

Data type name .....

Data type description .....

.....

.....

[6]

**9. June/2021/Paper2/Paper\_21/No.4a,c**

The pseudocode algorithm shown has been written by a teacher to enter marks for the students in her class and then to apply some simple processing.

```
Count ← 0
REPEAT
  INPUT Score[Count]
  IF Score[Count] >= 70
    THEN
      Grade[Count] ← "A"
    ELSE
      IF Score[Count] >= 60
        THEN
          Grade[Count] ← "B"
        ELSE
          IF Score[Count] >= 50
            THEN
              Grade[Count] ← "C"
            ELSE
              IF Score[Count] >= 40
                THEN
                  Grade[Count] ← "D"
                ELSE
                  IF Score[Count] >= 30
                    THEN
                      Grade[Count] ← "E"
                    ELSE
                      Grade[Count] ← "F"
                    ENDIF
                ENDIF
            ENDIF
          ENDIF
        ENDIF
      ENDIF
    ENDIF
  Count ← Count + 1
UNTIL Count = 30
```

(a) Describe what happens in this algorithm.

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..... [3]

(c) Describe how you could change the algorithm to allow teachers to use it with any size of class.

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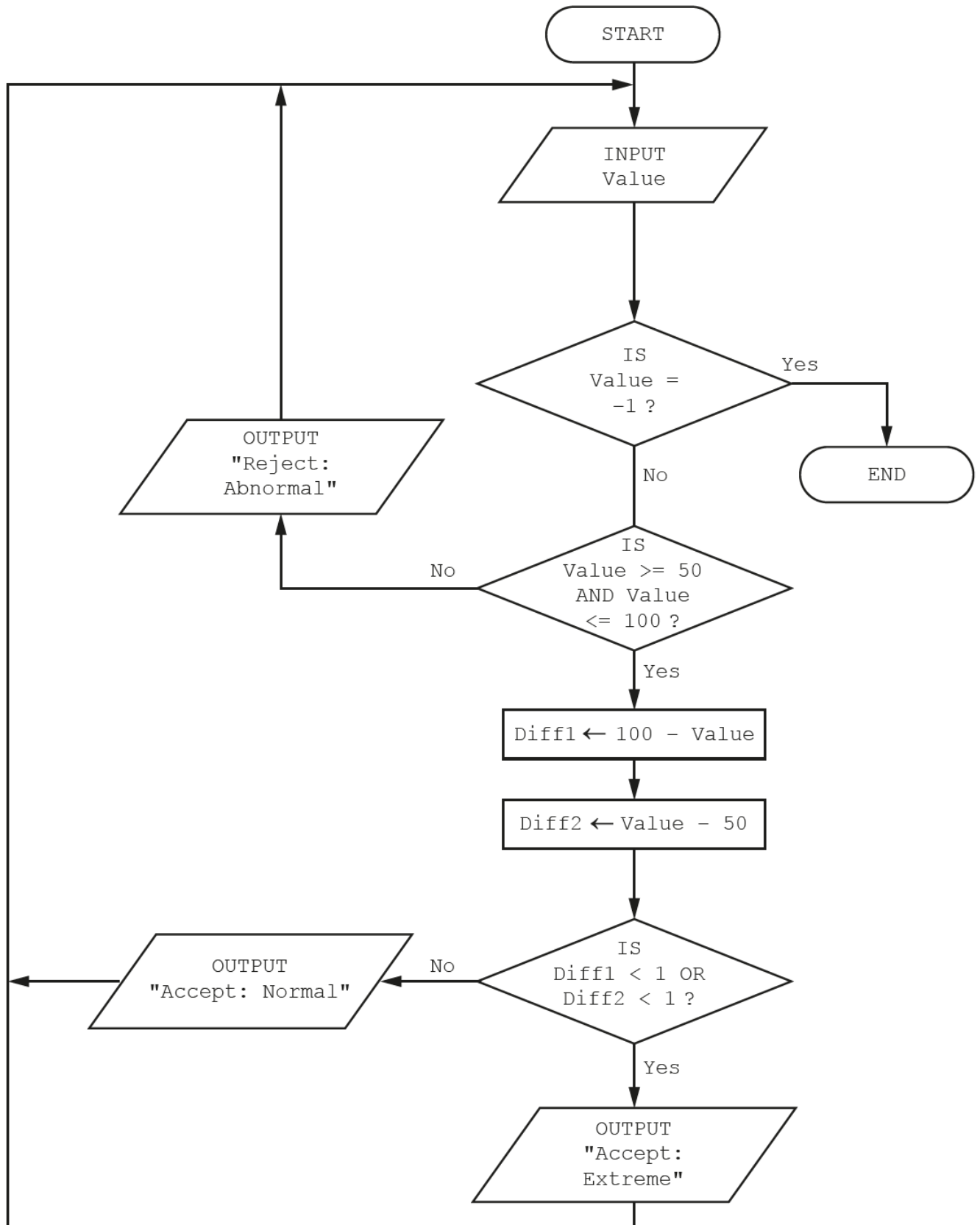
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..... [3]

