Flowcharts

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Introduction & Background

(1) Computers are machines which follow instructions given to them, and these instructions are in the form of programs.

(2) Computer Programs are now used in most/all areas of life - medicine, arts, sciences, business, etc.

(3) So, great care must be taken to ensure that the computer does what it is intended to do.

(4) A faulty program can be disastrous!

(5)Now, we cannot instruct a computer do a task unless:-

(i) We are clear in our own minds about what it is we are trying to do.

(ii) We have worked out for ourselves how the task should be done.

Introduction & Background

(1) So, in order for programs to work as they should, or rather to minimise the risks of things going wrong - certain processes are followed when developing software/large programs of:-

(2) Objectives, Fact Finding, Feasibility, Analysis, Design, Implementation, Testing, Documentation, Evaluation, Maintenance.

(3) (Can be remembered by the phrase:-
Oh ! Fussy Feeders Are Doomed If They Don't Eat Much).

(4) These processes are described in the next few slides:-

Introduction & Background

No.	Process		Description
1	**O**bjectives	(1) (2) (3) (4) (5)	What should the new system do? What are the business requirements? What are the customer requirements? What is the budget? What is the timeline?
2	**F**act Finding	(1) (2) (3) (4) (5)	What is the current system? What is the problem with the current system? Who will use the new system? How will they use the new system? What data is needed for the new system?
3	**F**easibility	(1) (2) (3) (4)	What are the problems with implementing the new system? So consideration will be given to:- Cost Technical expertise required Time
4	**A**nalysis Phase	(1) (2)	What exactly must the system do? This means clear information must be gathered and usually a requirements document is produced and those involved in the programming of the system must understand this thoroughly.
5	**D**esign of System	(1) (2) (3) (4)	In the design of the system, the key question is how is the problem to be solved? Note we are talking about ‘how’ after the ‘what’. This involves the production of an outline solution which may consist of:- A flowchart Pseudo-code

Introduction & Background

No.	Process	Description
6	**I**mplementation	(1) Implementation is when the new system is built and installed. (2) In this stage, the code is written. (3) This is perhaps the longest stage of the software development process. (4) In this stage the hardware and software is selected.
7	**T**esting	(1) The implementation is tested against the specification requirements to ensure that the product is actually providing the correct solution.
8	**D**ocumentation	(1) Various documents are produced about the system. These include:- (i) User Manual - this is for the user and explains how to use the software. (ii) System maintenance document - this is a technical document for the programmers & for those that need to maintain the system. (iii) Test document - this is for the programmer, customers and regulatory bodies.
9	**E**valuation	(1) After the system has been developed, the customer will immediately evaluate it to see how it meets their requirements & also it makes sense for the customer to periodically evaluate it to see if it still satisfies their requirements. Points taken into account include:- (2) Effectiveness - how many people can use the software at any one time, how long can users use the software for. (3) Learnability - how long will it take for users to learn how the software works. (4) Usability - how easy is to navigate around the user interface, how easy is it for users to read commands or guidance. (5) Maintainability - how easy is it to fix bugs, how easy is to modify for changing requirements
10	(Release, Deployment) and **M**aintenance	This is when the customer starts to use the software actual problems come up from time to time and they need to be solved. The process where care is taken for the developed product is known as maintenance.

Introduction & Background

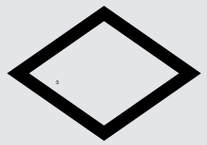
(1) Flowcharts (& Pseudocode) are tools to help with the design of programs.

(2) We will begin by looking at flowcharts

(3) Before we look at flowcharts let us look at the fundamental building blocks of flowcharts - the flowchart symbols.

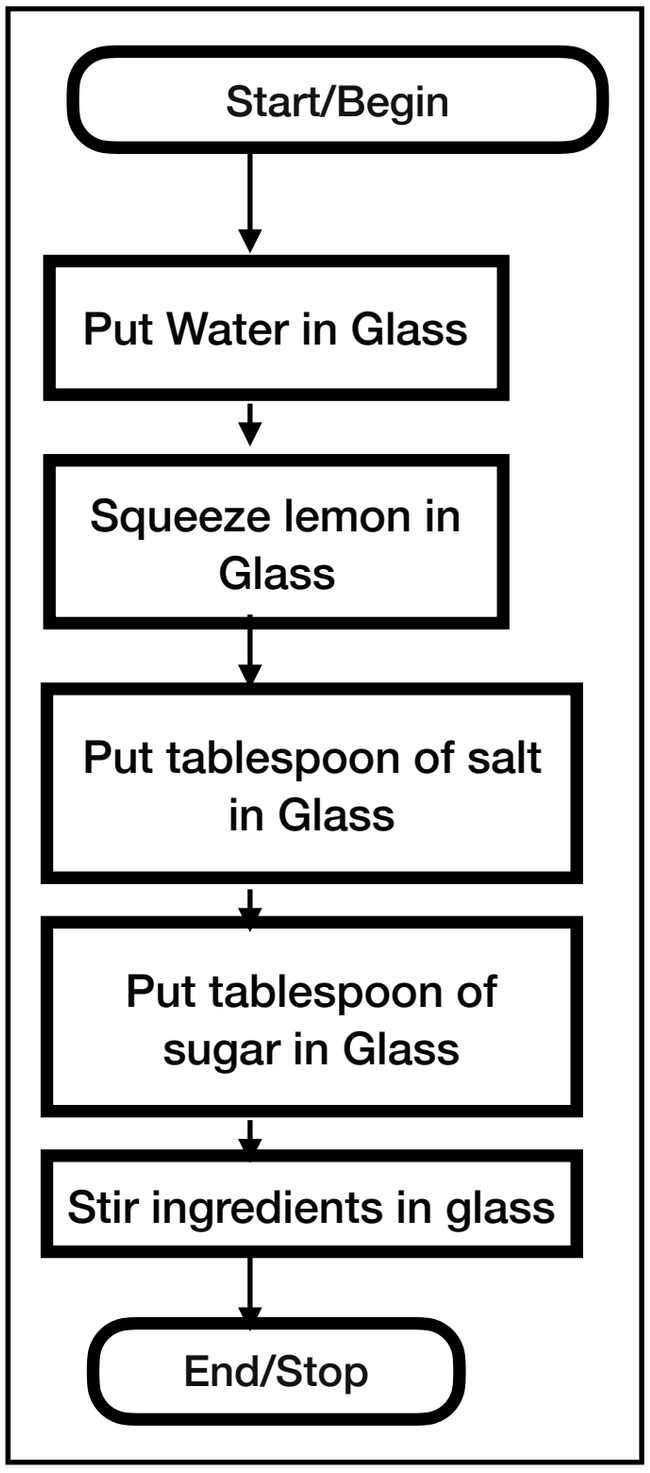
(4) And the meaning of these symbols will become clearer with examples.

Flowchart Symbols

No	Shape	Symbol		
1		**The Terminal Symbol**	**Used as the first or last symbol in a program**	
2		**The Input/ Output Symbol**	**Used for when data input or output is to be performed.**	
3		**The Decision Symbol**	**Used when a decision is to be made in selecting the subsequent path to be followed**	
4		**The Process Symbol**	**Used to represent any kind of processing.**	
5		**A Pre-defined Process Symbol or Subroutine**	**Used to represent a process which has been pre-defined elsewhere.**	**These can be frequently used operations designed to be reused in several different programs.**
6		**Used to show the flow of a sequence of symbols**		

Flowchart Example 1 - demonstrating SEQUENCE

Making a glass of lemonade



Please note the following:-

(1) A flowchart will always have a beginning and an end, and these have the same symbols.

(2) The rectangular symbols here which represent various processes.

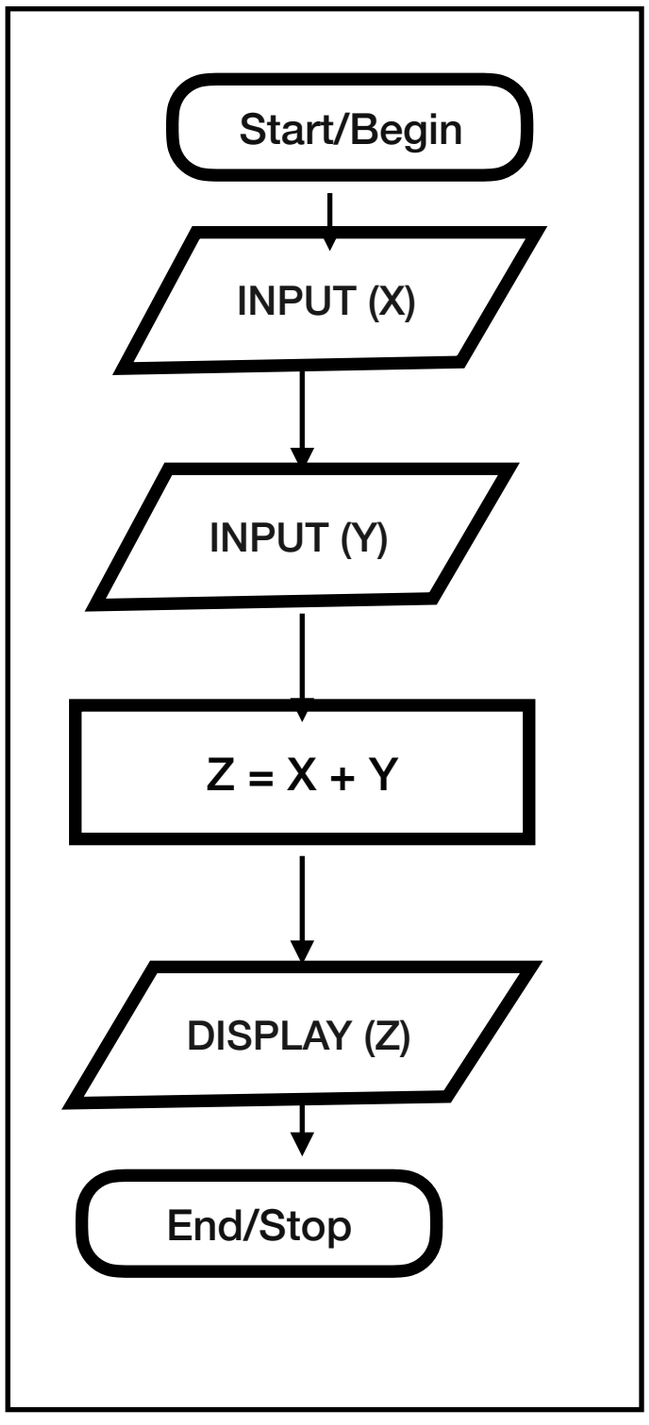
(3) The flowchart is modelling a 'non-programming' problem here.

