Principles of Computer مبادئ علوم الحاسوب

ح101، حسب 101

ALGORITHMS الخوارزميات

محاضرة #7

ALGORITHMS الخوارزميات

An algorithm is a finite set of rules that give a sequence of operations for solving a specific type of problem.

An algorithm is considered as the first step for writing computer program

Structure & Properties of an Algorithm

Structures:

the structure of the algorithm can be shown in a set of steps:

- **The input step.**
- **The assignment/simple process step.**
- **The decision process step.**
- **The repetitive process step, and**
- **The output step.**

Properties :

The algorithm possesses the following properties

Finiteness

An algorithm terminates after a finite number of steps, that is when the algorithm is totally executed, it comes to a stop after possibly executing a finite number of assignment, decision, and repetition processes.

Input-Output

An algorithm has certain precise inputs or initial data and the outputs are generated in the intermediate as well as the final steps of the algorithm.

Example #1

Write an algorithm that can be used to compute the area of a circle with radius r.

Solution: **the area of the circle is given by:**

$$A = \Pi * r * r$$

Solution

1. Start
2. Input r
3. Let $\prod = 3.14$
4. Compute $A = \prod * r * r$
5. Print A
6. Stop

Example #2

Write an algorithm that can be used to compare two numbers and print out the greatest one.

Solution :

1. Start
2. Input A , B
3. if A > B Goto 4 Else Goto 6
4. Print A
5. Goto 10
6. if B > A Goto 7 Else Goto 9
7. Print B
8. Goto 10
9. Print A, B
10. Stop

Example #3

Write an algorithm that can be used to find out the sum of following series.

$$1, 3, 5, 7, \ldots, 999$$

Solution (For Loop)

1. Start

2. Let Sum = 0

3. Loop: For (I = 1, 999)

4. Sum = Sum + I

5. I = I + 2

6. Repeat (Goto Step 3)

7. Print Sum

8. Stop

Solution (While Loop)

1. Start

2. Let Sum = 0,   I = 2

3. Loop: While (I <= 999)

4. Sum = Sum + I

5. I = I + 2

6. Repeat (Goto Step 3)

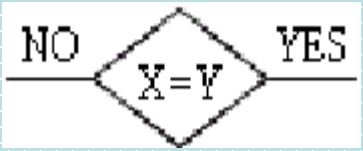
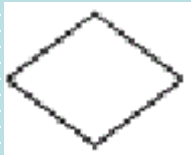
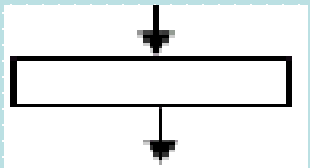
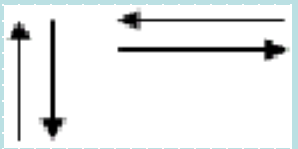
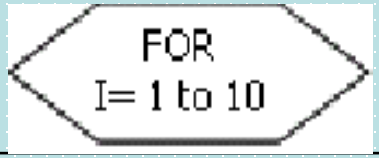
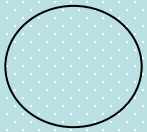
7. Print Sum

8. Stop

Flow Chart

It is way to represent the algorithm graphically, through set of predefined symbols.

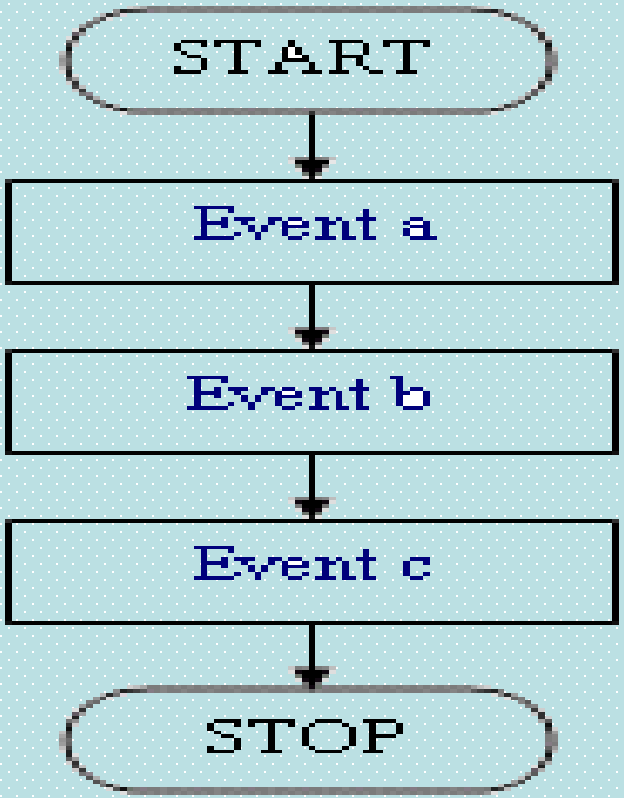
The symbols are:

example	Used for	Symbol
	Start/End of flow Chart	
	Simple Process	
	Input/Output	
	Decision Process	
	Flow Line	
	Loop Process	
	Connector	