## 10. June/2021/Paper2/Paper\_21/No.5

The flowchart represents an algorithm.

The algorithm will terminate if  $-1$  is entered.







11. June/2021/Paper2/Paper\_22/No.1a,b,d

All variables, constants and other identifiers must have meaningful names.

(a) Identify and give the data type and use of **one** array that you could have used for **Task 1**.

Array .....

Data type .....

Use .....

[3]

(b) Describe **two** validation checks that could be used when inputting the number of tickets to buy for **Task 2**. For each validation check give one example of normal data and one example of erroneous data.

Validation check 1 .....

.....

.....

Normal data .....

Erroneous data .....

Validation check 2 .....

.....

.....

Normal data .....

Erroneous data .....

[6]



12. June/2021/Paper2/Paper\_22/No.3

(a) Draw the most appropriate flowchart symbol for each pseudocode statement.

Pseudocode statement	Flowchart symbol
IF Number = 20	
PRINT Number	
Number ← Number + 1	

[3]

(b) State the type of each pseudocode statement. For example,  $X \leftarrow X + Y$  is totalling.

IF Number = 20 .....

PRINT Number .....

Number ← Number + 1 .....

[3]

**13. June/2021/Paper2/Paper\_22/No.4**

This algorithm checks passwords.

- Each password must be 8 or more characters in length; the predefined function `Length` returns the number of characters.
- Each password is entered twice, and the two entries must match.
- Either `Accept` or `Reject` is output.
- An input of 999 stops the process.

```
REPEAT
  OUTPUT "Please enter password"
  INPUT Password
  IF Length(Password) >= 8
    THEN
      INPUT PasswordRepeat
      IF Password <> PasswordRepeat
        THEN
          OUTPUT "Reject"
        ELSE
          OUTPUT "Accept"
        ENDIF
      ELSE
        OUTPUT "Reject"
      ENDIF
    UNTIL Password = 999
```



14. June/2021/Paper2/Paper\_22/No.5b

A one-dimensional array `dataArray[1:20]` needs each element set to zero.

(a) Write a pseudocode routine that sets each element to zero. Use the most suitable loop structure.

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.....  
.....  
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.....  
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.....  
..... [3]

(b) Explain why you chose this loop structure.

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

15. Nov/2020/Paper2/Paper\_22/No.1a,c,d

All variables, constants and other identifiers must have meaningful names.

(a) (i) Identify **one** array you could have used for **Task 1** and state its purpose.

Array .....

Purpose .....

.....

.....

[2]

(ii) Identify **one** variable you could have used for **Task 2** and state its purpose.

Variable .....

Purpose .....

.....

.....

[2]

(iii) Identify **one** constant you could have used for **Task 3** and state its purpose.

Constant .....

Purpose .....

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[2]

(b) Explain the benefits of storing Price as a real data type.

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[2]











## 17. Nov/2020/Paper2/Paper\_22/No.3

This pseudocode algorithm is used as a validation check.

```

PRINT "Input a number from 1 to 5000"
REPEAT
  INPUT Number
  IF Number < 1 OR Number > 5000
    THEN
      PRINT "Invalid number, please try again"
    ENDF
UNTIL Number >= 1 AND Number <= 5000
PRINT Number, " is within the correct range"

```

Identify **three** different types of test data. For each type, give an example of the test data you would use to test this algorithm and state a reason for your choice of test.