(4) Note the rectangular symbols here which represent various processes.

(5) The flowchart is demonstrating SEQUENCE.
In a SEQUENCE, the instructions are executed one after another.

Flowchart Example 2 - Demonstrating INPUT & SEQUENCE

Adding two numbers



Please note the following:-

(1) A flowchart will always have a beginning and an end, and these have the same symbols.

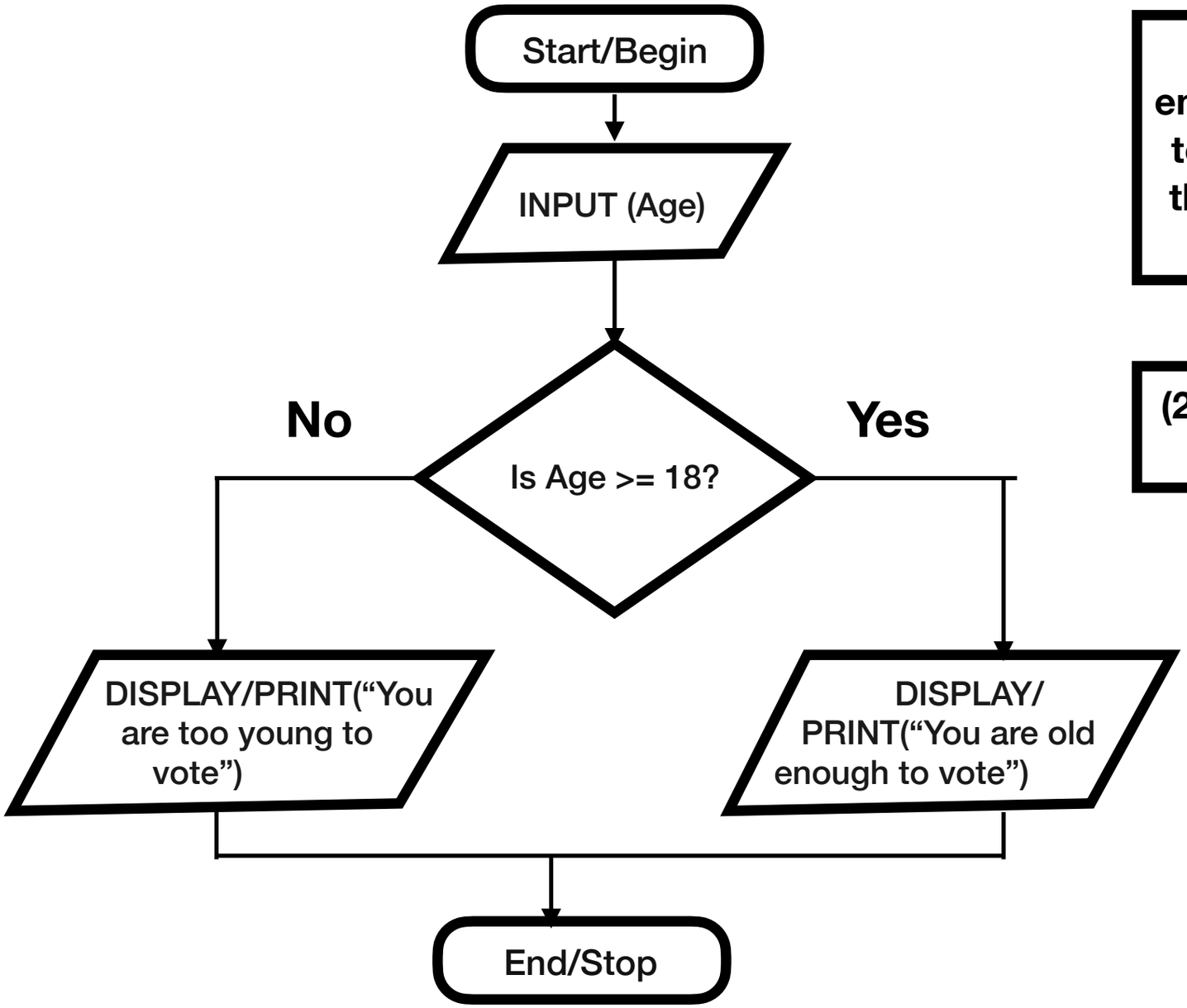
(2) The use of INPUT and OUTPUT symbols (and INPUT & OUTPUT share a symbol).

(3) The instructions are executed one after another. This is an example of a SEQUENCE being enacted.

(4) This flowchart shows the addition of 2 numbers.

Flowchart Example 3 - Demonstrating SELECTION

Seeing if person is old enough to vote



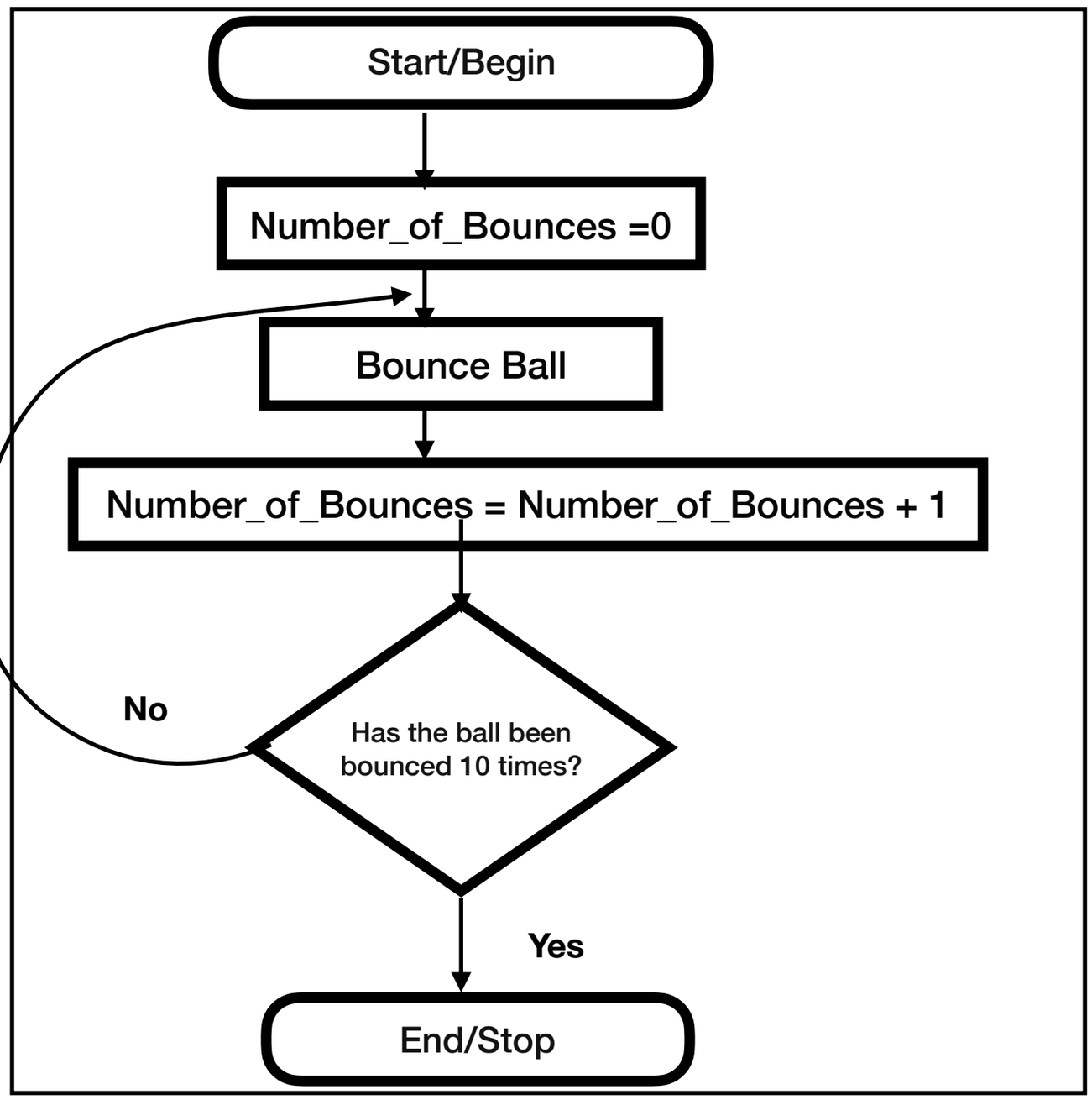
Please note the following:-

(1) This an example of SELECTION being enacted. We can see that a questions is asked as to whether Age is greater than equal to 18. And then there are 2 options which can be selected, depending on the answer.

(2) A flowchart will always have a beginning and an end, and these have the same symbols.

Flowchart Example 4 - Demonstrating ITERATION & Decision Symbols

Bouncing a ball 10 times



Please note the following:-

(1) A flowchart will always have a beginning and an end, and these have the same symbols.

(2) This an example of ITERATION (repetition/loop) being enacted with various instructions being repeated.

