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THE AQIB KHAN
AN INSTITUTE OF O/A LEVEL

AS - COMPUTER SCIENCE 9618

SIR AAQIB KHAN

PAPER - 2

TOPIC: FLOWCHART

WORKSHEET

STUDENT NAME: AQIB KHAN

CLASS: AS - P2

Question No. 1 [Sir Aaqib Khan]

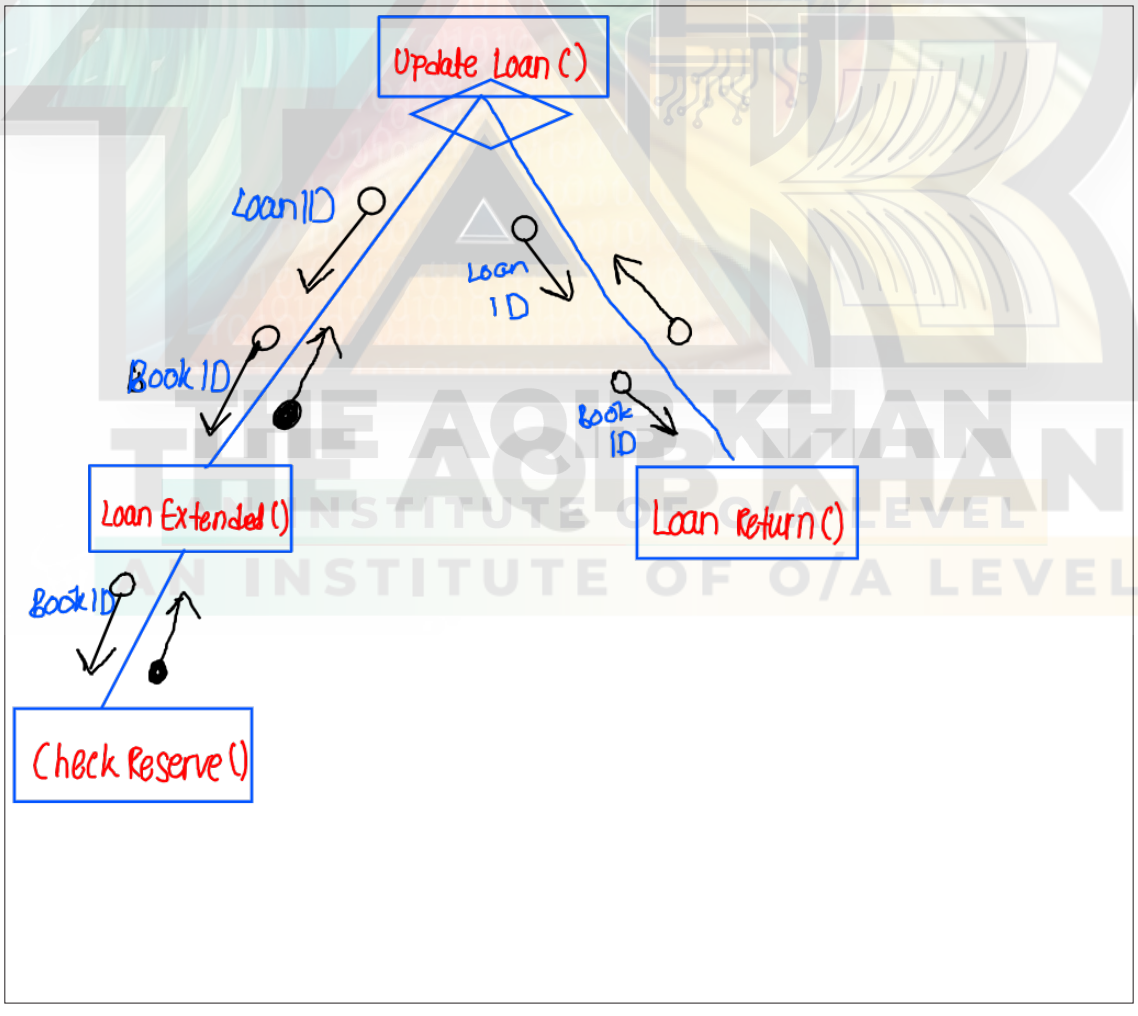
[May / June - 2021 / Paper - 21 / Question No 2]

2 (a) Four program modules form part of a program for a library.

A description of the relationship between the modules is summarised as follows:

Module name	Description
`UpdateLoan()`	• Calls either `LoanExtend()` or `LoanReturn()`
`LoanExtend()`	• Called with parameters `LoanID` and `BookID` • Calls `CheckReserve()` to see whether the book has been reserved for another library user • Returns `TRUE` if the loan has been extended, otherwise returns `FALSE`
`CheckReserve()`	• Called with `BookID` • Returns `TRUE` if the book has been reserved, otherwise returns `FALSE`
`LoanReturn()`	• Called with parameters `LoanID` and `BookID` • Returns a `REAL` (which is the value of the fine to be paid in the case of an overdue loan)

Draw a structure chart to show the relationship between the four modules and the parameters passed between them.



[5]

(b) The definition for module `LoanReturn()` is amended as follows:

Module name	Description
`LoanReturn()`	Called with parameters `LoanID`, `BookID` and `Fine` The module code checks whether the book has been returned on time and then assigns a new value to `Fine`

- `LoanID` and `BookID` are of type `STRING`
- `Fine` is of type `REAL`

Write the pseudocode header for the **amended** module `LoanReturn()`.

PROCEDURE LoanReturn (LoanID, BookID : STRING,
BY REF Fine : REAL)

[2]

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(c) A program will:

1. input 50 unique integer values
2. output the largest value
3. output the average of the values **excluding** the largest value.

IF N>LARGE THEN LARGE ← NUM

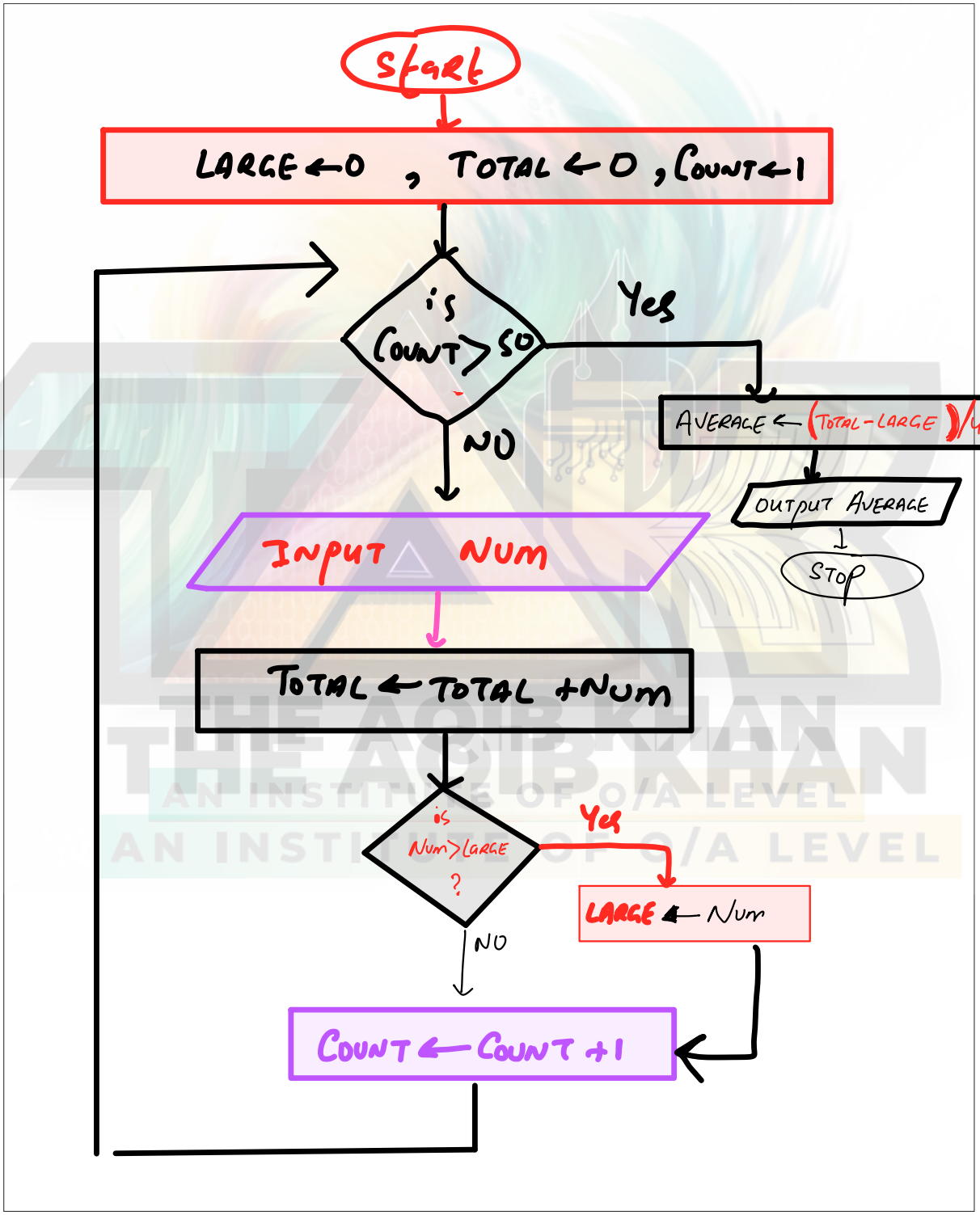
TOTAL ← TOTAL + NUM

AVG ← (TOTAL - LARGE) / 49

Draw a program flowchart to represent the algorithm.

✗ Variable declarations are **not** required.

✗ It is not necessary to check that each input value is unique.



[6]

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Question No. 2 [Sir Aaqib Khan]

[Oct / Nov - 2021 / Paper - 21 / Question No 2]

2 (a) An algorithm to sort a 1D array into ascending order is described as follows:

- move the largest value to the end
- keep repeating until the array is sorted.

Apply the process of stepwise refinement to this algorithm in order to produce a more detailed description.

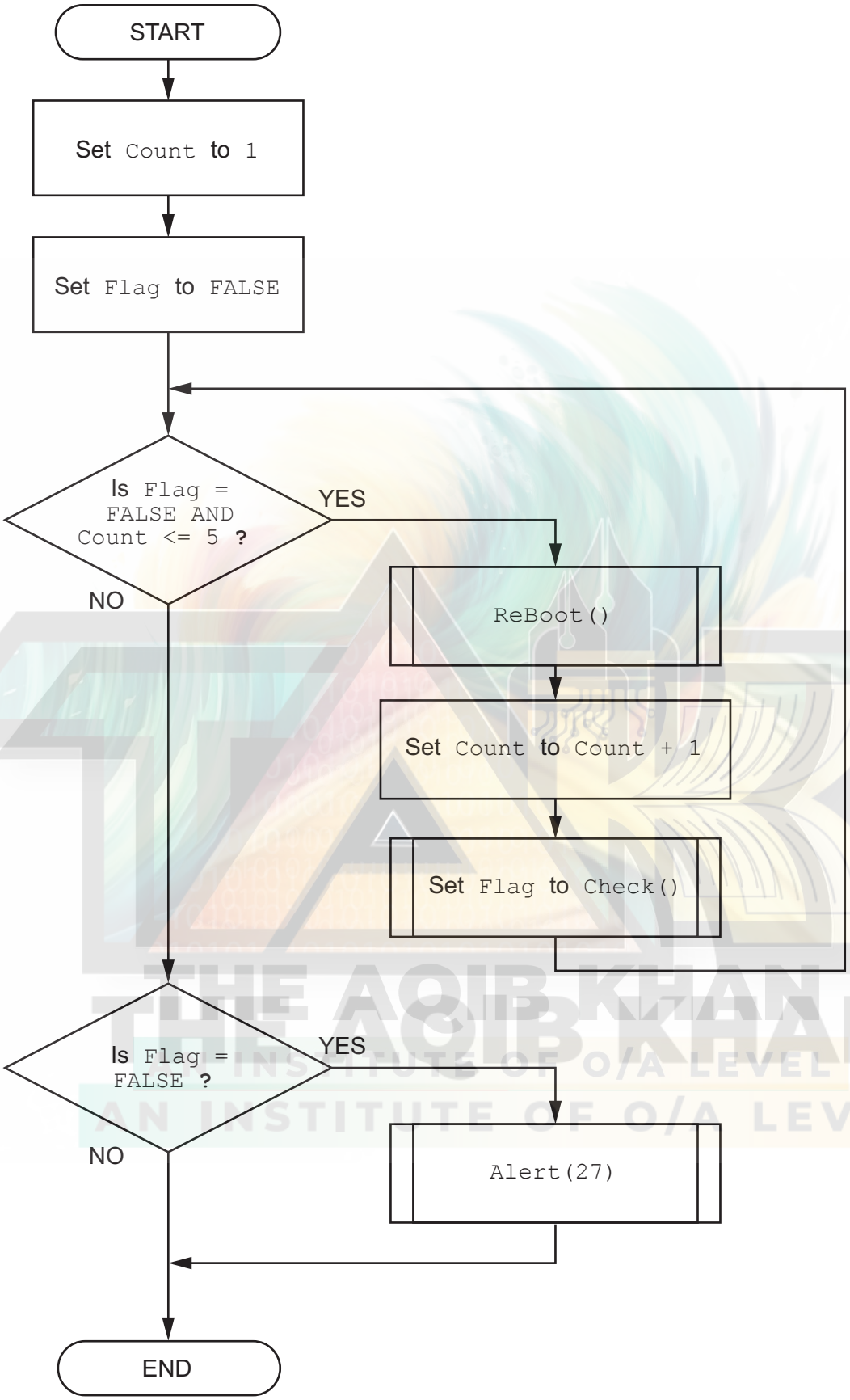
Write the more detailed description using **structured English**. Your explanation of the algorithm should not include pseudocode statements.