Type of test data 1 .....

Test data .....

Reason .....

.....

Type of test data 2 .....

Test data .....

Reason .....

.....

Type of test data 3 .....

Test data .....

Reason .....

.....

[6]

**18. Nov/2020/Paper2/Paper\_22/No.5**

This pseudocode represents an algorithm.

```
REPEAT
  Flag ← 0
  FOR Count ← 0 to 3
    IF Num[Count] < Num[Count + 1]
      THEN
        Store ← Num[Count]
        Num[Count] ← Num[Count + 1]
        Num[Count + 1] ← Store
        Flag ← 1
      ENDIF
  NEXT Count
UNTIL Flag = 0
```



Draw a flowchart symbol to represent each of the following:

Input/Output	Decision

[2]

20. [June/2020/Paper2/Paper\\_21/No.2](#)

Tick (✓) **one** box in each row to identify if the statement about structure diagrams is true or false.

Statement	True (✓)	False (✓)
A structure diagram is a piece of code that is available throughout the structure of a program.		
A structure diagram shows the hierarchy of a system.		
A structure diagram is another name for an array.		
A structure diagram shows the relationship between different components of a system.		

[2]



21. June/2020/Paper2/Paper\_21/No.3

Programs can perform validation and verification checks when data is entered.

(a) Give the names of **two** different validation checks and state the purpose of each one.

Check 1 .....

Purpose .....

.....

.....

Check 2 .....

Purpose .....

.....

.....

[4]

(b) Give the name of **one** verification check.

..... [1]

(c) Describe the difference between validation and verification.

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..... [2]



(c) Describe how you could change your pseudocode in **part (b)** so that it prevents numbers below 100 and above 200 from being stored in the array `Values[ ]`

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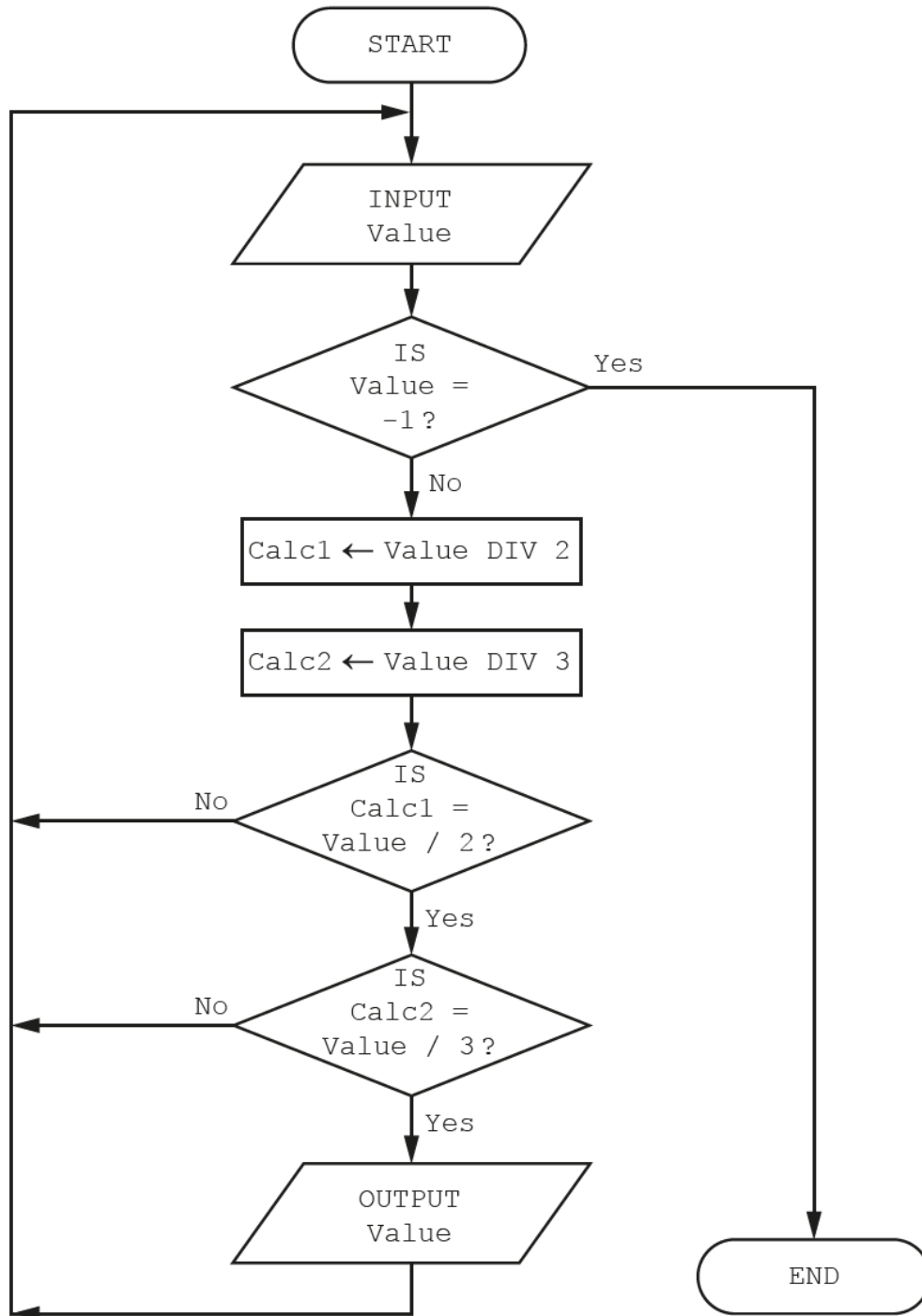
..... [2]