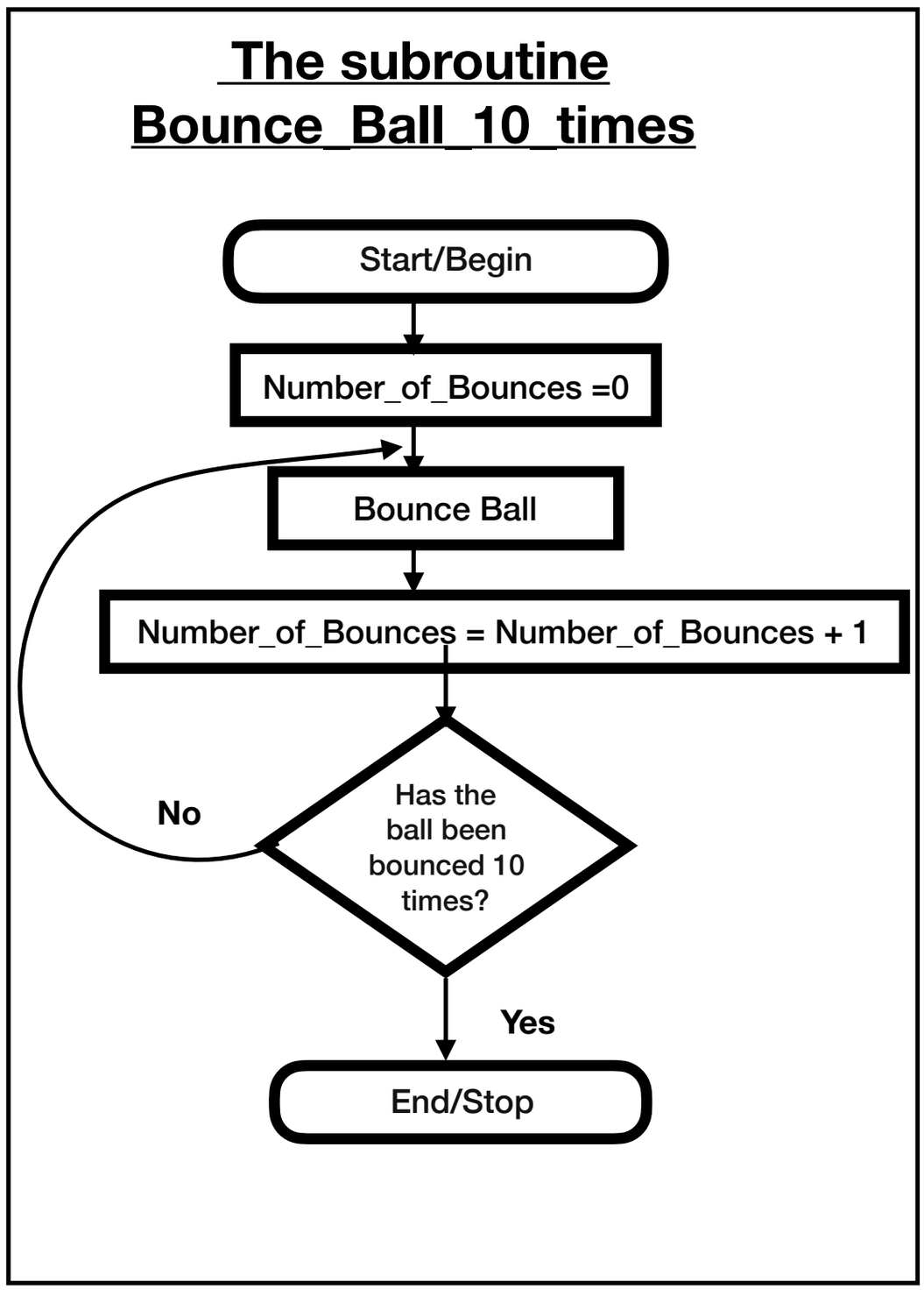
(3) The diamond symbol is the decision box

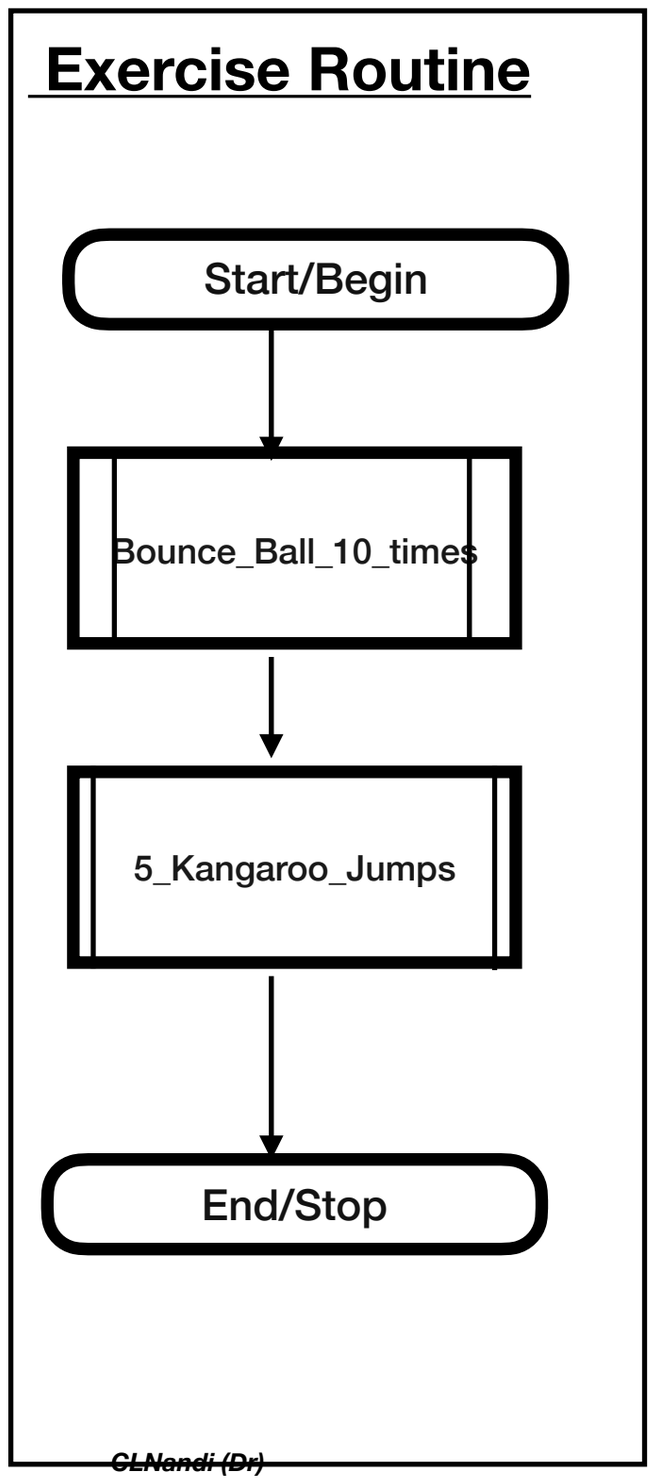
(4) The rectangular symbols here which represent various processes.

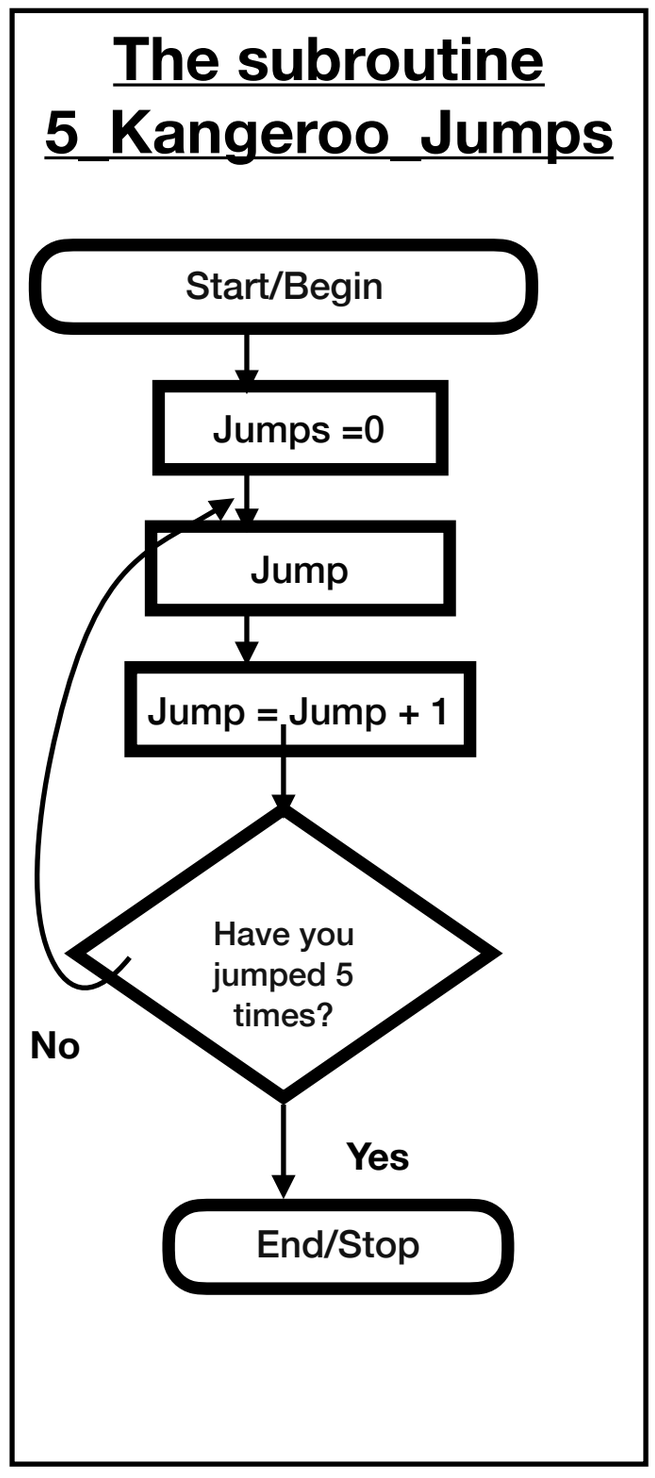
(5) A variable called Number_of_Bounces is defined and assigned a value of zero initially.

(6) Every time the ball is bounced, the variable Number_of_Bounces is incremented/increased by 1.