The use of a variable as an index to the array. A Loop will iterate through array, an inner loop with the reducing range. Test if the current element is greater than next element if yes than swap the element. There will be description of swap - Attempt it at efficient algorithm.

[6]

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(b) The program flowchart shown describes a simple algorithm.



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Write pseudocode for the simple algorithm shown on page 6.

```
Count ← 1
Flag ← FALSE
WHILE Flag = FALSE AND Count <= 5 DO
    CALL Reboot()
    count ← Count + 1
    Flag ← Check()
ENDWHILE
IF Flag = FALSE THEN
    CALL Alert(27)
ENDIF
```

[6]

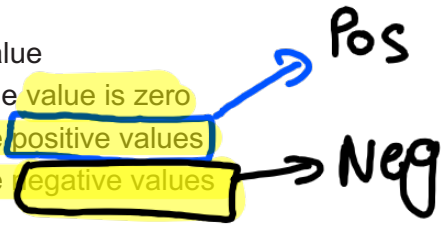
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Question No. 3 [Sir Aaqib Khan]

[Oct / Nov - 2021 / Paper - 22 / Question No 2]

2 (a) An algorithm will:

1. input an integer value
2. jump to step 6 if the value is zero
3. sum and count the positive values
4. sum and count the negative values
5. repeat from step 1
6. output the two sum values and the two count values.

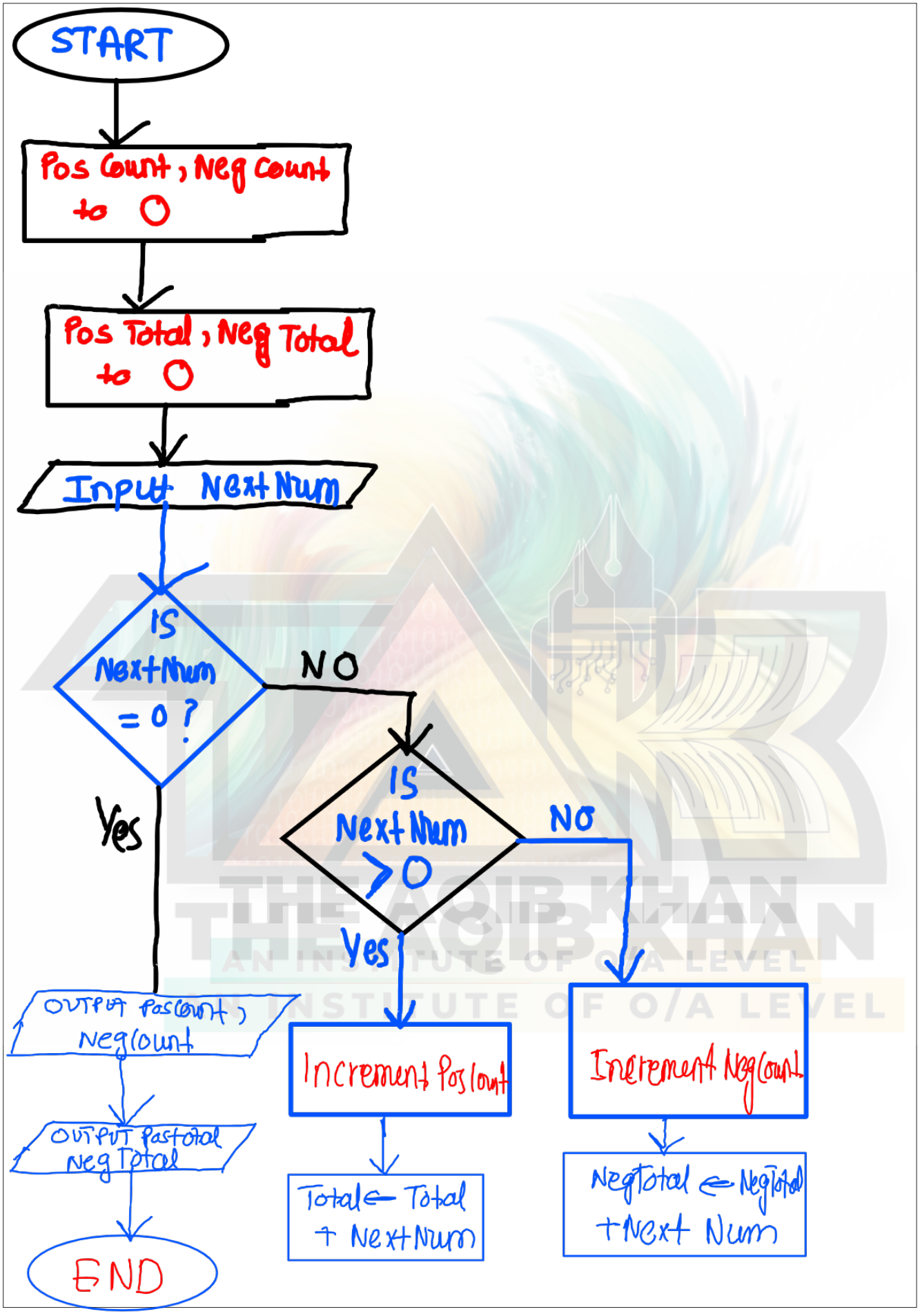


Draw a program flowchart on the following page to represent the algorithm.

Note that variable declarations are not required in program flowcharts.

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[5]

(b) A software company is working on a project to develop a website for a school.

The school principal has some ideas about the appearance of the website but is unclear about all the details of the solution. The principal would like to see an initial version of the website.

(i) Identify a life cycle method that would be appropriate in this case.

Give a reason for your choice.

Life cycle method ..... Iterative .....

Reason ..... It provides a working model and to review it. .....

.....

.....

[2]

(ii) The website project has progressed to the design stage.

State **three** activities that will take place during the design stage of the program development life cycle.

1 ..... Data Structures .....

2 ..... Testing method .....

3 ..... User Interface. .....

[3]

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Question No. 4 [Sir Aaqib Khan]

[Oct / Nov - 2021 / Paper - 23 / Question No 2]

2 (a) An algorithm to sort a 1D array into ascending order is described as follows:

- move the largest value to the end
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Apply the process of stepwise refinement to this algorithm in order to produce a more detailed description.

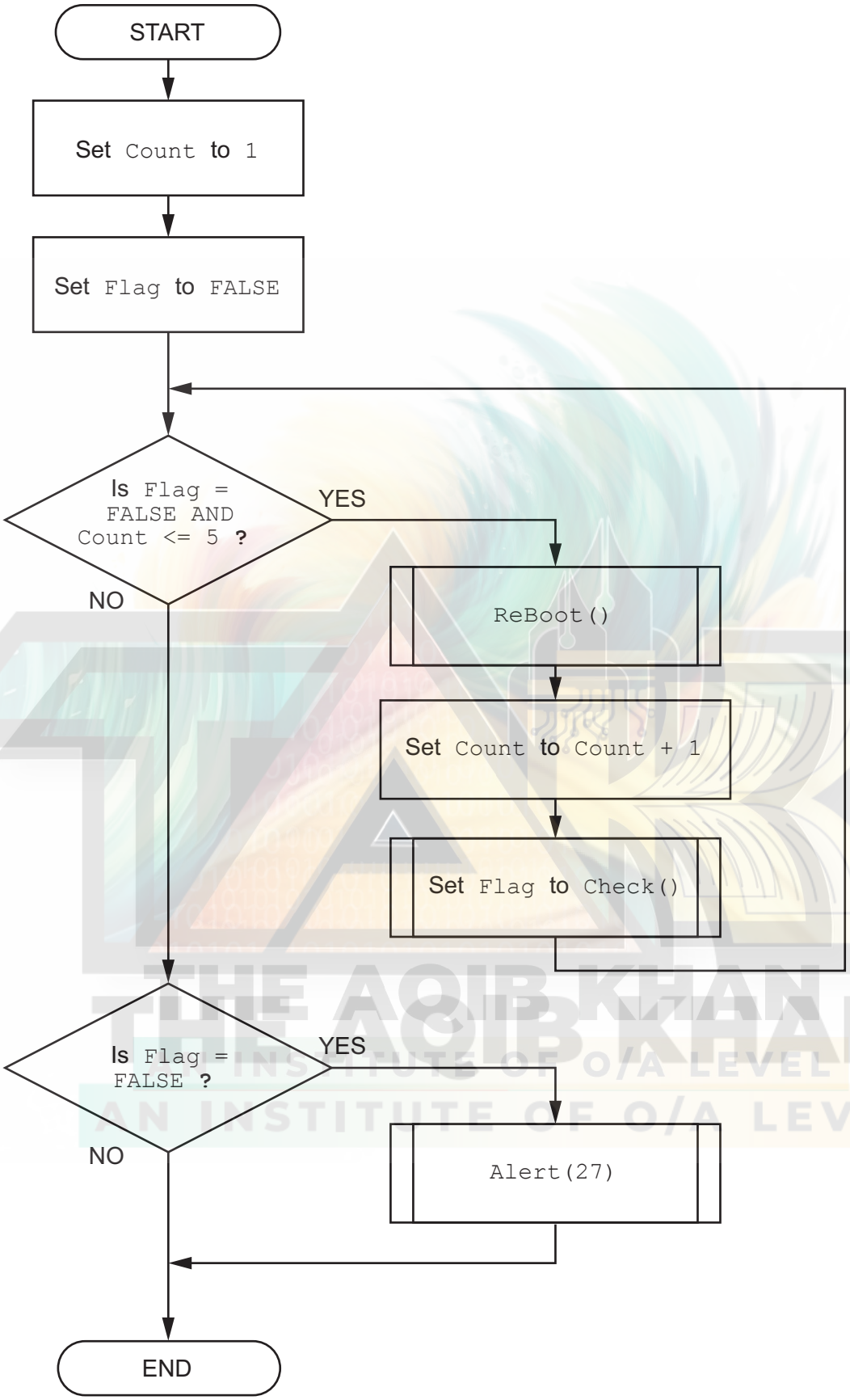
Write the more detailed description using **structured English**. Your explanation of the algorithm should not include pseudocode statements.

The use of a variable as an index to the array. A Loop will iterate through array, an inner loop with the reducing range. Test if the current element is greater than next element if yes than swap the element. There will be description of swap - Attempt it at efficient algorithm.

[6]

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(b) The program flowchart shown describes a simple algorithm.



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Write pseudocode for the simple algorithm shown on page 6.

```
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Flag ← FALSE
WHILE Flag = FALSE AND Count <= 5 DO
    CALL Reboot()
    count ← Count + 1
    Flag ← Check()
ENDWHILE
    IF Flag = FALSE THEN
    CALL Alert(27)
ENDIF
```

[6]

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Question No. 5 [Sir Aaqib Khan]

[May / June - 2022 / Paper - 21 / Question No 1]

1 **(a)** A programmer draws a program flowchart to show the sequence of steps required to solve a problem.

Give the technical term for a sequence of steps that describe how to solve a problem.