**23. June/2020/Paper2/Paper\_21/No.5**

The flowchart represents an algorithm.

The predefined function `DIV` gives the value of the result of integer division, for example,  $y \leftarrow 9 \text{ DIV } 4$  gives  $y$  a value of 2

An input value of  $-1$  ends the algorithm.



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

50, 33, 18, 15, 30, -1, 45, 12, 90, 6

Value	Calc1	Calc2	OUTPUT

[4]

(b) Describe the purpose of the algorithm.

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

**24. June/2020/Paper2/Paper\_22/No.2**

Most programming languages include basic data types. Ahmad is describing the basic data types he has used.

State the data type that Ahmad is describing in each sentence.

Choose the data type from this list of programming terms.

**Array      Boolean      Char      Constant      Function      Integer**  
**Iteration      Procedure      Real      String      Variable**

A number with a fractional part that can be positive or negative and used in calculations

Data type .....

A whole number that can be positive, negative or zero and used in calculations

Data type .....

A single number, symbol or letter

Data type .....

A sequence of characters

Data type .....

A data type with two values, True or False

Data type .....

[5]

**25. June/2020/Paper2/Paper\_22/No.3**

- (a) An algorithm has been written in pseudocode to input the names and marks of 35 students. The algorithm stores the names and marks in two arrays `Name[ ]` and `Mark[ ]`. The highest mark awarded is found and the number of students with that mark is counted. Both of these values are output.

```
01 HighestMark ← 100
02 HighestMarkStudents ← 0
03 FOR Count ← 1 TO 35
04     OUTPUT "Please enter student name"
05     INPUT Name[Count]
06     OUTPUT "Please enter student mark"
07     INPUT Mark[Counter]
08     IF Mark[Count] = HighestMark
09         THEN
10             HighestMarkStudents ← HighestMarkStudents + 1
11     ENDIF
12     IF Mark[Count] > HighestMark
13         THEN
14             HighestMark ← Mark[Count]
15             HighestMarkStudents ← 1
16     ENDIF
17 NEXT Count
18 OUTPUT "There are ", HighestMarkStudents, " with the highest mark of ",
    HighestMark
```

Give line numbers where the **four** errors are to be found in the pseudocode. 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 .....

.....

[4]





## 26. June/2020/Paper2/Paper\_22/No.4

This flowchart inputs the points won and the points lost when playing a game. The difference between the points won and lost is calculated and depending on the result the player can: move up to the next level, stay at the same level, or move down to the previous level. The flowchart finishes when the input for points won is  $-1$ .