Types of Flow Chart

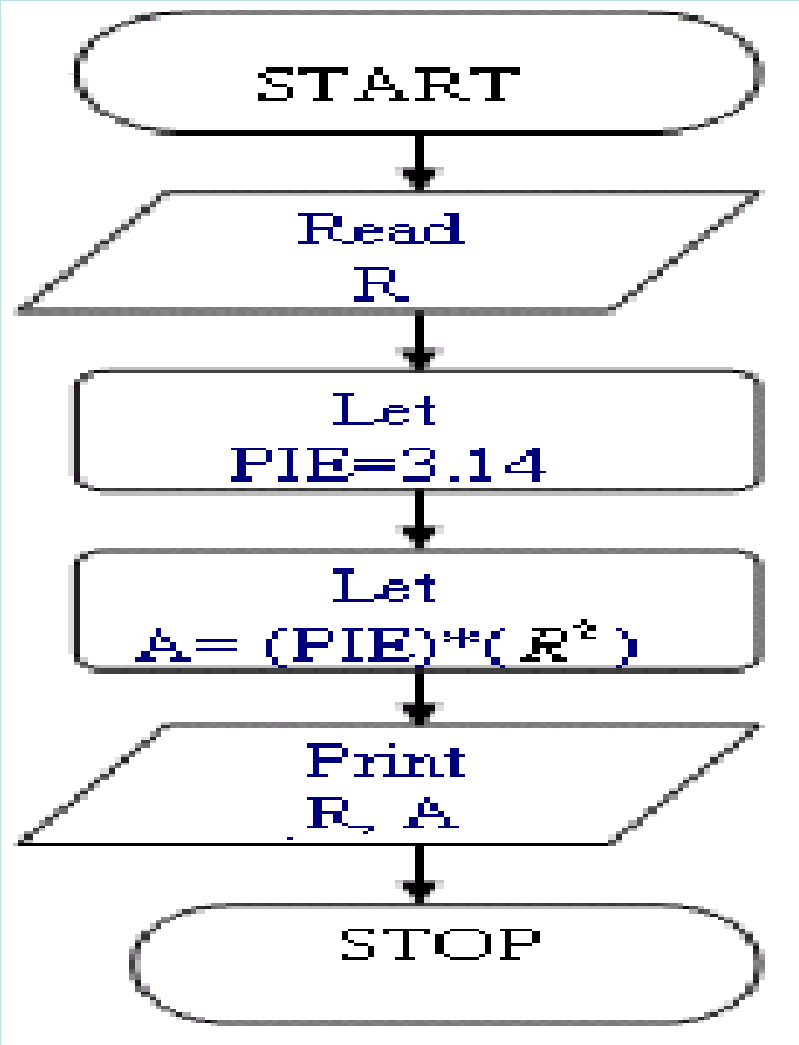
a. Simple Flow Chart

Contains no branching or loop as shown



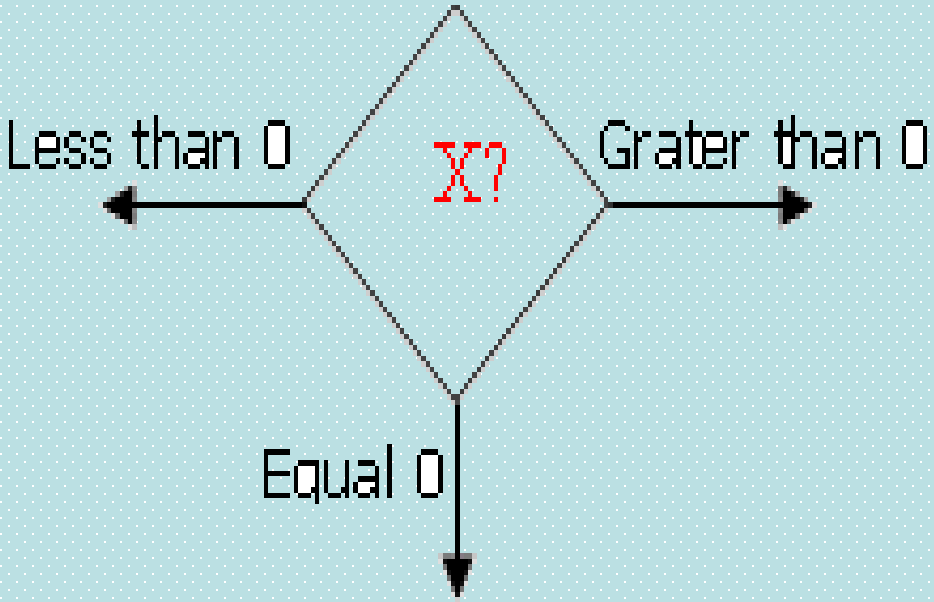
Example #4

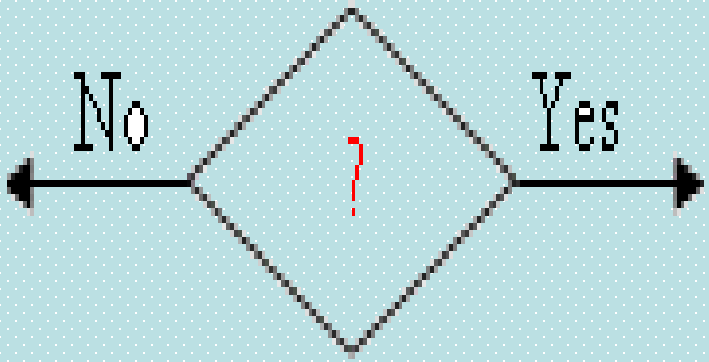
Draw a flow chart for Example #1.