Alogorithm

..... [1]

(b) The table lists some of the variables used in a program.

(i) Complete the table by writing the most appropriate data type for each variable.

Variable	Use of variable	Data type
`Temp`	Stores the average temperature	REAL
`PetName`	Stores the name of my pet	STRING
`MyDOB`	To calculate the number of days until my next birthday	DATE
`LightOn`	Stores state of light; light is only on or off	BOOLEAN

[4]

(ii) One of the names used for a variable in the table in part **1(b)(i)** is not an example of good practice.

Identify the variable and give a reason why it is **not** good practice to use that name.

Variable Temp

Reason It is an abreviation and it is not enough descriptive.

[2]

(c) Complete the table by evaluating each expression.

10.3 + 1 = 11

Expression	Evaluation
`INT((31 / 3) + 1)`	11
`MID(TO_UPPER("Version"), 4, 2)` (1 2 3 4 5 6 7)	SI
`TRUE AND (NOT FALSE)`	TRUE
`NUM_TO_STR(27 MOD 3)`	0

[4]

Question No. 6 [Sir Aaqib Khan]

[May / June - 2022 / Paper - 21 / Question No 7]

7 A string is a palindrome if it reads the same forwards as backwards.

The following strings are examples of palindromes:

"Racecar"
"madam"
"12344321"

Upper-case and lower-case characters need to be treated the same. For example, 'A' is equivalent to 'a'.

(a) A function `IsPalindrome()` will take a string parameter. The function will return `TRUE` if the string is a palindrome and will return `FALSE` if the string is not a palindrome.

Write pseudocode for `IsPalindrome()`.

```
Function Is Palindrome (InString : STRING) Returns Boolean
    DECLARE LeftPointer : INTEGER
    DECLARE RightPointer : INTEGER
    DECLARE UpString : STRING
// Convert string to upercase
    UpString ← UCASE (InString)
    LeftPointer ← 1
    RightPointer ← LENGTH (UpperString)
WHILE LeftPointer < RightPointer
    IF MID(UpperString, LeftPointer, 1) <> MID(UpperString, RightPointer, 1)
        Return FALSE
    ENDIF
        LeftPointer ← LeftPointer + 1
        RightPointer ← RightPointer - 1
ENDWHILE
    RETURN TRUE
ENDFUNCTION
```

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..... [7]

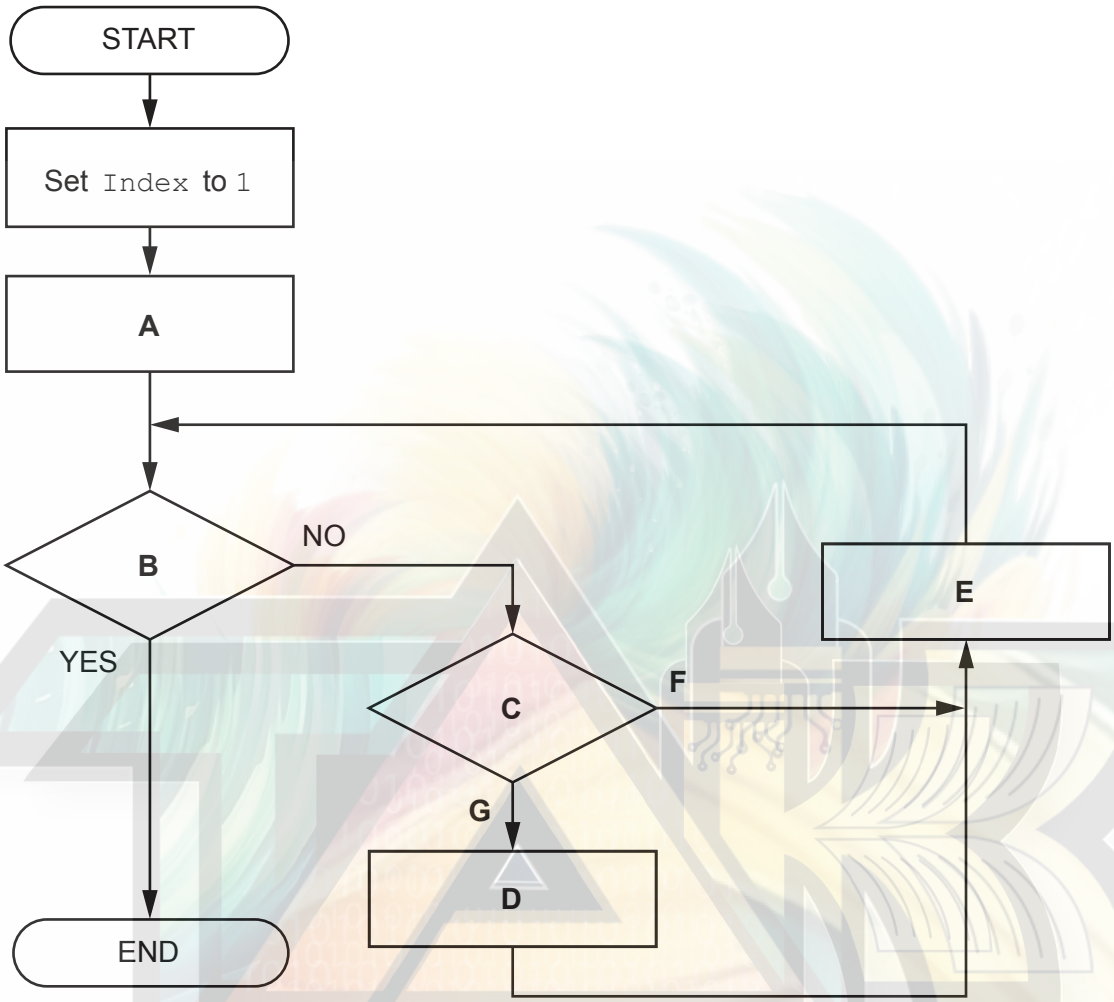
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(b) Strings may consist of several words separated by spaces.

For example, the string "never odd or even" becomes a palindrome if the spaces are removed.

The program flowchart represents an algorithm to produce a string `OutString` by removing all spaces from a string `InString`.



Complete the table by writing the text that should replace each of the labels **B**, **C**, **D**, **F** and **G**.

Note: the text may be written as a pseudocode statement.

Label	Text
A	Set `OutString` to `""`
B	Index > LENGTH(InString)
C	MID(InString, Index, 1) <> ""
D	OutString ← OutString + MID(InString, Index, 1)
E	Set `Index` to `Index + 1`
F	NO
G	Yes

[4]

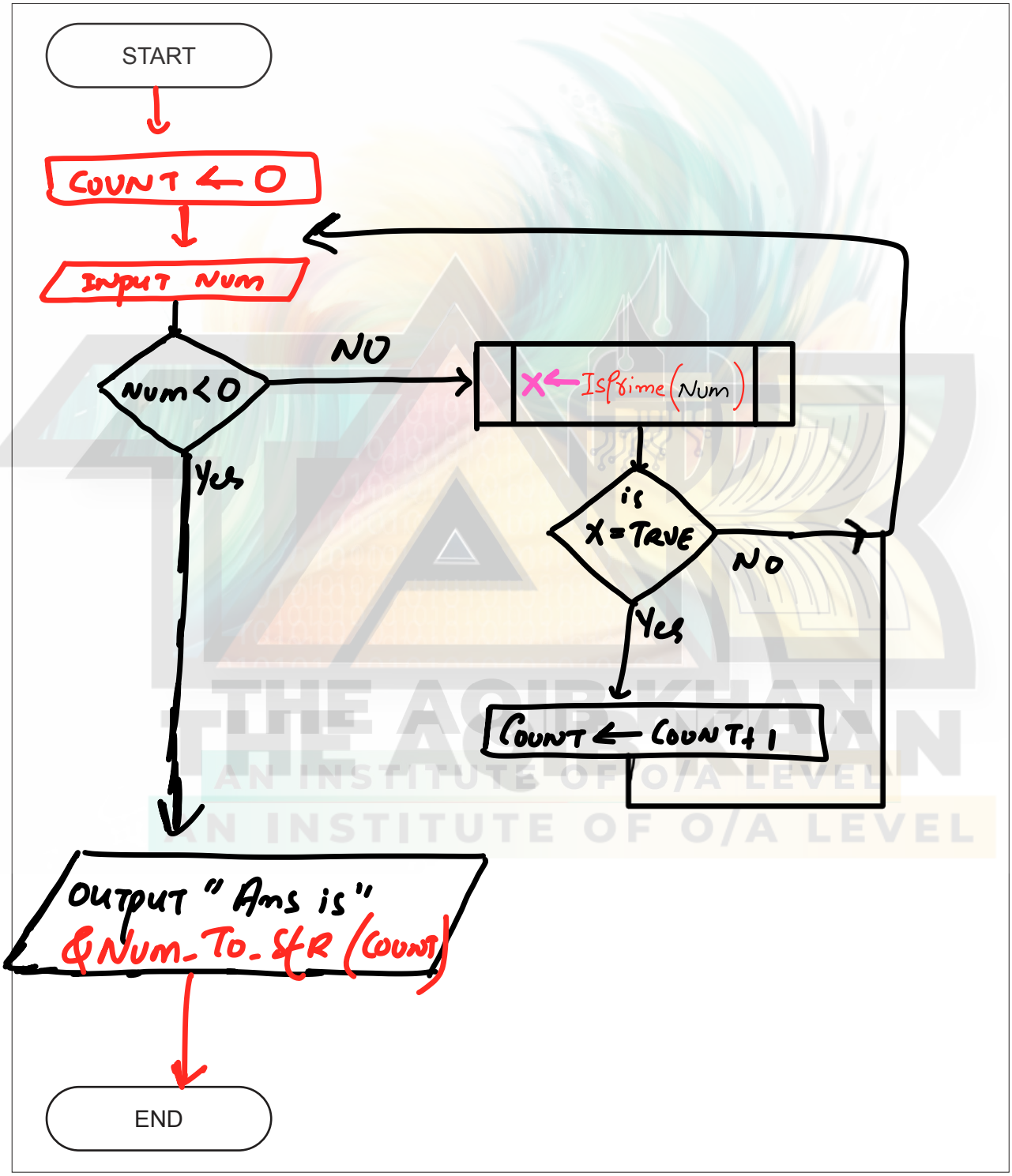
Question No. 7 [Sir Aaqib Khan]

[May / June - 2022 / Paper - 22 / Question No 2]

2 An algorithm is described as follows:

1. Input an integer value.
2. Jump to step 6 if the value is less than zero.
3. Call the function `IsPrime()` using the integer value as a parameter
4. Keep a count of the number of times function `IsPrime()` returns `TRUE`.
5. Repeat from step 1.
6. Output the value of the count with a suitable message.

Draw a program flowchart to represent the algorithm.



[4]

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Question No. 8 [Sir Aaqib Khan]

[May / June - 2022 / Paper - 23 / Question No 6]

6 (a) The factorial of a number is the product of all the integers from 1 to that number.

For example:

factorial of 5 is given by $1 \times 2 \times 3 \times 4 \times 5 = 120$
factorial of 7 is given by $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 = 5040$
factorial of 1 = 1

Note: factorial of 0 = 1

A function `Factorial()` will:

- be called with an integer number as a parameter
- calculate and return the factorial of the number
- return −1 if the number is negative.

Write pseudocode for the function `Factorial()`.

```
Function Factorial (n: INTEGER) RETURN INTEGER
    DECLARE result : INTEGER
    DECLARE i : INTEGER
    IF n<0 THEN
        RETURN -1
    ELSE
        result ← -1
    ENDIF
    // Loop from 1 to input number n
    FOR i ← 1 TO n
        result ← result * 1
    NEXT i
    RETURN result
ENDFUNCTION
```

[6]

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(b) A procedure `FirstTen()` will output the factorial of the numbers from 0 to 9. The procedure will use the function from **part (a)**.