Flowchart Example 5 -Demonstrating Pre-defined Processes (or Subroutine)





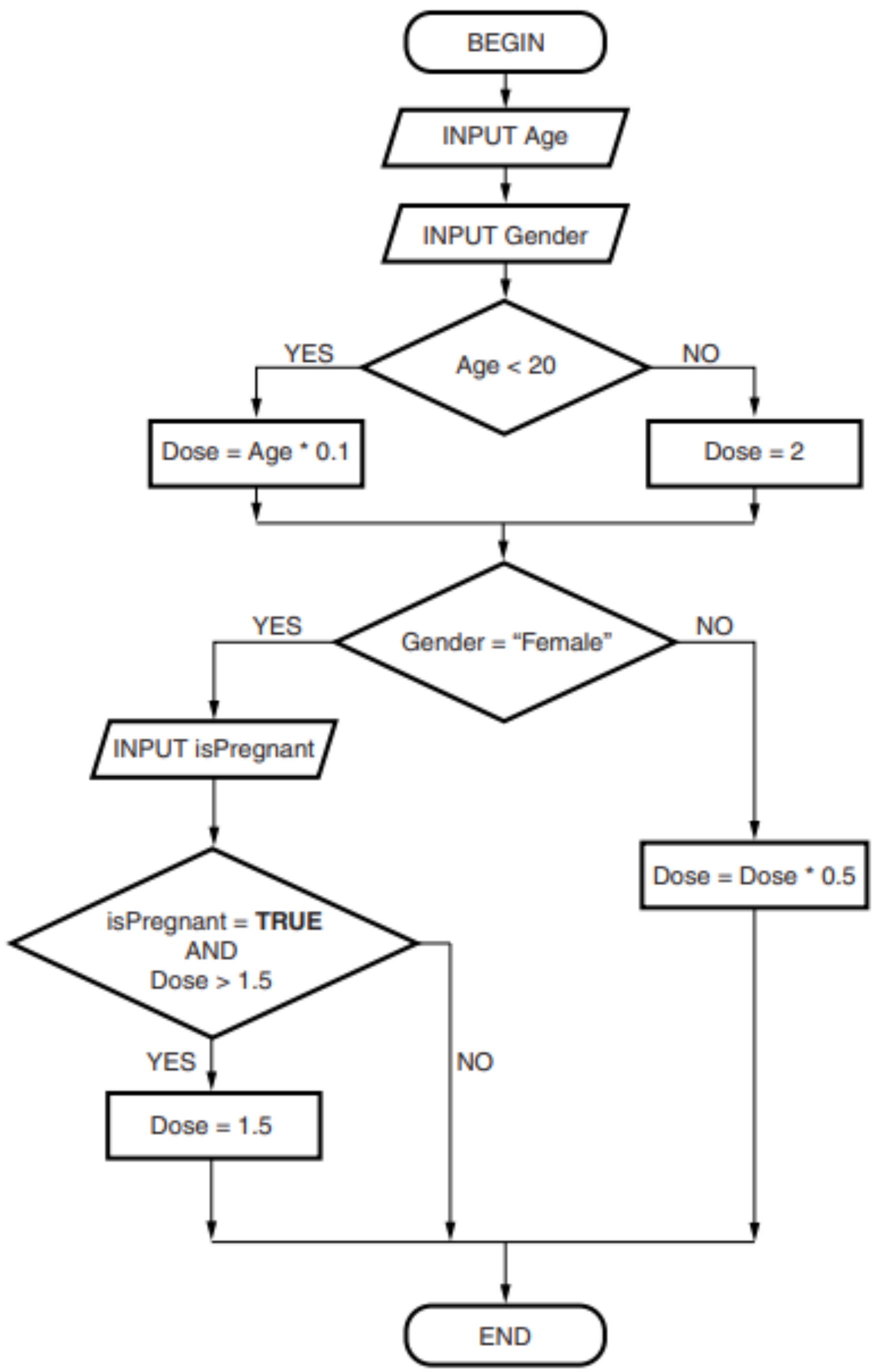


Now, the most likely questions is that you are provided with a flowchart and you are asked questions around it.
Therefore, you need to know how to interpret flowcharts.
Please try the following questions on interpreting flowcharts.

Question 1 - Please try this (from Past Paper)

A computer program calculates the correct dose in grams of a type of medicine.

The algorithm used is shown by the flow diagram below.



(a) The data type of the variable Age is Integer.

State the data type of the following variables used in the flow diagram.

Variable	Data Type
Gender	
Dose	
isPregnant	

[3]

(b) Use the flow diagram to calculate the correct dose of medicine for a male aged 30.

You must show your working.

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.... **[3]**

(c) Use the flow diagram to calculate the correct dose of medicine for a pregnant female aged 19. You must show your working.

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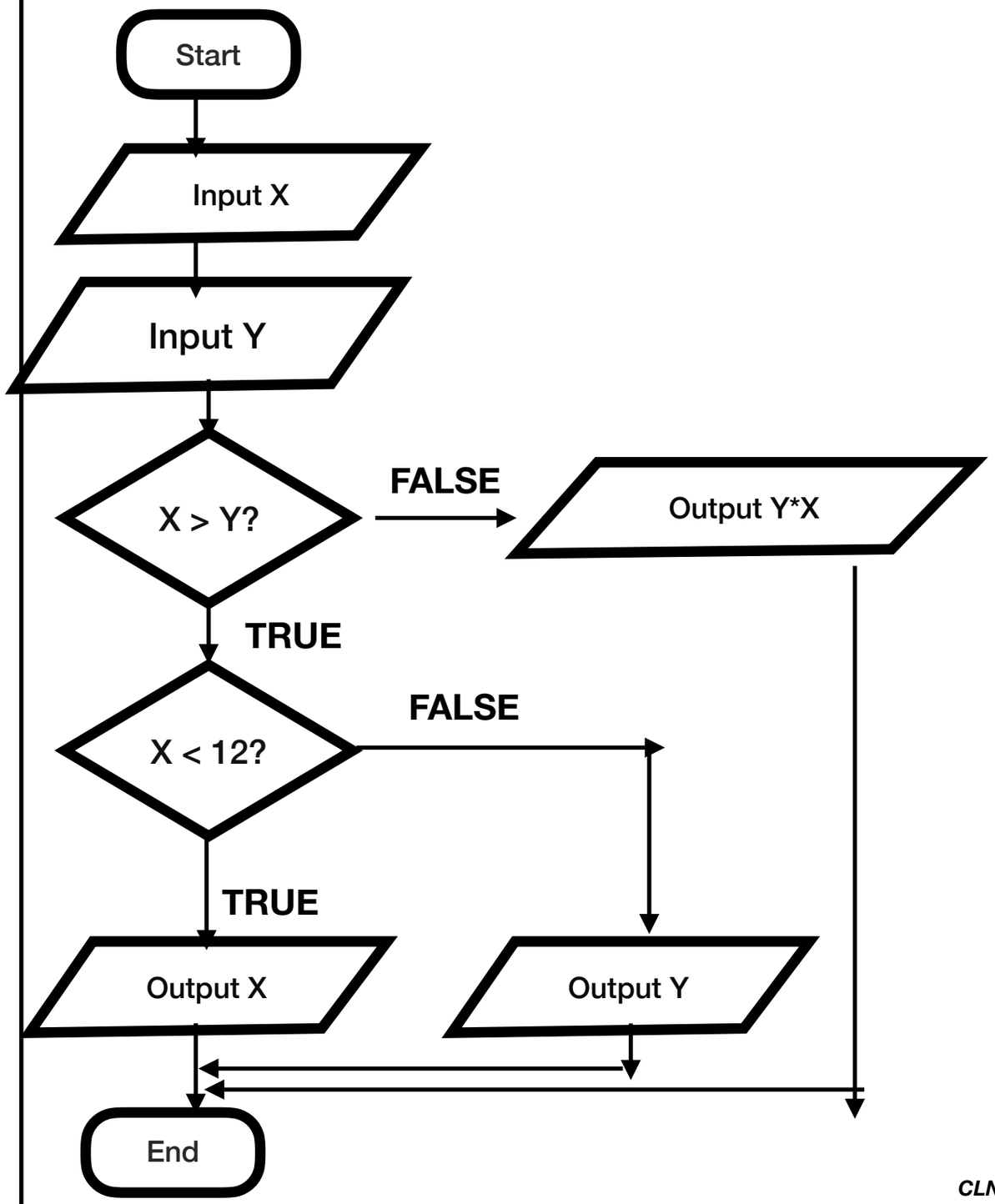
.... **[4]**

Question 2 - Please try this (from Past Paper)

A programmer creates an algorithm using a flowchart.



(a) Complete the table to give the output when each of the following set of values are input into the algorithm as X & Y (4 marks)

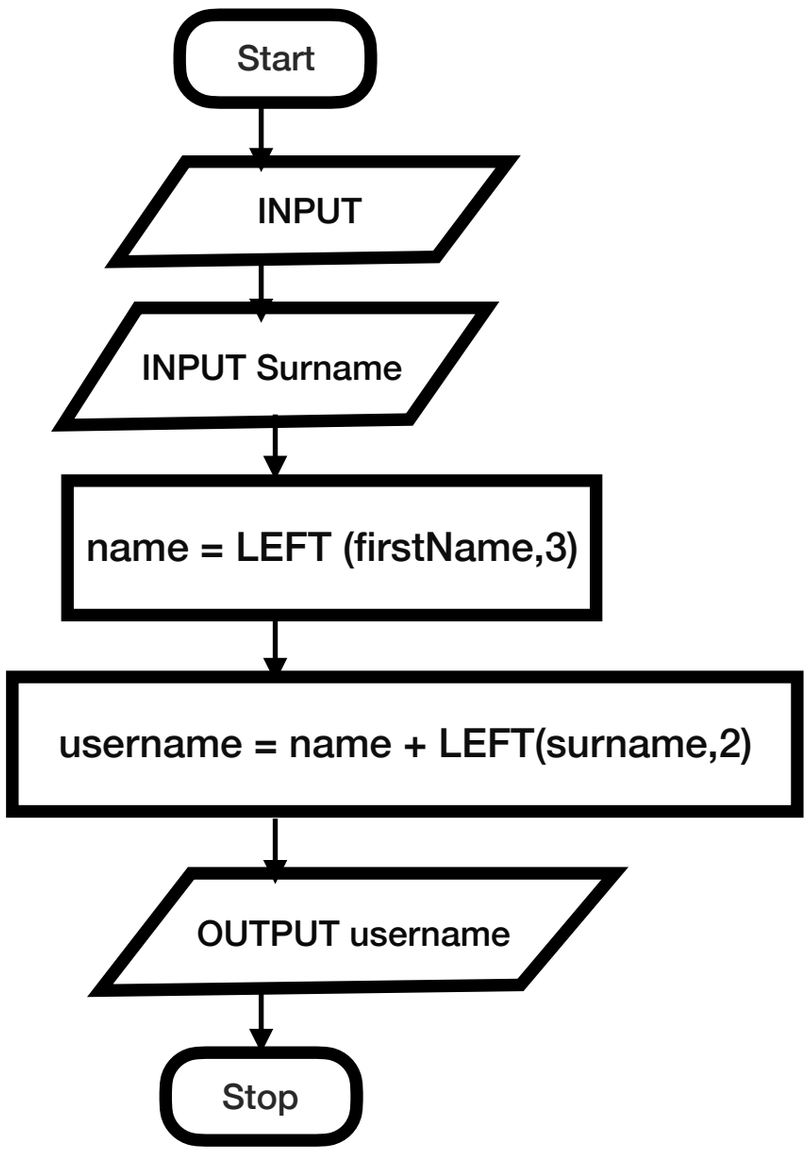
Input Value of X	Input Value of Y	Output
15	10	
6	5	
2	3	
12	2	

(b) Write the algorithm in pseudocode (i.e you can write the algorithm in a programming language if you wish) (6 marks)

OCR 2019, No. 2, page 158, 159

Question 3 - Please try this (from Past Paper)

Johnny is writing a program to create usernames. The first process he has developed is shown in the flowchart below:-



For example, using the Flowchart, Tom Ward's user name would be:- TomWa

(a) State, using the process, the username for Rebecca Ellis. (3marks)

Username:-

Explanation:-

(b) Johny has updated the process used to create the usernames as follows:-

If the person is male, their username is the last 3 letters of their surname and the first 2 pesters of their first name.