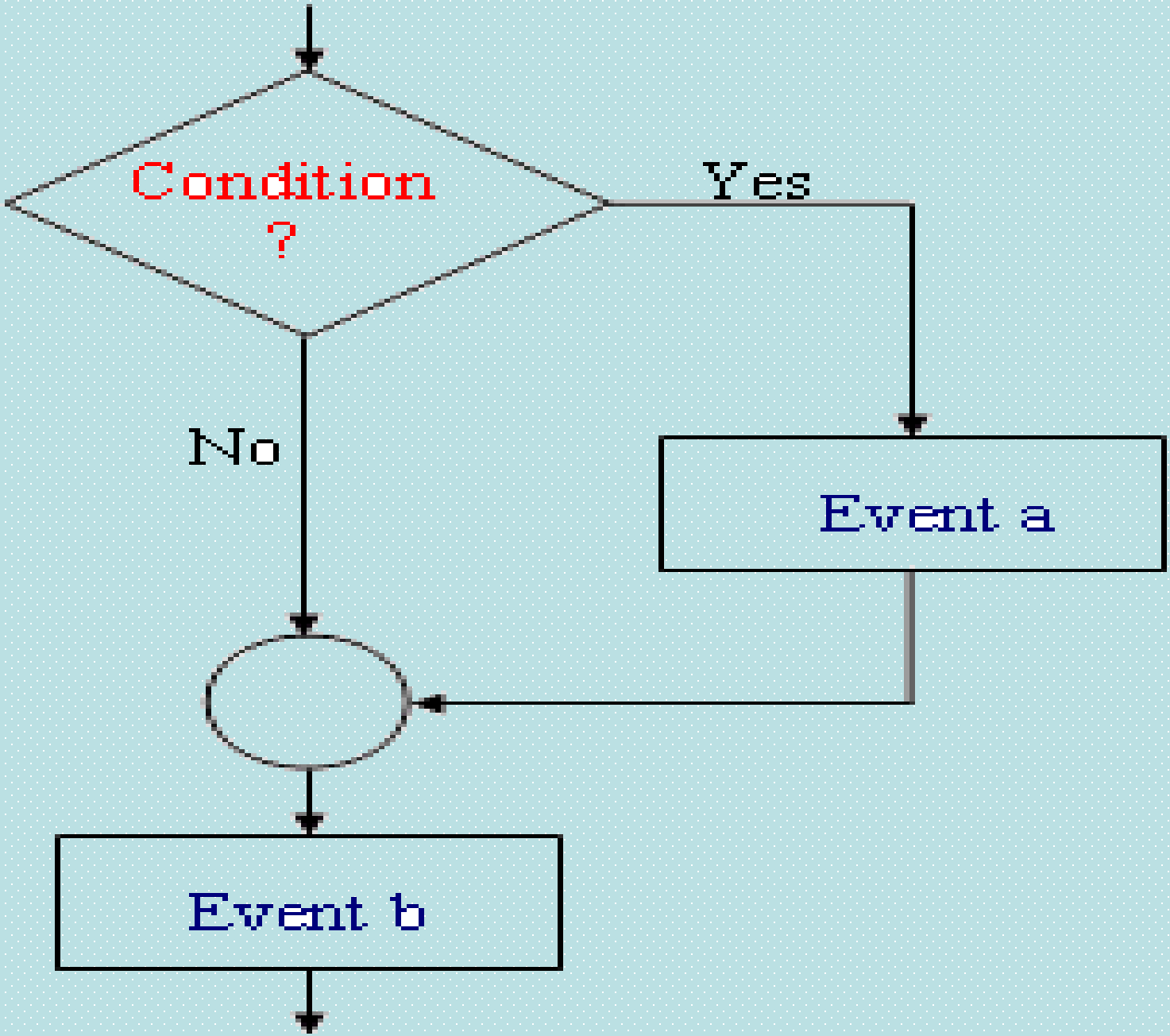


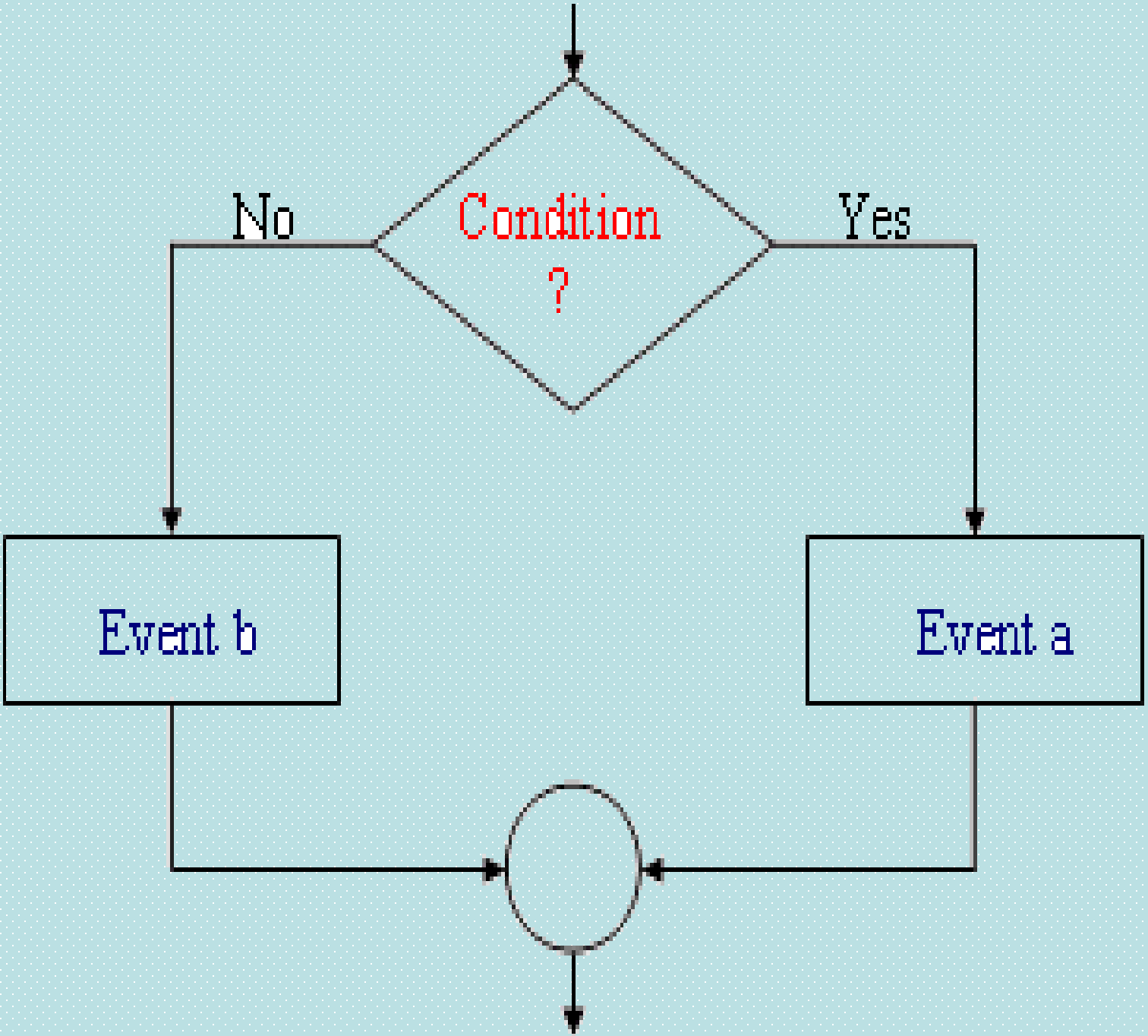
b. Branching Flow Chart

Contains branches decision making as shown.