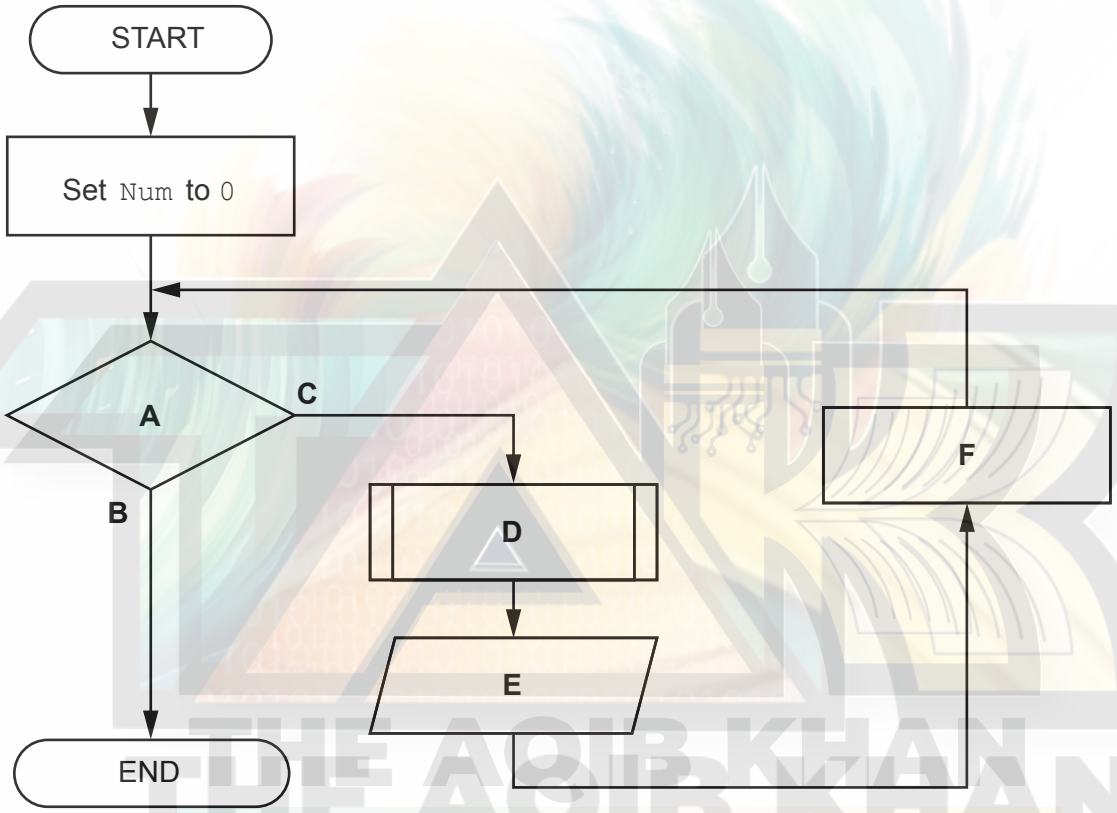
The required output is:

```
Factorial of 0 is 1
Factorial of 1 is 1
Factorial of 2 is 2
```



```
Factorial of 9 is 362880
```

The program flowchart represents an algorithm for `FirstTen()`.



Complete the table by writing the text that should replace each label **A** to **F**.

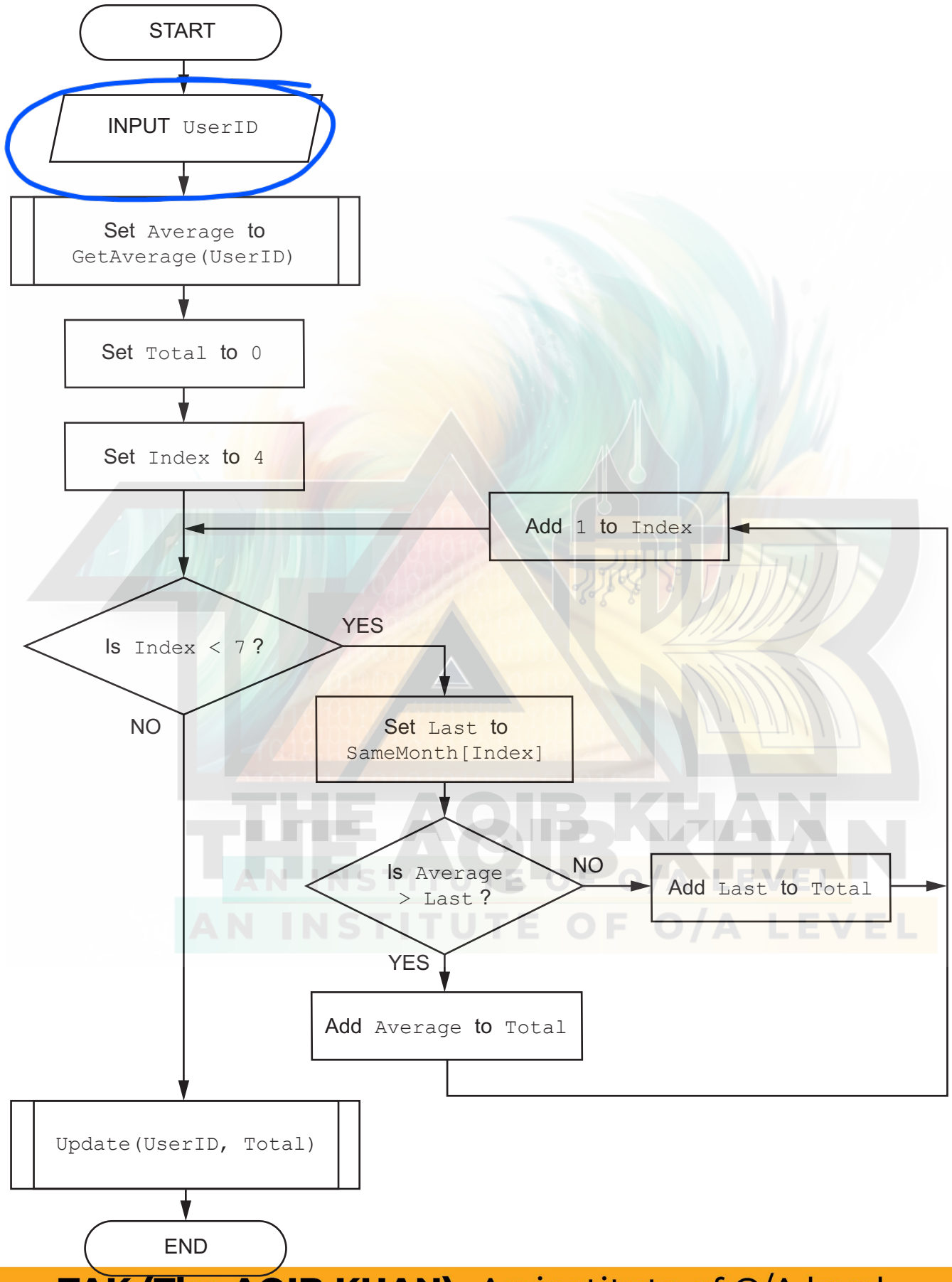
Label	Text
A	Num ≤ 9
B	NO
C	YES
D	Fact ← Factorial(Num)
E	Output Factorial of Num is Fact
F	Num ← Num + 1

[4]

Question No. 9 [Sir Aaqib Khan]

[Oct / Nov - 2022 / Paper - 22 / Question No 4]

4 The program flowchart represents a simple algorithm.



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(a) Write the equivalent pseudocode for the algorithm represented by the flowchart.

```
Input UserID
Average ← GetAverage(UserID)
Total ← 0
Index ← 4
WHILE Index < 7
    Last ← SameMonth[Index]
    IF Average > Last THEN
        Total ← Total + Average
    ELSE
        Total ← Total + Last
    ENDIF
ENDWHILE
Update(UserID, Total)
```

[6]

(b) Give the name of the iterative construct in the flowchart.

Because the condition Index < 7 is checked before executing the statements inside loop. [1]

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Question No. 10 [Sir Aaqib Khan]

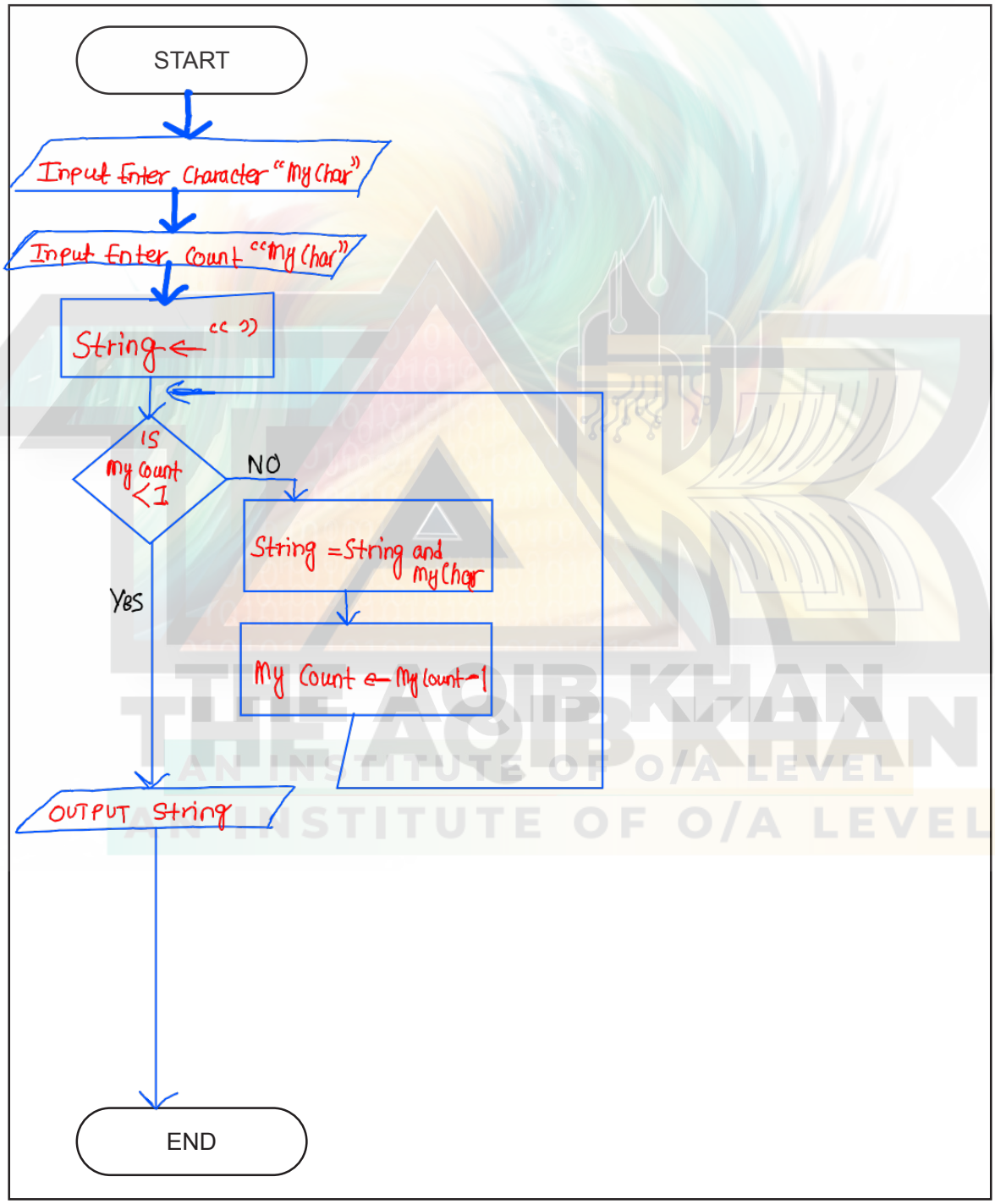
[May /June - 2023 / Paper - 21 / Question No 2]

2 A program contains an algorithm to output a string of a specified length containing identical characters.

(a) The algorithm is described as follows:

1. prompt and input a character and store in `MyChar` input
2. prompt and input an integer and store in `MyCount`
3. generate a string consisting of `MyChar` repeated `MyCount` times String ("")
4. output the string.

Draw a program flowchart to represent the algorithm.



[4]

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(b) A different part of the program uses the variable `StartDate`.

Write pseudocode statements to declare `StartDate` **and** assign to it the date corresponding to 15/11/2005.