If the person is female, then their username is the first 3 letters of their first name and the first 2 letters of their surname.

(i) What would be the username for a male called Fred Biscuit using the updated process? (1 mark)

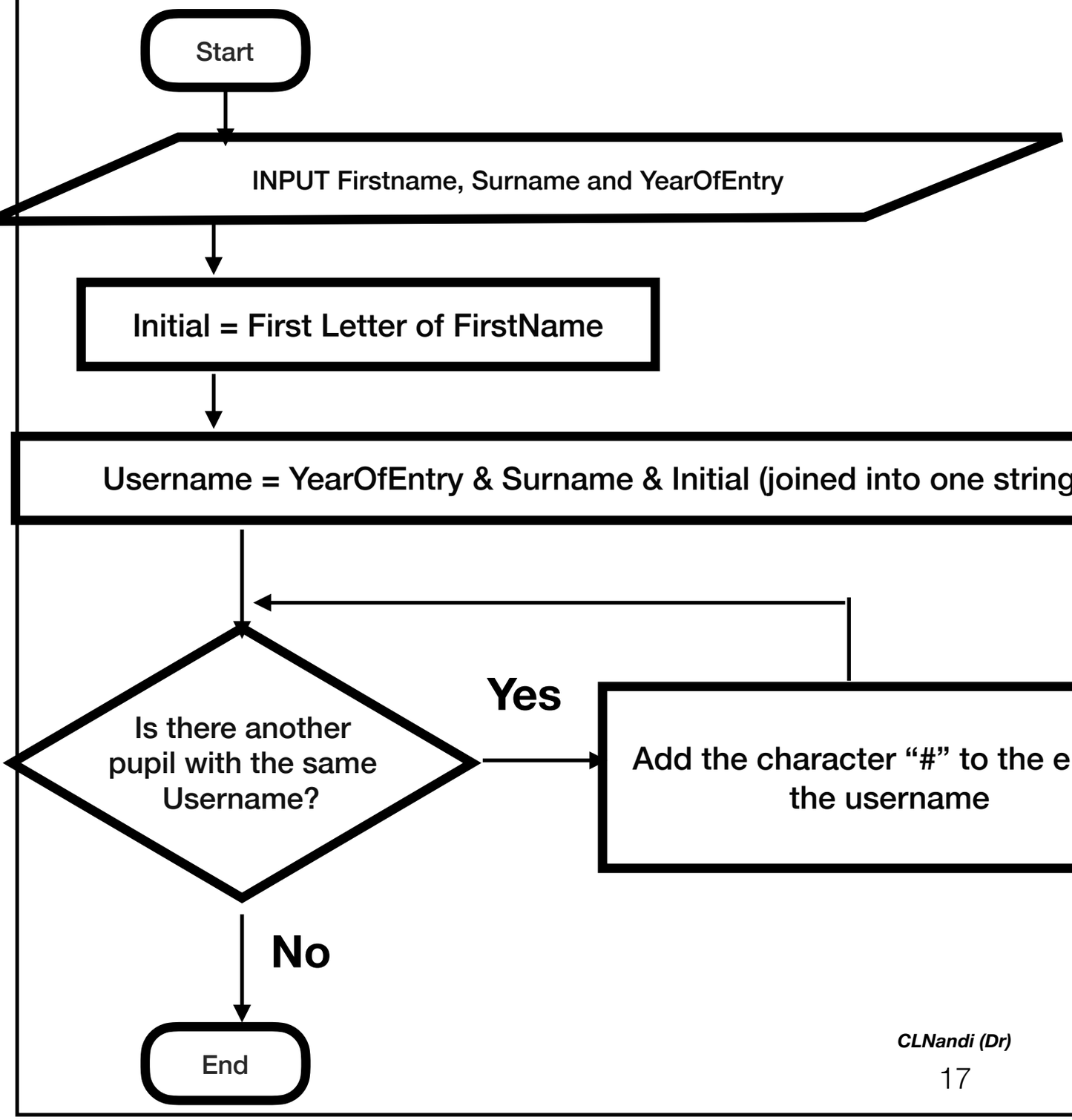
(ii) Write an algorithm for Johnny to output a username using the updated process. (6 marks)

OCR 2015, Sample Question Paper, No. 4, page 194, 195

Question 4 - Please try this (from Past Paper)

A school uses a computer program to give every new pupil a username for logging onto computers,

The algorithm used to choose the username is shown below:-



Mark Johnson joins the school in 2012. No other pupil called Johnson joins the school in the same year.

(a) State the username which Mark will be given and explain how you obtained your answer from the flow diagram (3 marks).

Username:-

Explanation:-

(b) A pupil has the username 2010ali####.

State the 4 facts that we can work out this username (4 marks)

1

2

3

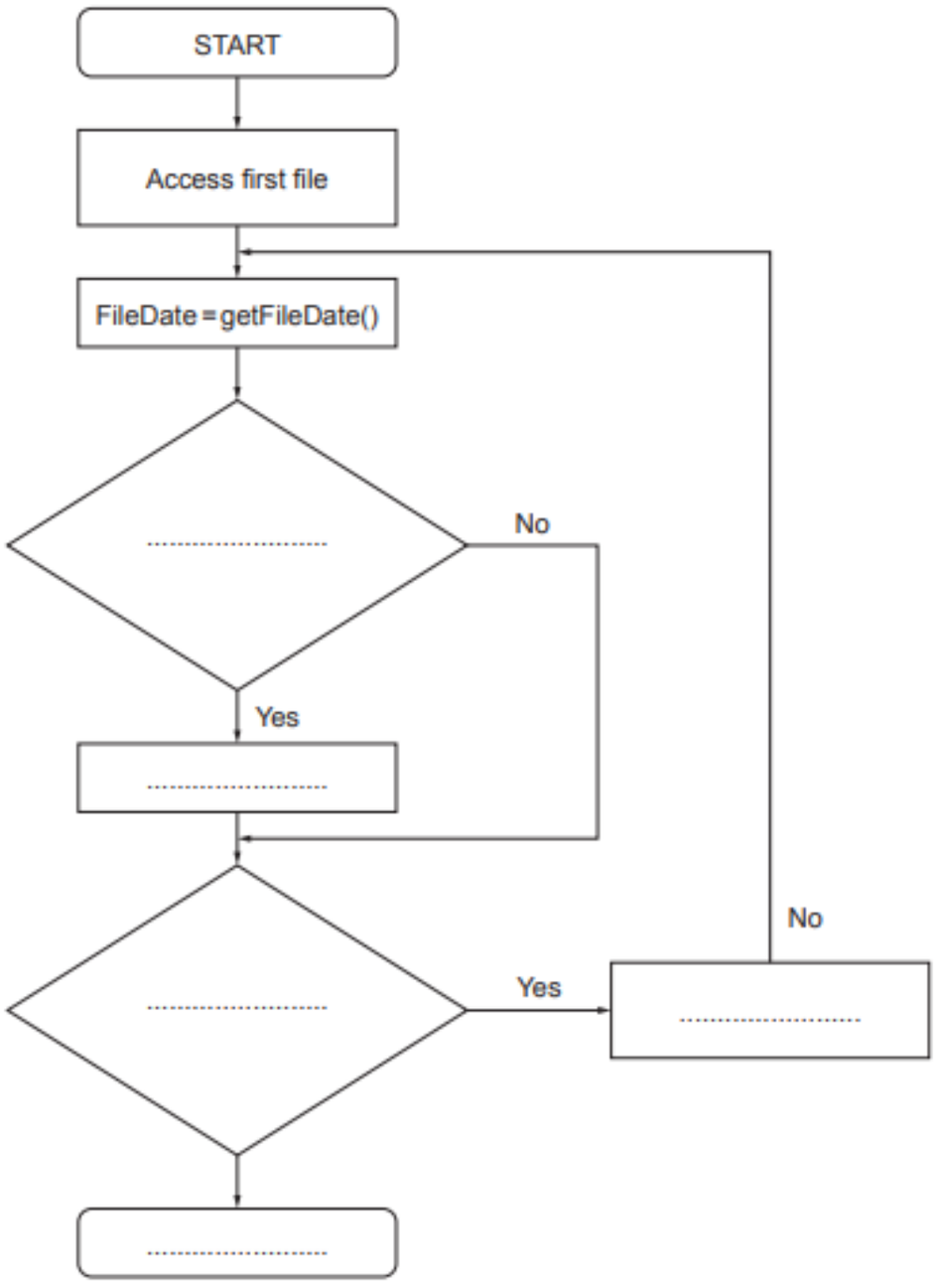
4

OCR 2012

Question 5 - Please try this (from Past Paper)

OCRApp uses an incremental backup strategy at the end of each working day.