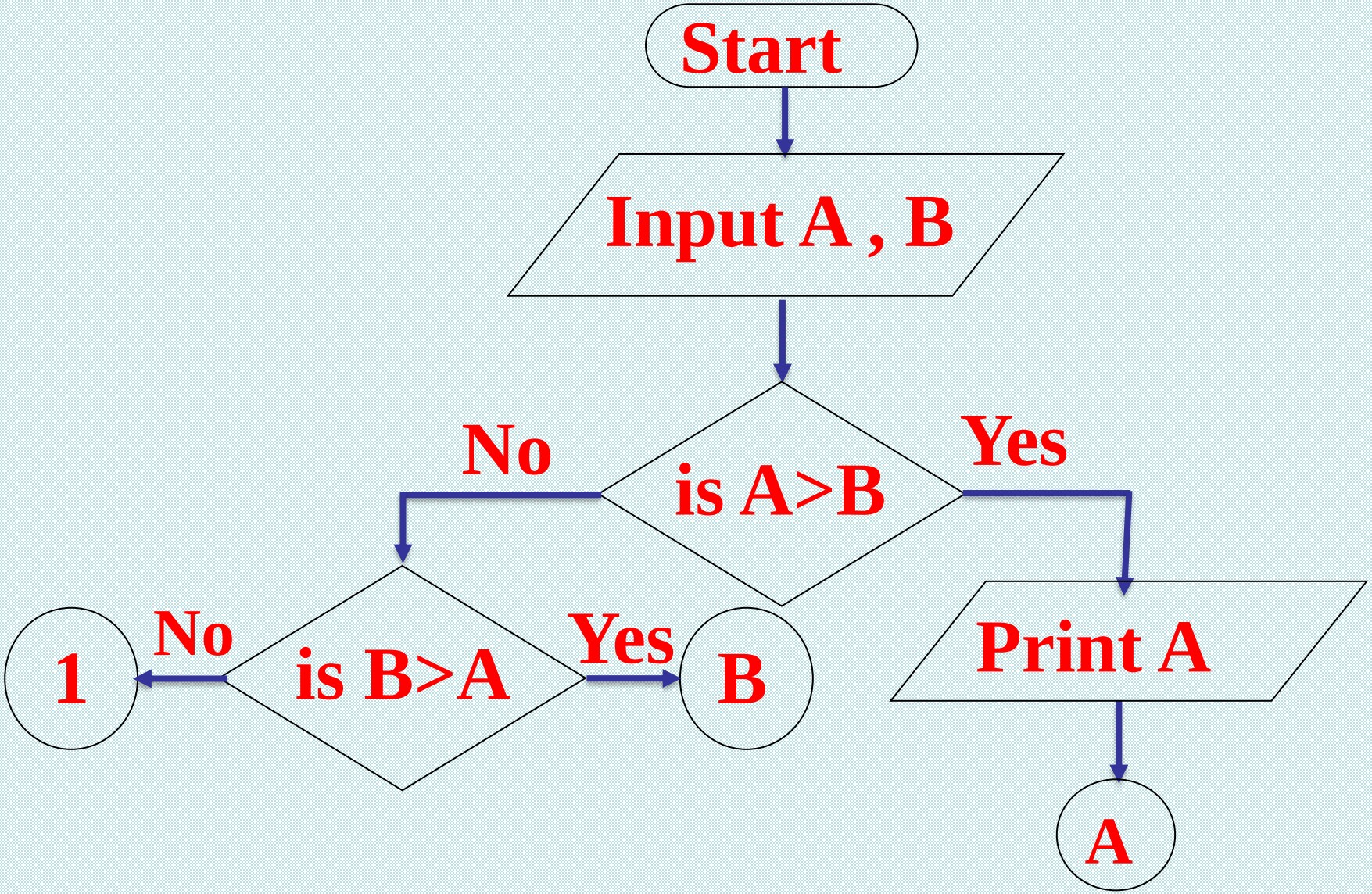


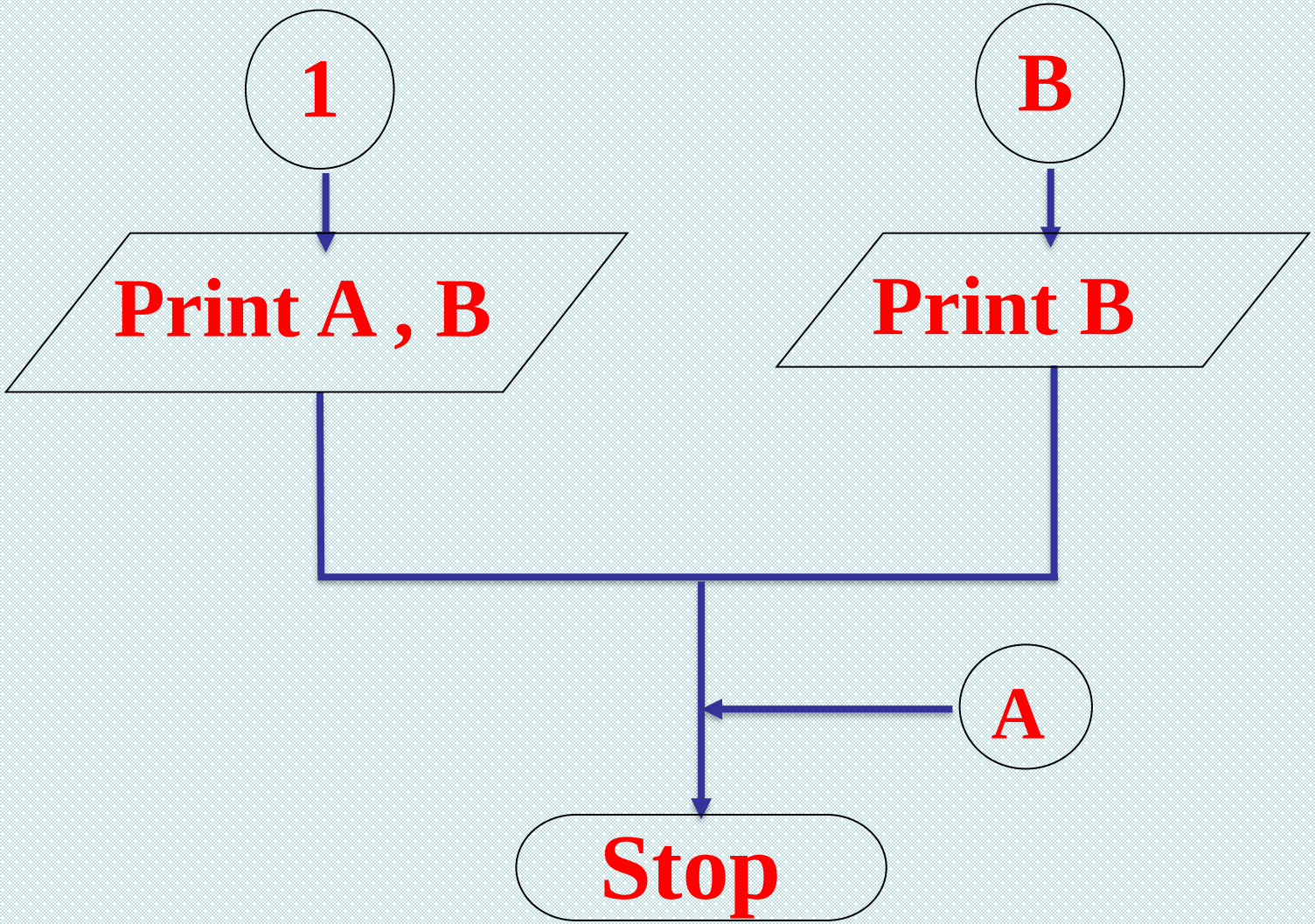

Condition
?
Yes
No
Event a
Event b


No
Condition
?
Yes
Event b
Event a

Example #5

Draw a flow chart for Example #2.