Declaration Declare Start Date : DATE

Assignment Start Date ← Set Date (15,11,2025)

[3]

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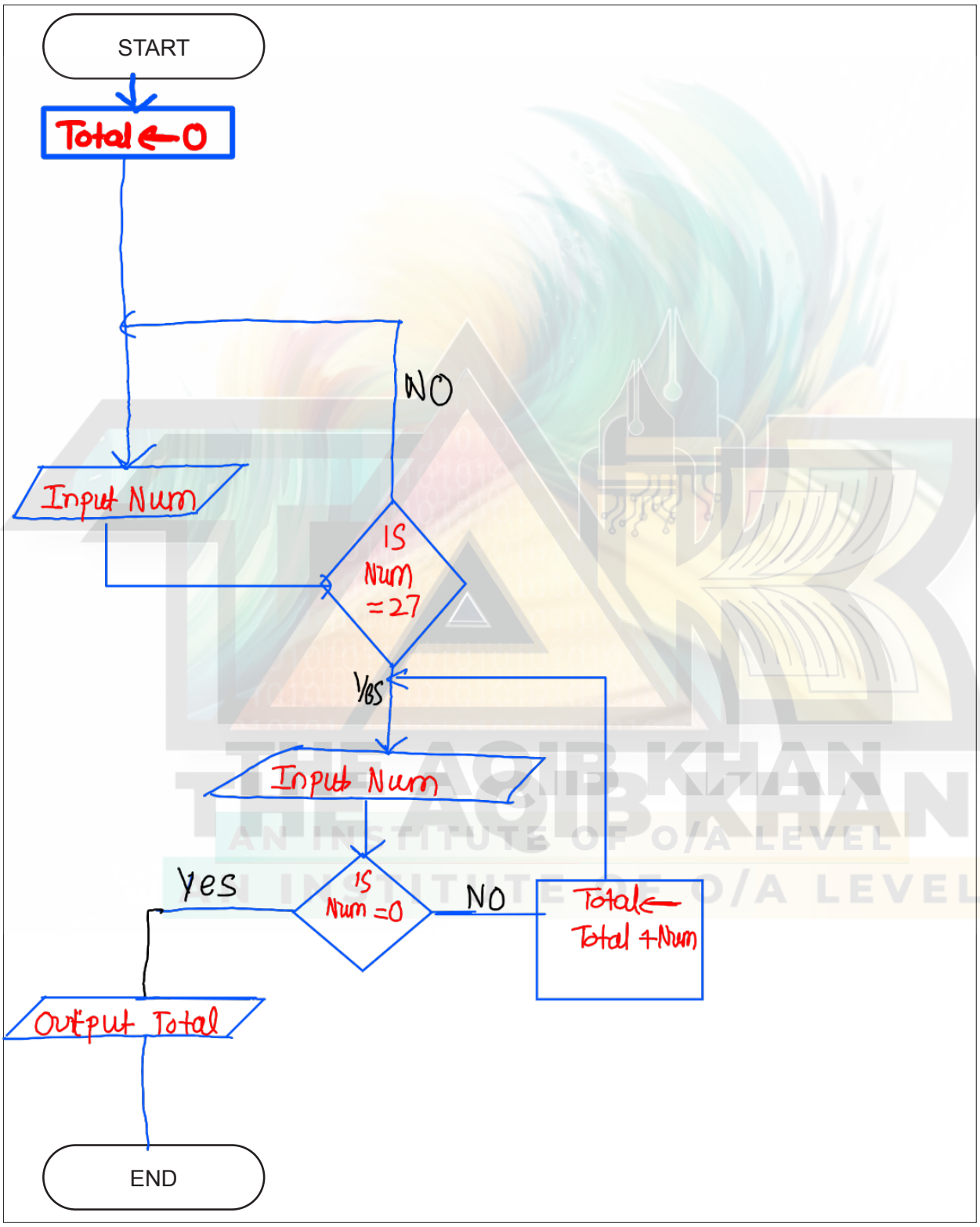
Question No. 11 [Sir Aaqib Khan]

[Oct / Nov - 2023 / Paper - 22 / Question No 2]

2 An algorithm will:

1. input a sequence of integer values, one at a time
2. ignore all values until the value 27 is input, then sum the remaining values in the sequence
3. stop summing values when the value 0 is input and then output the sum of the values.

(a) Draw a program flowchart to represent the algorithm.



[5]

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(b) The solution to the algorithm includes iteration.

Give the name of a suitable loop structure that could be used.

Justify your answer.

Name Post condition loop

Justification The number of iterations is not known.

[2]

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Question No. 12 [Sir Aaqib Khan]

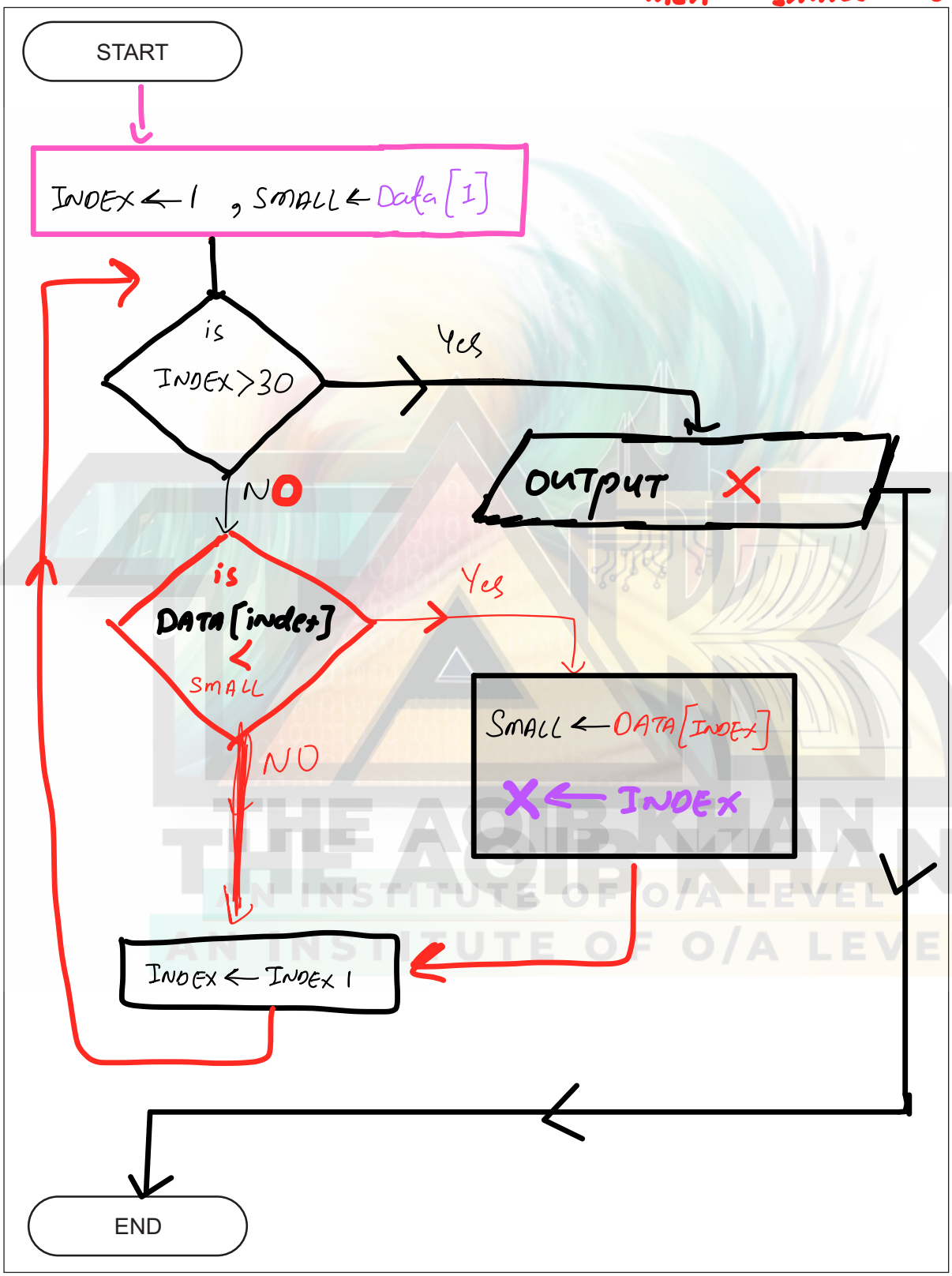
[Oct / Nov - 2023 / Paper - 23 / Question No 2]

2 Data is a 1D array of integers, containing 30 elements. All element values are unique.

(a) An algorithm will output the index of the element with the smallest value.

Draw a program flowchart to represent the algorithm.

if N<small Then small←num



[5]

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(b) The 30 data values could have been stored in separate variables rather than in an array.

Explain the benefits of using an array when designing a solution to part **(a)**.

It simplifes the program and allow storage of many values using single identifier [2]

(c) The requirement changes. Array `Data` needs to hold 120 elements and each value may include a decimal place.

Write a pseudocode statement to declare the modified array.

DECLARE Date : ARRAY[1:120] OF REAL

[2]

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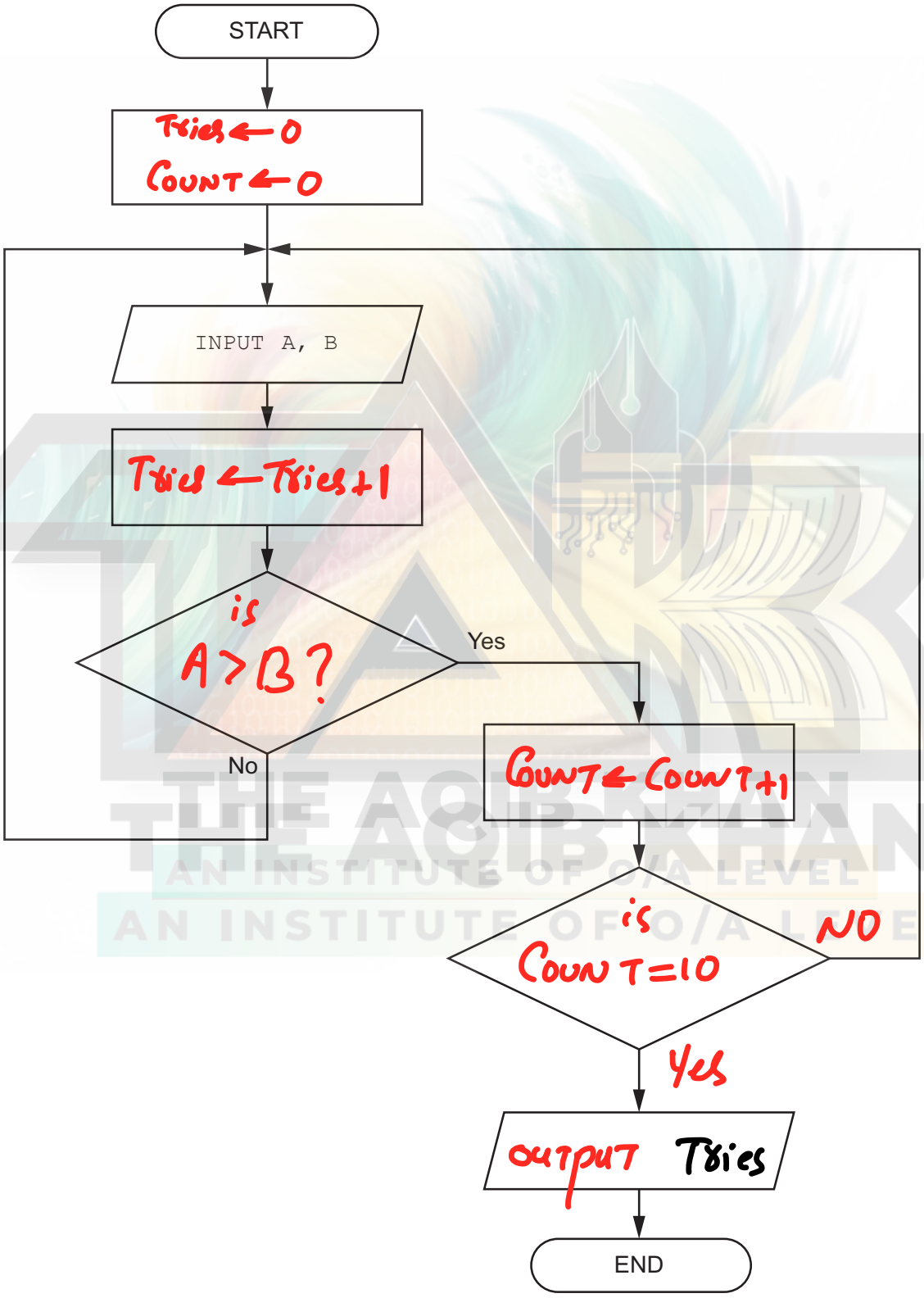
Question No. 13 [Sir Aaqib Khan]

[May / June - 2024 / Paper - 21 / Question No 2]

2 An algorithm has three steps. It will:

1. repeatedly input a pair of numeric values A and B
2. count the number of pairs that are input until A has been greater than B 10 times
3. output the number of pairs that were input.