The flowchart describes the stages of an incremental backup.
The function `getFileDate()` returns the date the current file was last accessed.
The function `lastBackupDate()` returns the date of the last backup.



(d) Complete the flowchart by writing the number of the missing statements in the correct flowchart symbols.

Number	Statement
1	STOP
2	Move to next file
3	Is there another file?
4	Copy file to backupFile
5	Is fileDate > lastBackupDate()?

[4]

Question 1 & Answer - Please try this

A computer program calculates the correct dose in grams of a type of medicine.

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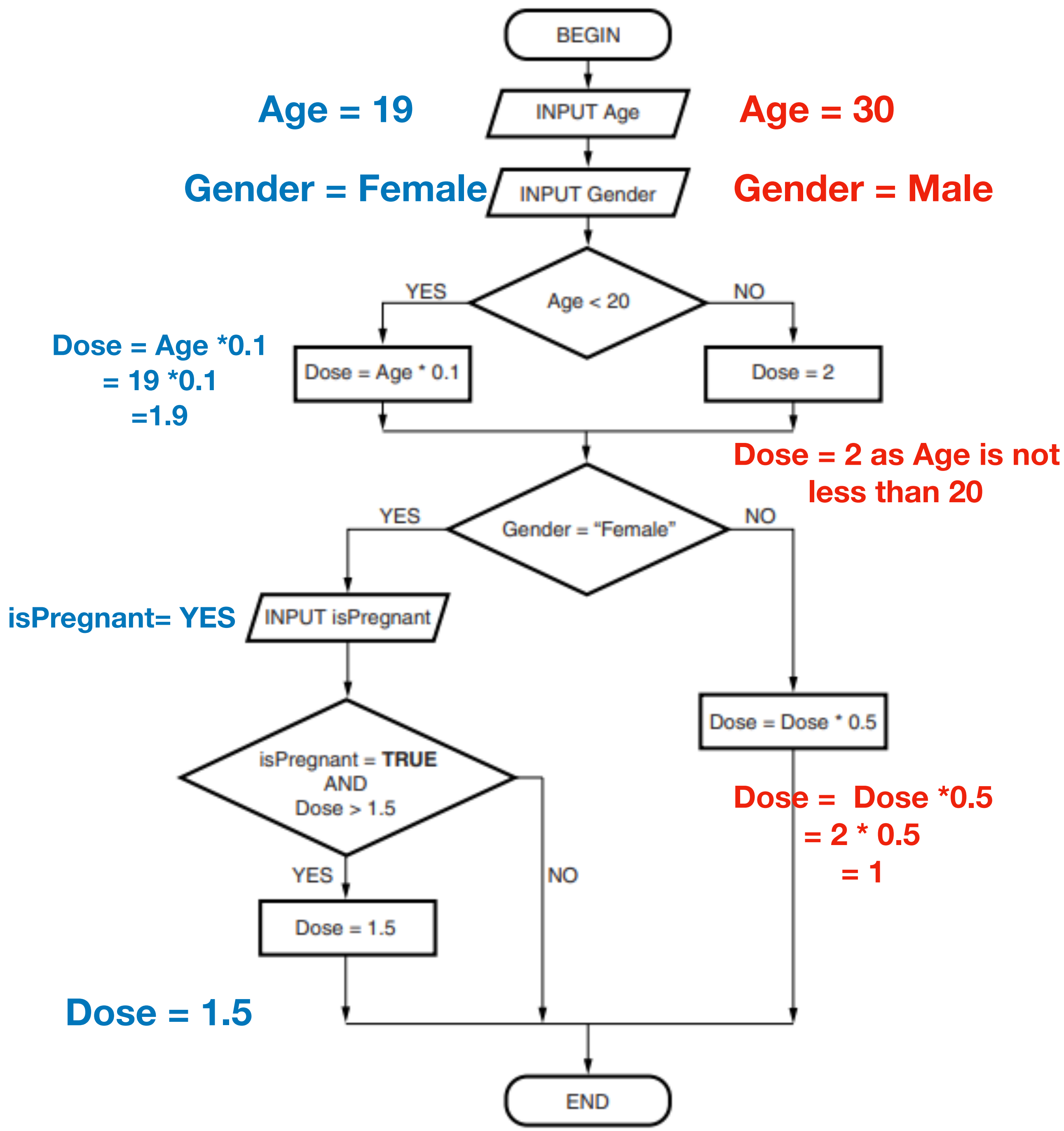

(a) The data type of the variable Age is Integer.

State the data type of the following variables used in the flow diagram.

Variable	Data Type
Gender	Boolean
Dose	Real
isPregnant	Boolean

[3]

(b) Use the flow diagram to calculate the correct dose of medicine for a male aged 30.

You must show your working.

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(c) Use the flow diagram to calculate the correct dose of medicine for a pregnant female aged 19.
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.... [4]

Question & Answer 2 - Please try this (from Past Paper)

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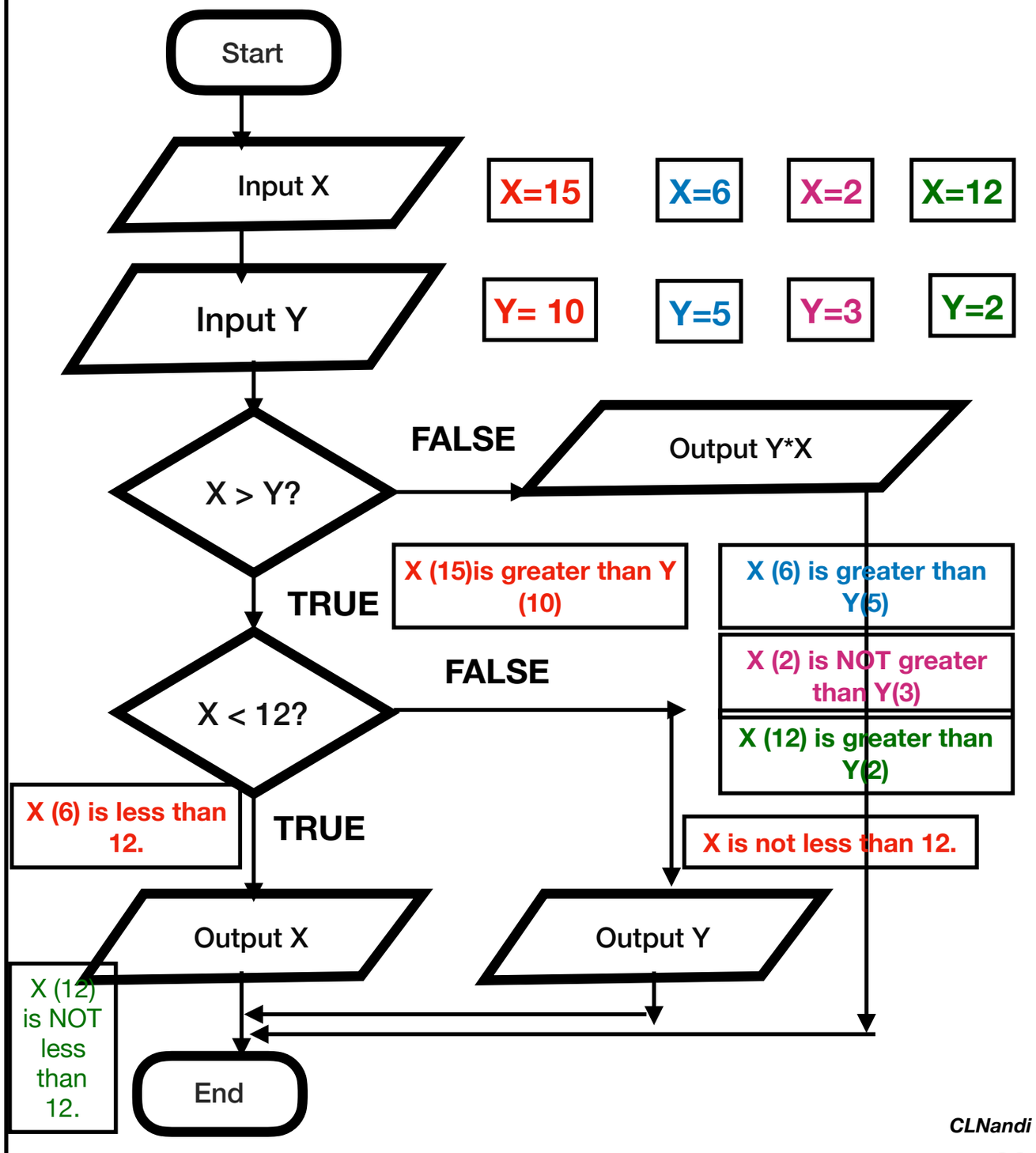


(a) Complete the table to give the output when each of the following set of values are input into the algorithm as X & Y (4 marks)