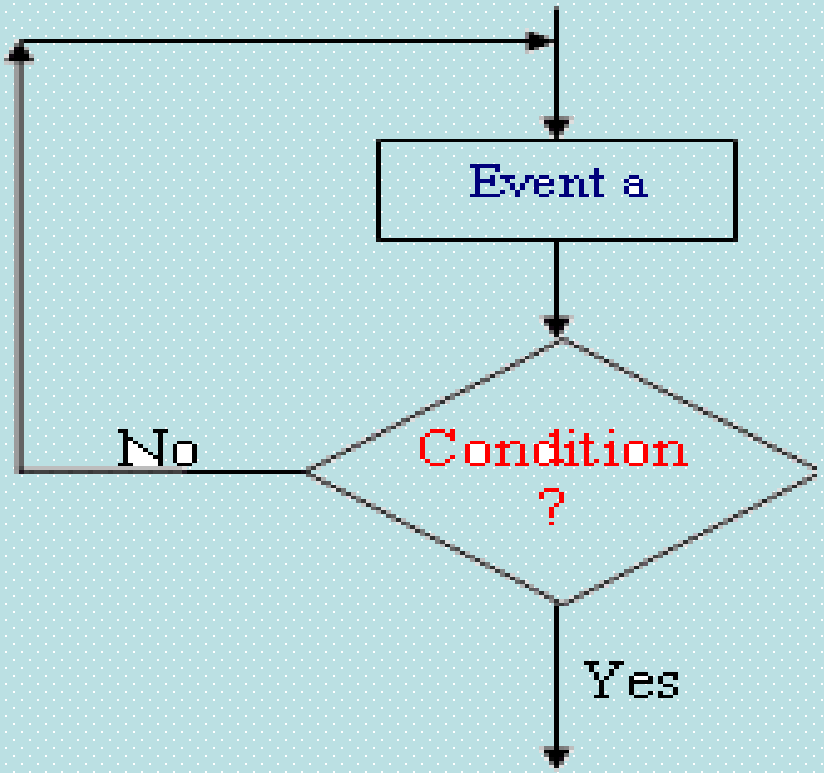



1
B
Print A , B
Print B
A
Stop

c. Looping Flow Chart

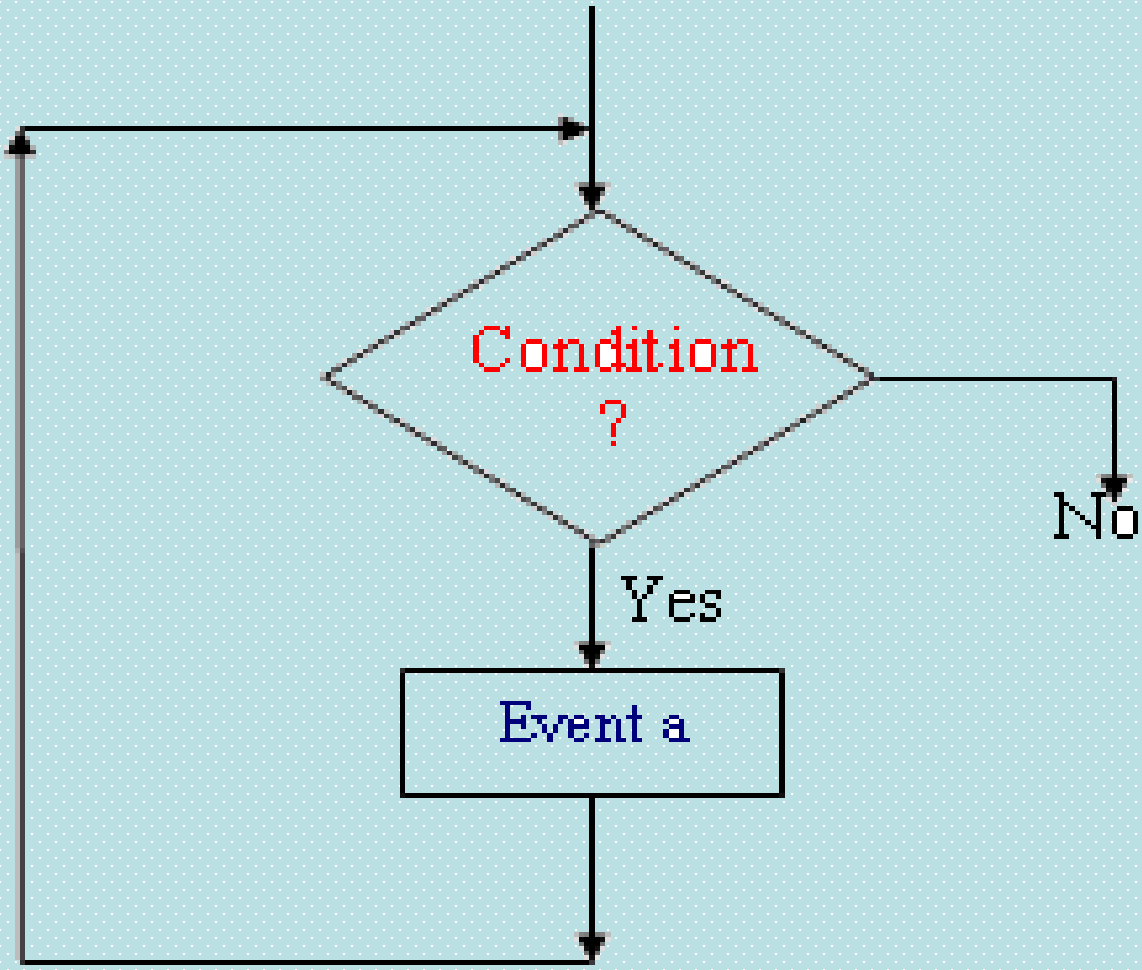
Part of flow chart will be repeated number of times as shown.