(a) Complete the program flowchart.



[5]

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(b) Step 1 of the algorithm is changed.

A variable `ThisSequence` is used to enter a sequence of 10 pairs of numeric values, using a single input statement.

Following the input of `ThisSequence` the revised algorithm will extract the pairs of numbers.

Describe the variable `ThisSequence` and how the numbers are extracted.

A variable of type string will be input. The identified character would need to use seperate each numeric value.

[2]

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Question No. 14 [Sir Aaqib Khan]

[May / June - 2024 / Paper - 22 / Question No 2]

2 A program is being developed.

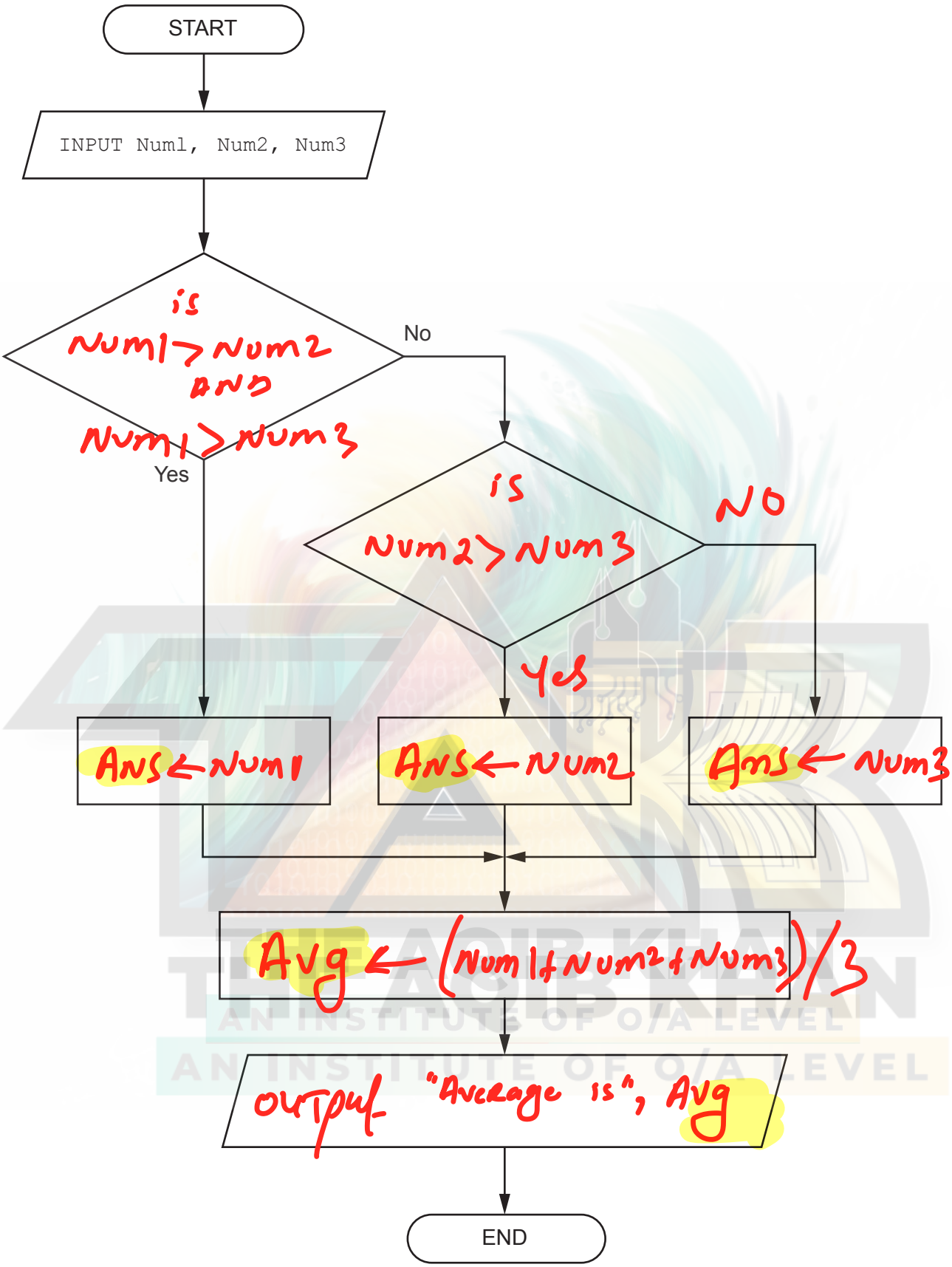
(a) An algorithm for part of the program will:

- input three numeric values and assign them to identifiers `Num1`, `Num2` and `Num3`
- assign the largest value to variable `Ans`
- output a message giving the largest value and the average of the three numeric values.

Assume the values are all different and are input in no particular order.

Complete the program flowchart on page 5 to represent the algorithm.

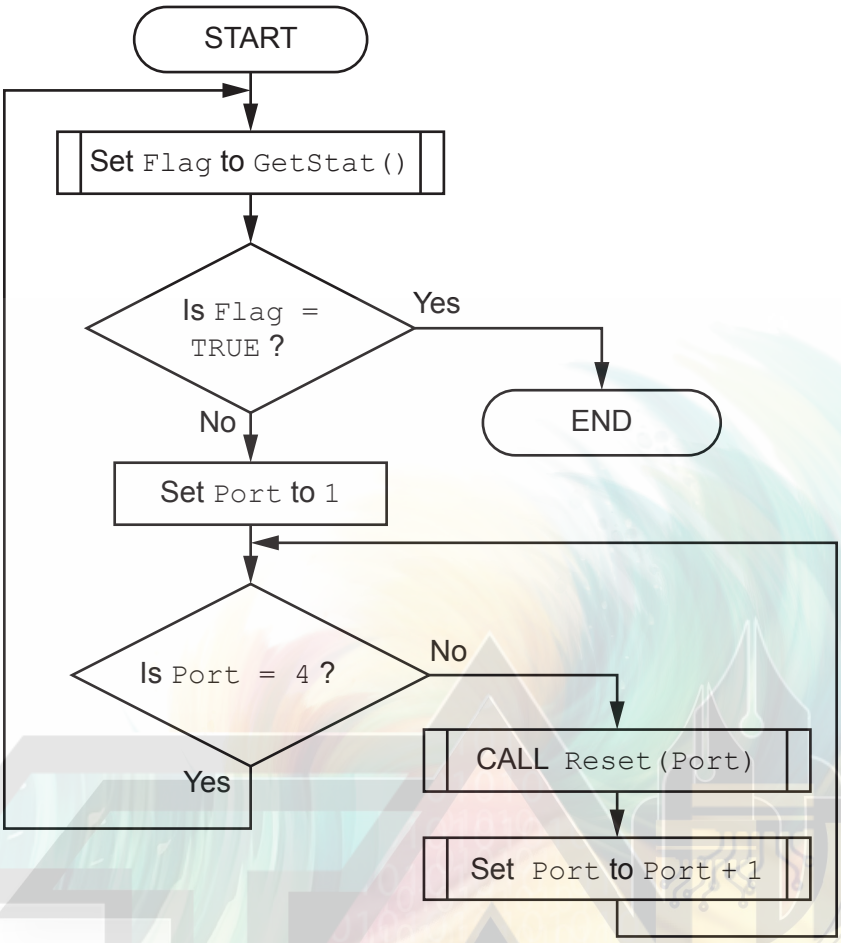
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[5]

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(b) A different part of the program contains an algorithm represented by the following program flowchart:



Write pseudocode for the algorithm.

```
Flag ← Getstat()
Repeat
    port ← 1
    WHILE Port < 4 DO
        CALL Reset(port)
        Port ← port + 1
    ENDWHILE
UNTIL Flag = TRUE
```

[5]

Question No. 15 [Sir Aaqib Khan]

[May / June - 2024 / Paper - 23 / Question No 3]

3 A record structure is declared to hold data relating to components being produced in a factory:

```
TYPE Component
   DECLARE Item_ID : STRING
   DECLARE Reject : BOOLEAN
   DECLARE Weight : REAL
ENDTYPE
```

The factory normally produces a batch (or set) of 1000 components at a time. A global array is declared to store 1000 records for a batch:

```
DECLARE Batch : ARRAY [1:1000] OF Component
```

Two global variables contain the minimum and maximum acceptable weight for each component. The values represent an inclusive range and are declared as:

```
DECLARE Min, Max : REAL
```

(a) (i) A program uses a variable `ThisIndex` as the array index to access a record.

To 1000

Write a pseudocode clause to check whether or **not** the weight of an individual component is within the acceptable range.

IF Batch[ThisIndex].Weight >= Min
AND
Batch[ThisIndex].Weight <= MAx

[3]

(ii) When batches of less than 1000 components are processed, it is necessary to indicate that certain elements in the array are unused.

Suggest how an unused array element could be indicated.

Set Item_ID field to an empty string (Weight <= 0)

[1]

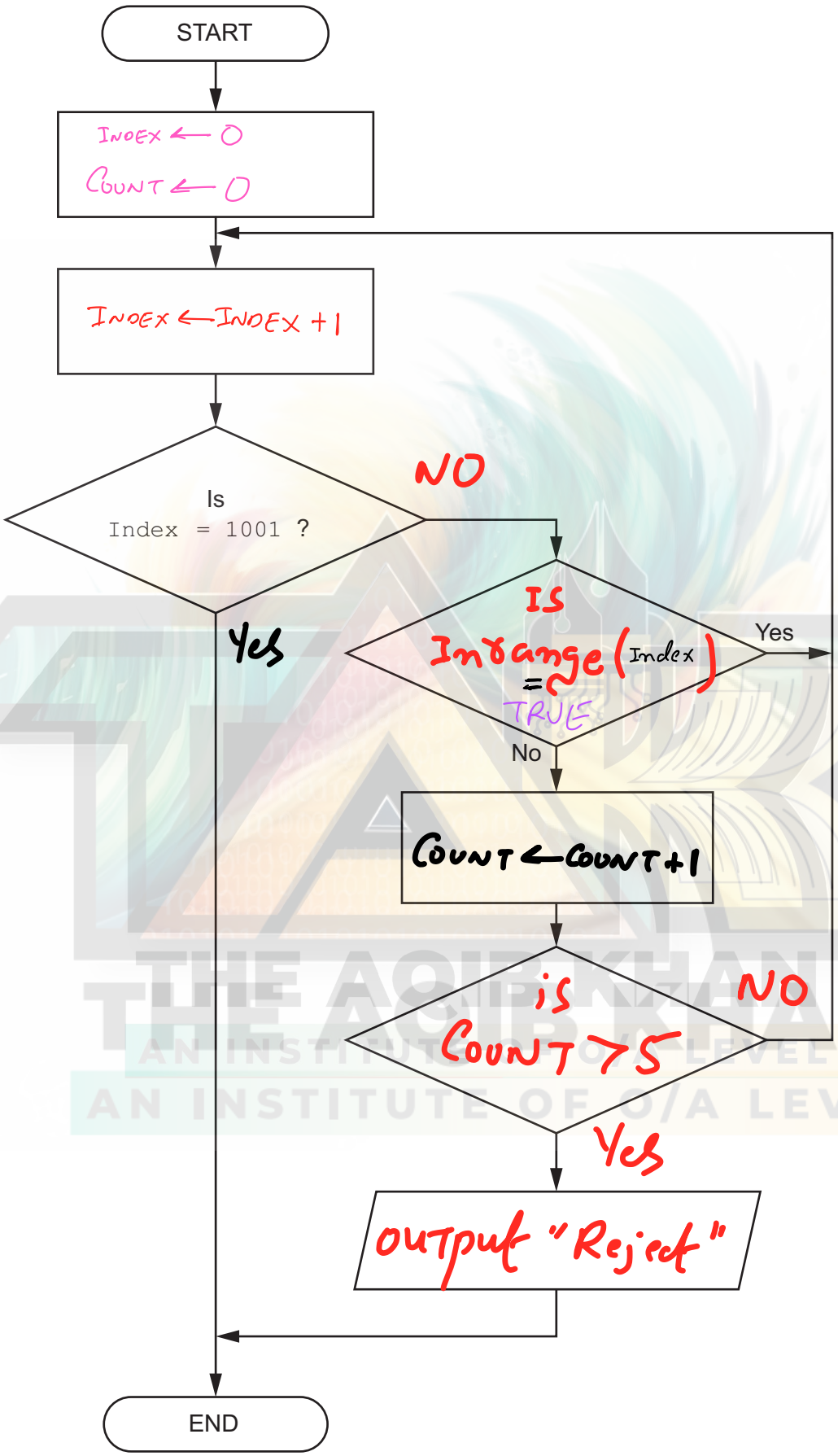
(b) A module `InRange()` will:

- 1 be called with an integer parameter representing an index value of a record in the `Batch` array
- 2 check if the weight of the indexed component is within the acceptable range
- 3 return `TRUE` if the weight is in the range and `FALSE` if it is **not**.