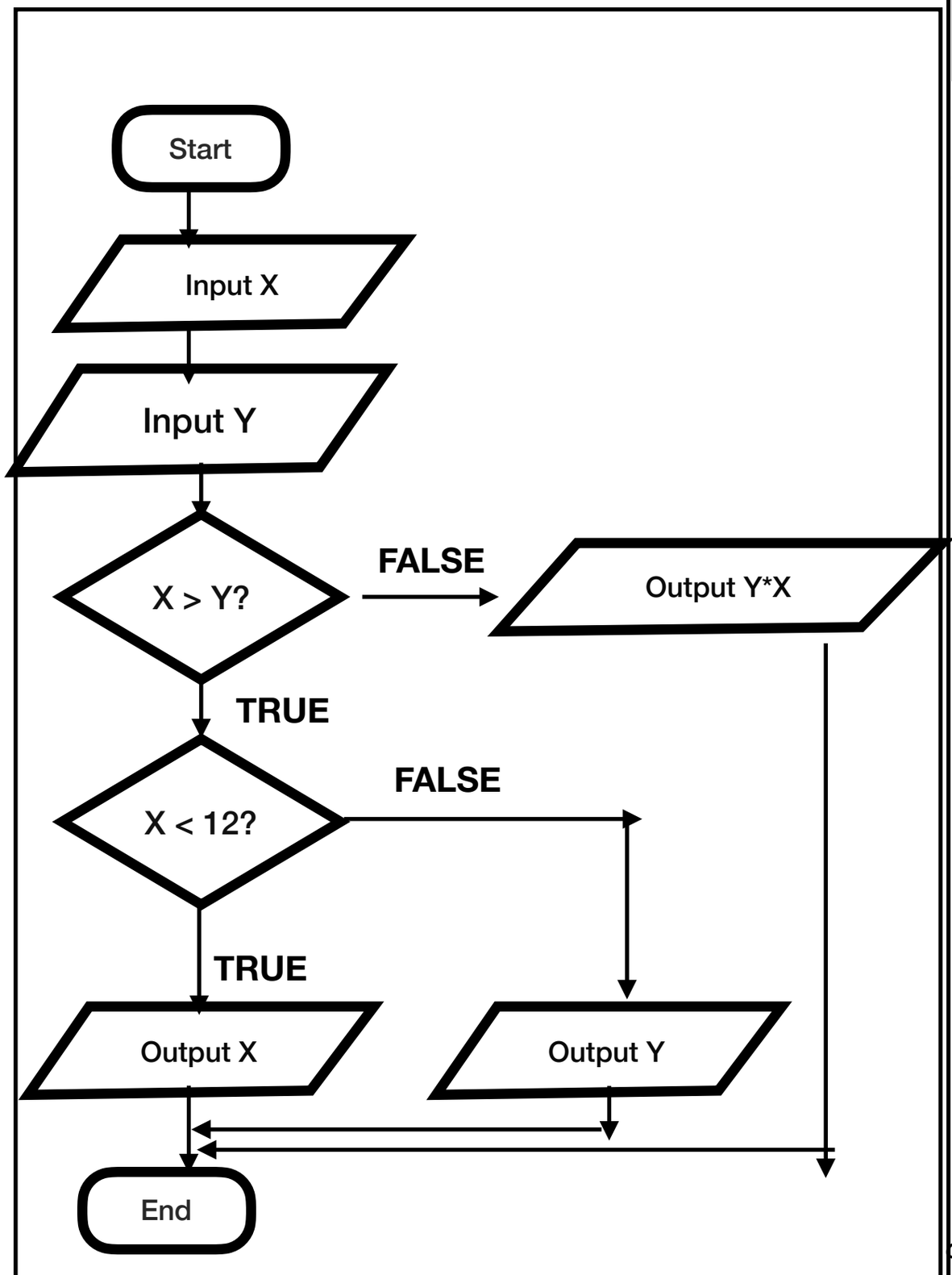
Input Value of X	Input Value of Y	Output
15	10	10
6	5	6
2	3	6
12	2	12

(b) Write the algorithm in pseudocode (i.e you can write the algorithm in a programming language if you wish) (6 marks)

Please see solution on next page.

OCR 2019, No. 2, page 158, 159

Question & Answer 2 - Please try this (from Past Paper)



(b) Write the algorithm in pseudocode (i.e you can write the algorithm in a programming language if you wish) (6 marks)

Pseudo-code

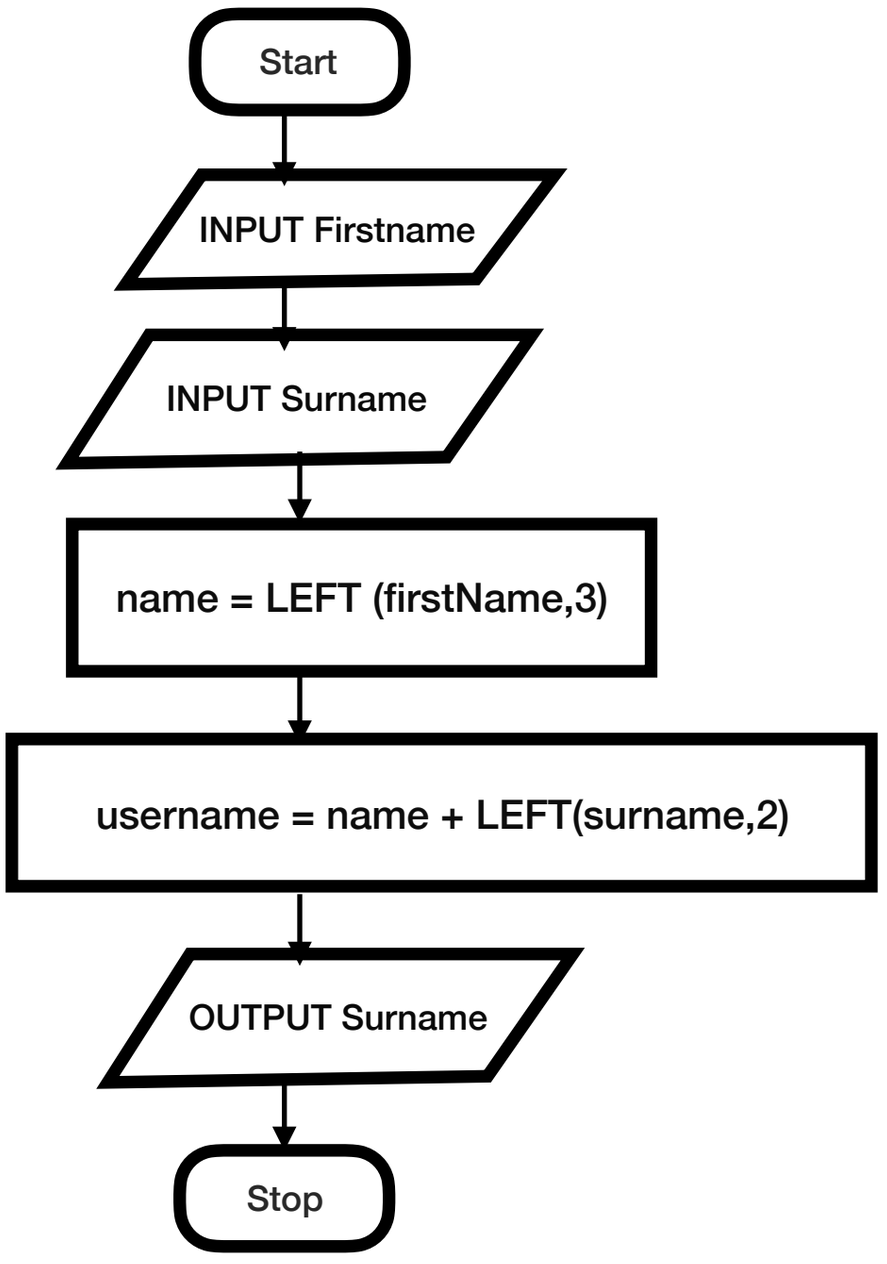
```
BEGIN
    INPUT X
    INPUT Y
    IF X > Y THEN
        IF X < 12 THEN
            PRINT (X)
        ELSE
            PRINT (Y)
        ENDIF
    ELSE
        PRINT (Y * X)
    ENDIF
END
```

Python

```
X =  int(input("Enter X "))
Y = int(input ("Enter Y"))
if X > Y:
    if X > 12:
        print(X)
    else:
        print(Y)
else:
    print(Y*X)
```

Question & Answer 3 - Please try this (from Past Paper)

Johnny is writing a program to create usernames. The first process he has developed is shown in the flowchart below:-



For example, using the Flowchart, Tom Ward's user name would be:- TomWa

(a) State, using the process, the username for Rebecca Ellis. (3marks)

Username:- RebEl

Explanation:-

This is formed from the first 3 letters of the first name Reb

Followed by the first 2 letters of the surname El

(b) Johny has updated the process used to create the usernames as follows:-

If the person is male, their username is the last 3 letters of their surname and the first 2 letters of their first name.

If the person is female, then their username is the first 3 letters of their first name and the first 2 letters of their surname.

(i) What would be the username for a male called Fred Biscuit using the updated process? (1 mark)

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(ii) Write an algorithm for Johnny to output a username using the updated process. (6 marks)

See next page for answer

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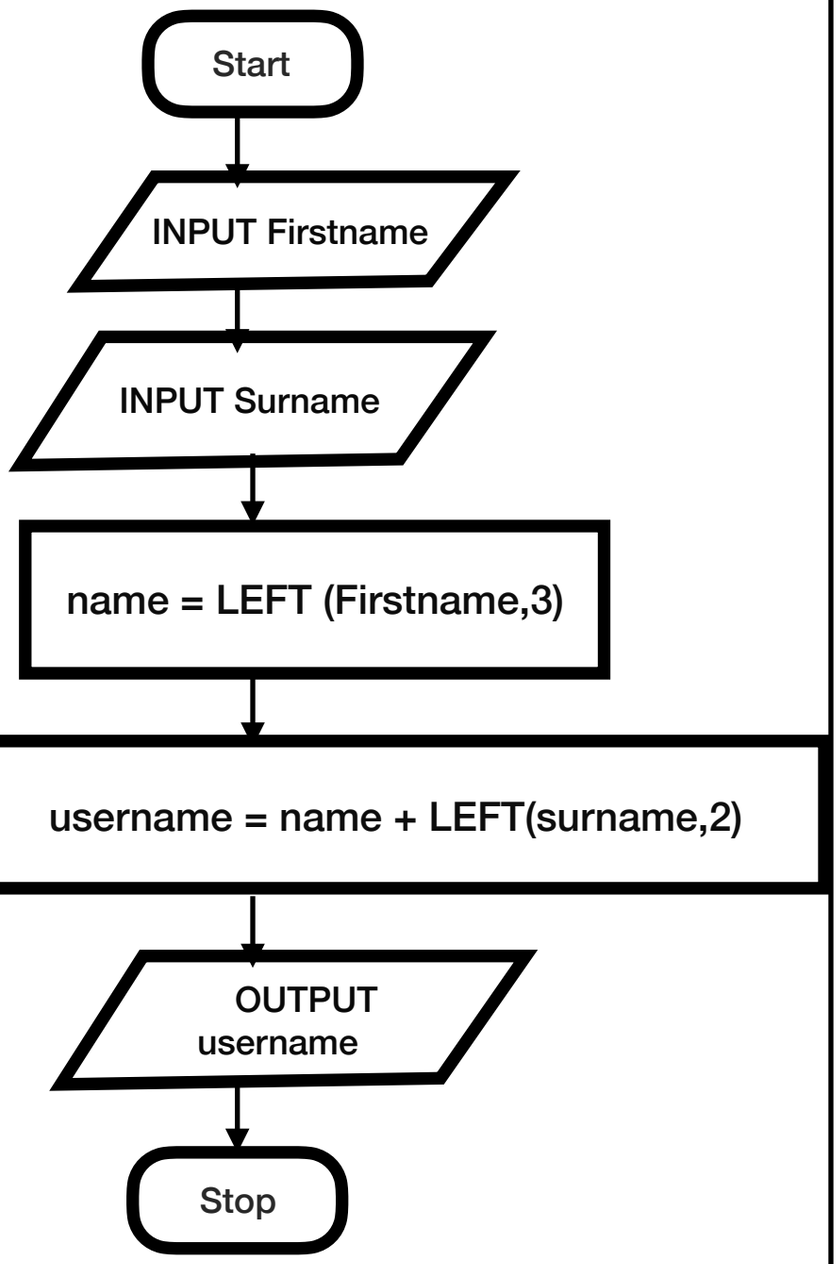

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If the person is female, then their username is the first 3 letters of their first name and the first 2 letters of their surname.