A module `BatchCheck()` will:

- 4 iterate through a batch of 1000 component records
- 5 call module `InRange()` to check each individual component record
- 6 keep a count of the number of components that fail
- 7 output a suitable warning message and immediately stop if the number of failed components exceeds 5.

Complete the program flowchart to represent the algorithm for module `BatchCheck()`.



[5]

Question No. 16 [Sir Aaqib Khan]

[Oct / Nov - 2024 / Paper - 23 / Question No 3]

3 The implementation of a linked list uses an integer variable and a 1D array `List` of type `Node`.

Record type `Node` is declared in pseudocode as follows:

```
TYPE Node
   DECLARE Data : STRING
   DECLARE Pointer : INTEGER
ENDTYPE
```

The array `List` is declared in pseudocode as follows:

```
DECLARE List : ARRAY[1:200] OF Node
```

The linked list will operate as follows:

- Integer variable `HeadPointer` will store the array index for the first node in the linked list.
- The `Pointer` field of a node contains the index value of the next array element (the next node) in the linked list.
- The value 0 is used as a null pointer.

List[2].Pointer = 1

(a) (i) State why the value 0 has been selected as the null pointer.

There is no element index with the 0 in the array. [1]

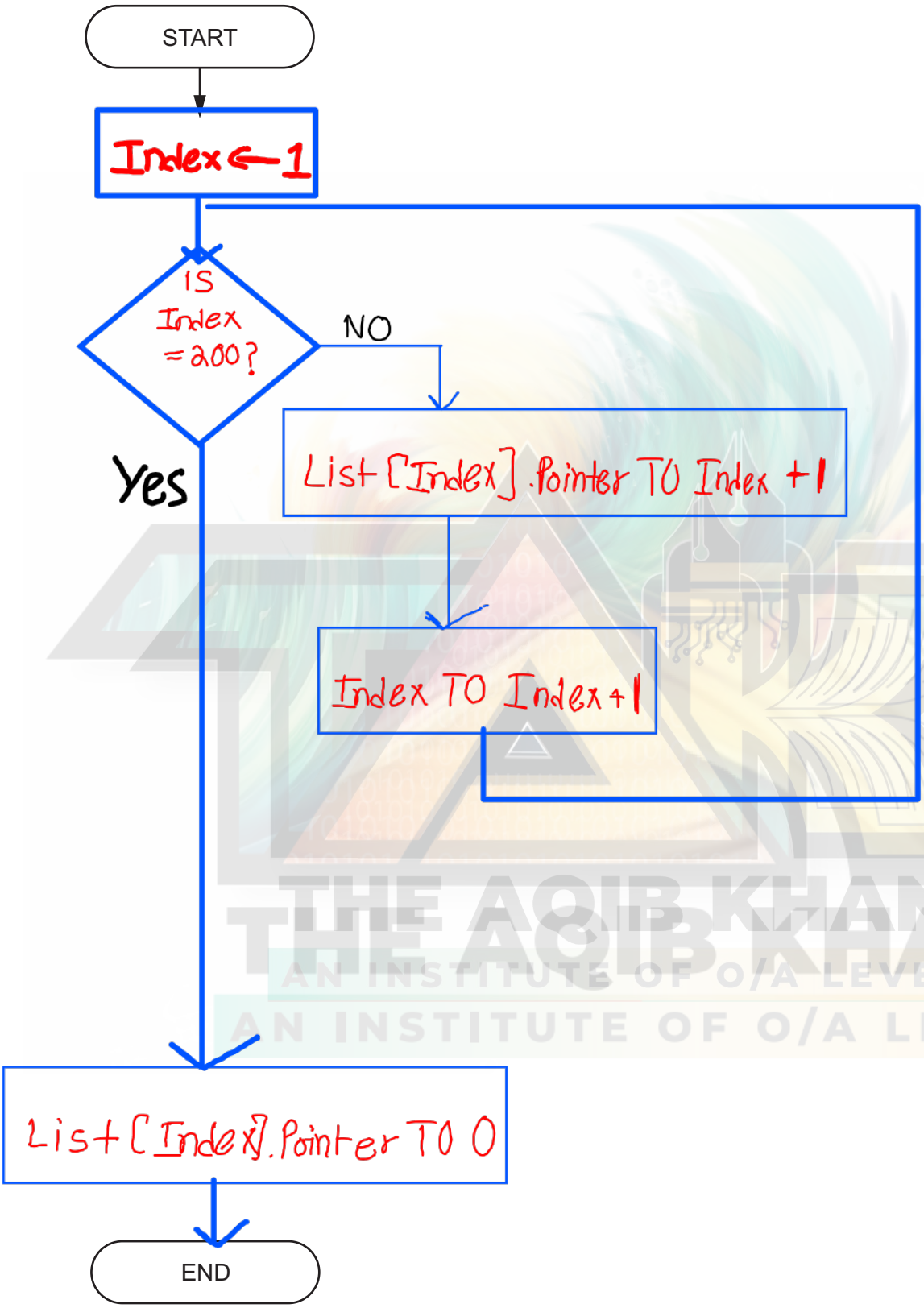
(ii) Give the range of valid values that could be assigned to variable `HeadPointer`.

0 to 200 [1]

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(b) The array `List` will be initialised so that each node points to the following node. The last node will contain a null pointer.

Complete the program flowchart to represent the algorithm for this operation.



[4]

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(c) An algorithm outputs the `Data` field from all nodes in the array `List`. The order the `Data` is output should be the same order it is stored in the linked list.

Describe the algorithm in **four** steps.

Do **not** use pseudocode statements in your answer.

Step 1 Assign the Head pointer's value to Correct pointer.

Step 2 Loop the following until current Pointer is zero (0)

Step 3 Output the data field from array element at index correntpointer

Step 4 Assign pointer field from current array element.

[4]

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Question No. 17 [Sir Aaqib Khan]

[May / June - 2025 / Paper - 21 / Question No 2]

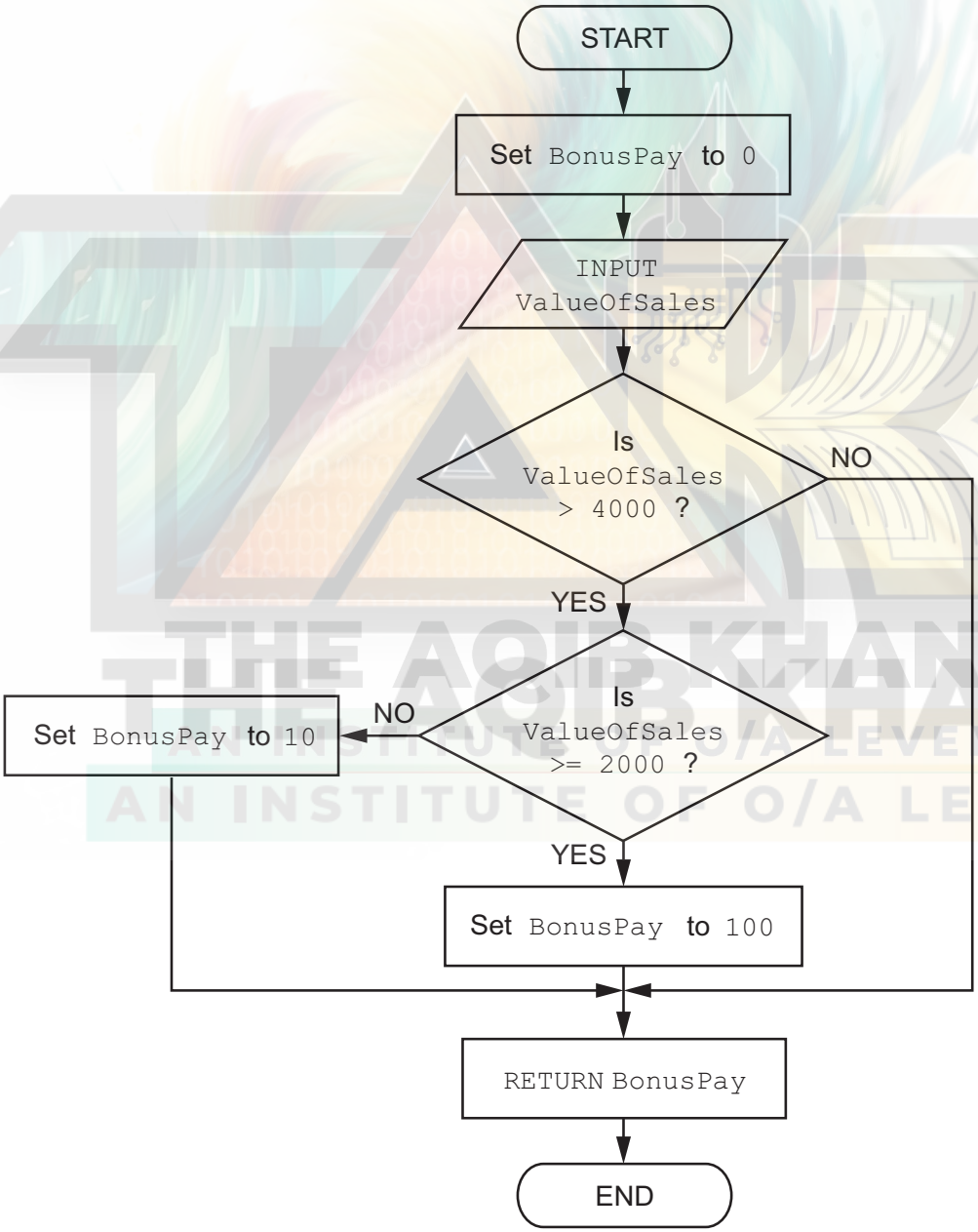
2 A program is being developed to calculate the pay of employees working for a company.

A function `CalculateBonus()` calculates bonus pay based on the value of sales.

Bonus pay is calculated as shown in the table.

Value of sales (in dollars)	Bonus pay (in dollars)
below 2000	0
between 2000 and 4000 inclusive	10
above 4000	100

A flowchart for the function `CalculateBonus()` has been designed.



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(a) The flowchart contains logic errors.

One logic error is that `BonusPay` will **not** be set to `10` although the `ValueOfSales` input is between `2000` and `4000` inclusive.

(i) Explain why this error occurs.

First decision should check for value greater or equals to 2000 ..... [1]

(ii) Explain how this error could be corrected.

first decision should be check>=200 and 2nd decision should be check>=4000 ..... [1]

(b) There are different ways to reduce the risk of errors when developing the new program, such as the use of constants.

(i) State a value that could be replaced by a constant in the function `CalculateBonus()`

2000 or 4000 or 10 or 100 ..... [1]

(ii) Explain how the use of constants helps to reduce the risk of programming errors.

1) Value can not be changed
2) Avoid repeatedly writting some value throughout program ..... [2]

(iii) One other way that can reduce the risk of errors when writing the program is the use of library routines.

Explain how library routines can reduce the risk of programming errors.

- Tried and Tested ..... [1]

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(c) All the logic errors have been corrected, and the program has been coded.

Identify and describe **two** other types of error that the program could contain.

Type of error Syntax Error

Description The rules of programming language is not followed.

Type of error Runtime Error

Description The program perform illegal operation.