(ii) Write an algorithm for Johnny to output a username using the updated process. (6 marks)

```
START
INPUT Firstname
INPUT Surname
INPUT Gender
IF Gender = "Male" THEN
    M_Firstname = LEFT (Firstname,2)
    M_Surname= RIGHT (Surname,3)
ELSE
    M_Firstname = LEFT (Firstname,3)
    M_Surname=LEFT (Surname,2)
ENDIF
User_name = M_FIrstname + M_Surname
PRINT(User_name)
END
```


OCR 2015, Sample Question Paper, No. 4, page 194, 195

Question & Answer 4 - Please try this (from Past Paper)

A school uses a computer program to give every new pupil a username for logging onto computers,

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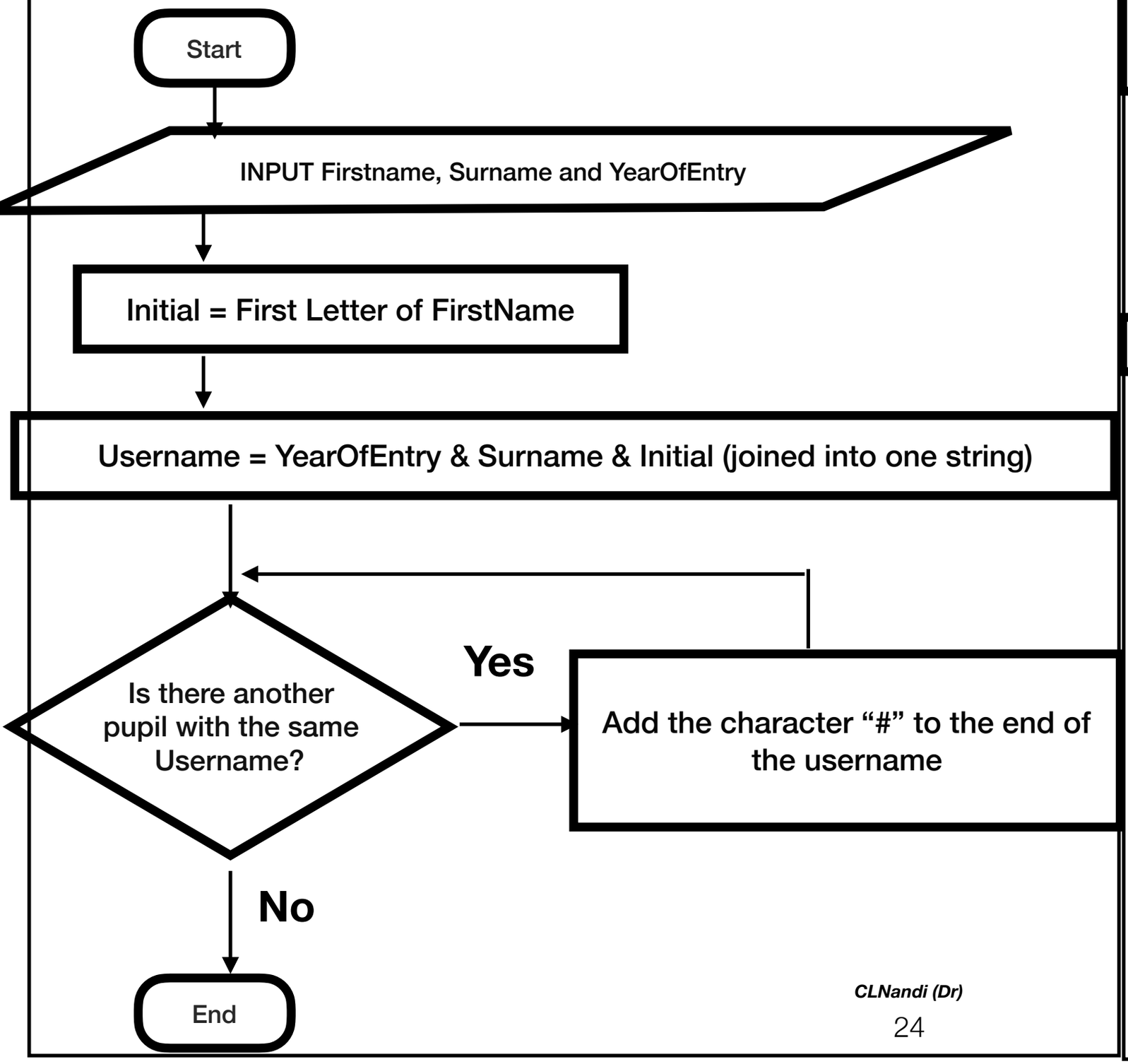

Mark Johnson joins the school in 2012. No other pupil called Johnson joins the school in the same year.

(a) State the username which Mark will be given and explain how you obtained your answer from the flow diagram (3 marks).

Username:-

2012JohnsonM

Explanation:-

YearOfEntry = 2012
Surname = "Johnson"
Initial = "M"
No # is needed at the end as he is the only one in the year.

(b) A pupil has the username 2010ali####.

State the 4 facts that we can work out this username (4 marks)

1 **YearOfEntry = 2010**

2 **Surname = "al"**

3 **Initial = "i"**

4 **There are 4 # - this means there are 5 people who joined in the same year with the same surname and initial**

OCR 2012

Question & Answer 5

OCRApp uses an incremental backup strategy at the end of each working day.

The flowchart describes the stages of an incremental backup.
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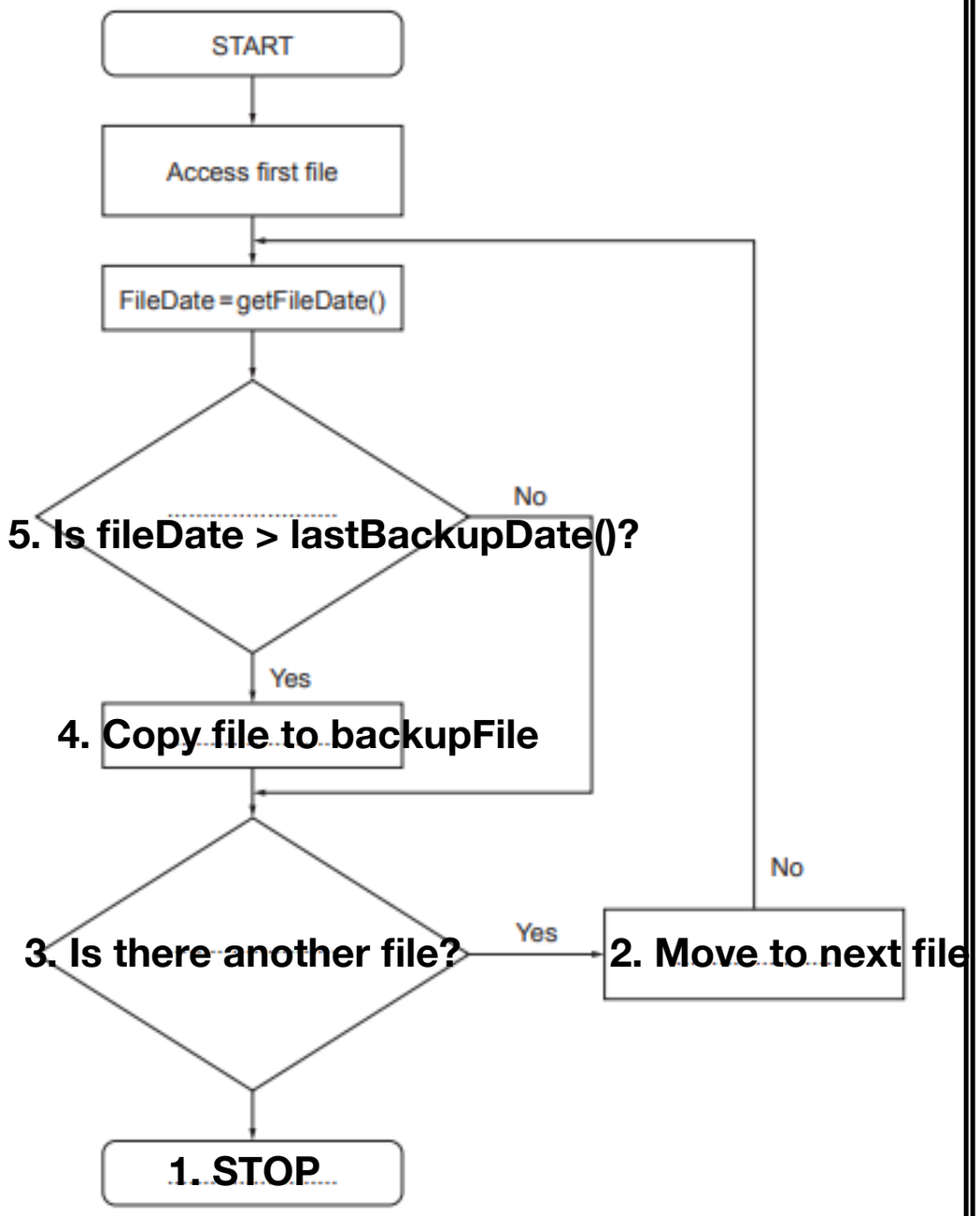

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Number	Statement
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2	Move to next file
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4	Copy file to backupFile
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[4]

That's all for now folks