[4]

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Question No. 18 [Sir Aaqib Khan]

[May / June - 2025 / Paper - 22 / Question No 4]

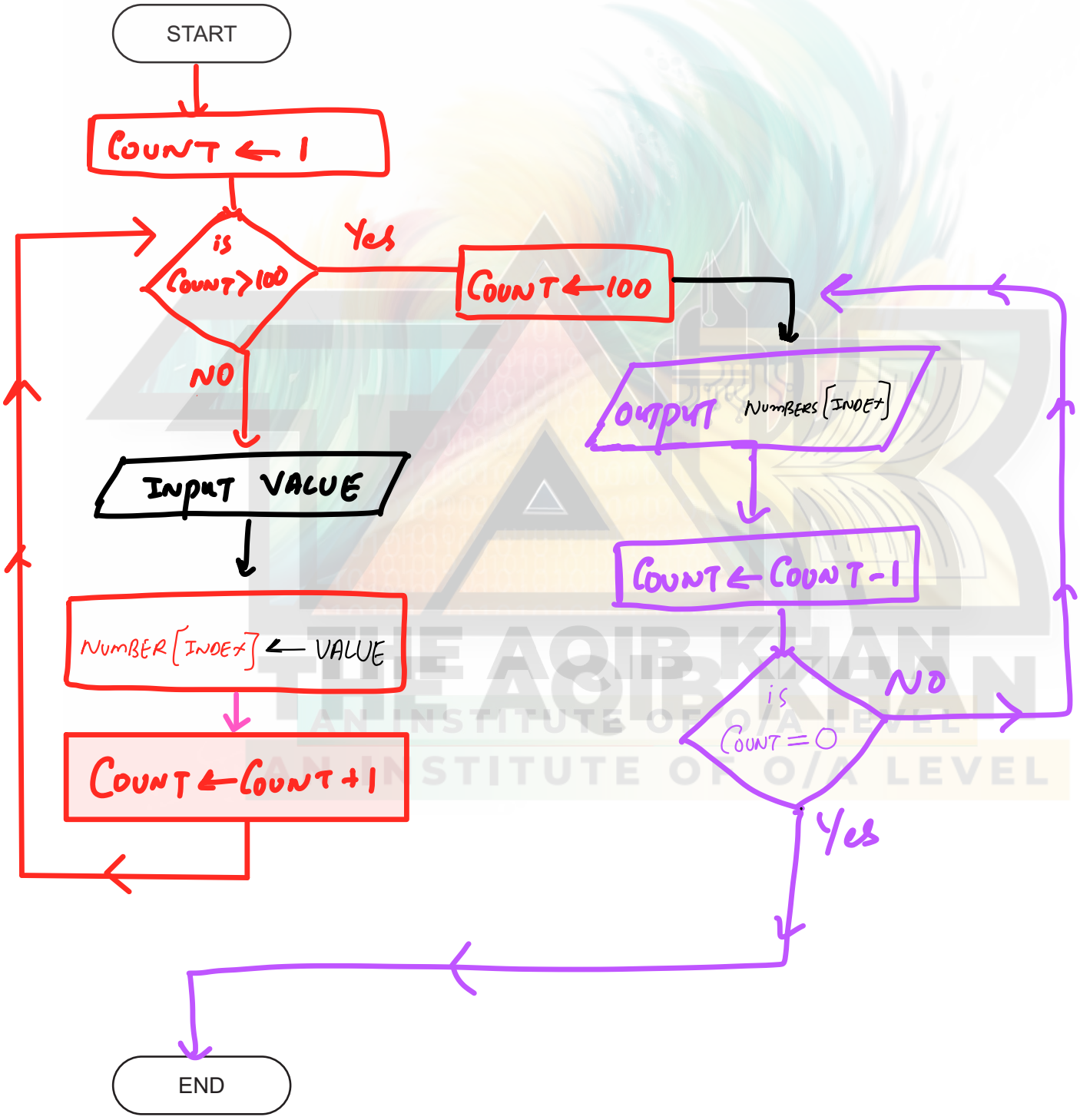
Array = number
100 index

4 An algorithm will:

1 input 100 integer values, one value at a time
2 store the first value input into the first location of the array `Number`
3 store the next input value in the next unused location of the array `Number`
4 output the contents of `Number` array in the opposite sequence to that in which the values were input.

Complete the program flowchart to represent the algorithm.

Variable declarations are **not** required.



[6]

Question No. 19 [Sir Aaqib Khan]

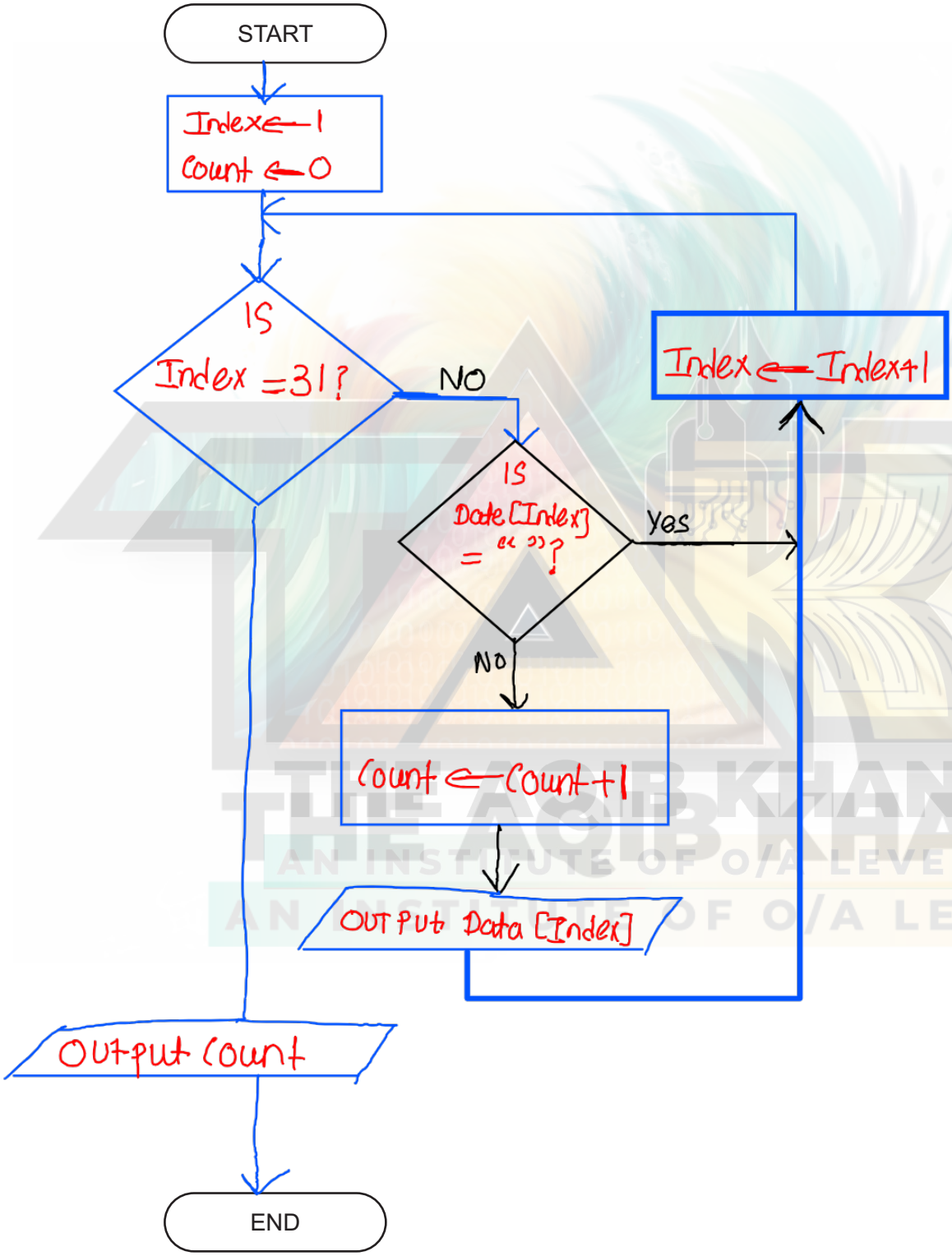
[Oct / Nov - 2025 / Paper - 21 / Question No 2]

2 `Data` is a global 1D array containing 30 elements of type `STRING`

An algorithm will output:

- all non-blank elements (elements that do **not** contain an empty string)
- the final total of the number of elements output.

Complete the program flowchart to represent the algorithm:



[5]

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Question No. 20 [Sir Aaqib Khan]

[Oct / Nov - 2025 / Paper - 22 / Question No 2]

2 `Data` is a global 1D array containing 20 elements of type `REAL`

STOP → NUM = 99.9
→ INDEX > 20

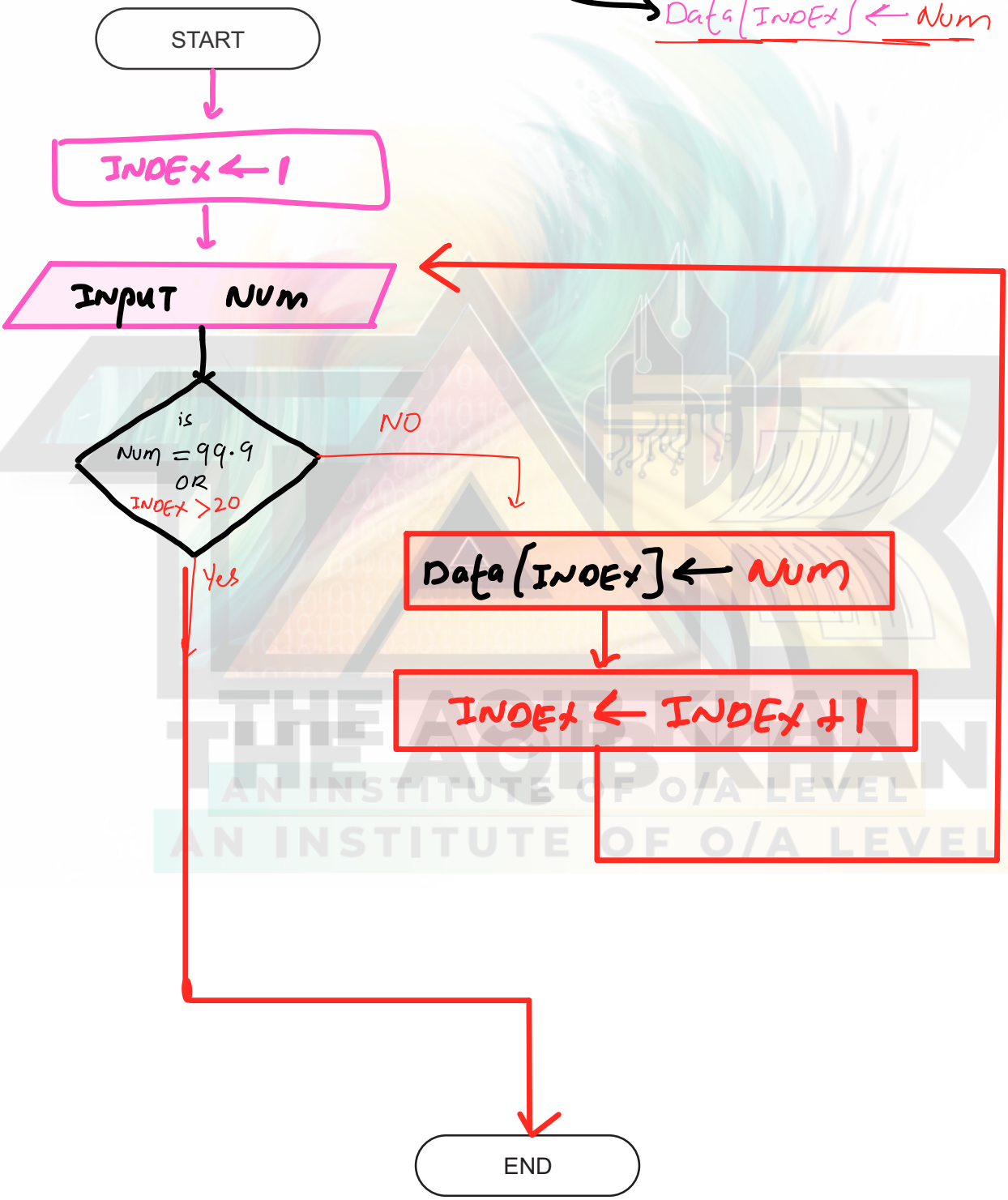
An algorithm will:

1. input a sequence of real values, one at a time
2. assign each value to consecutive array elements, starting from index 1
3. end when the value 99.9 is input, or all 20 elements have been assigned (the value 99.9 must **not** be stored in the array).

NUM

Data[INDEX] ← NUM

Complete the program flowchart to represent the algorithm:



[5]