1.



Event (a) will be repeated until condition becomes false.

2.



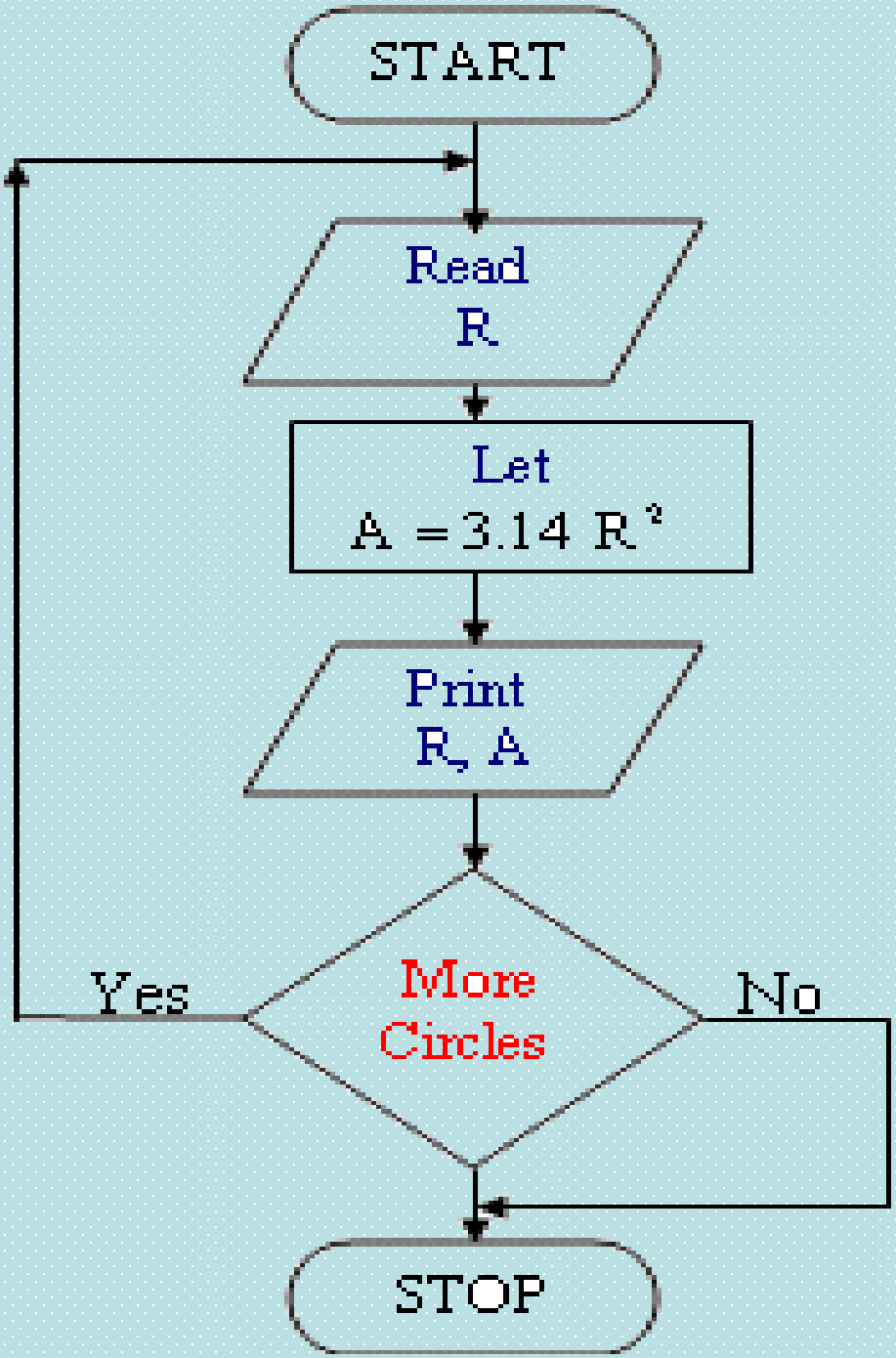
Event (a) will be repeated when ever the condition is true.

Example #6

Write an algorithm that can be used to find out area of a group of circles with different radiuses, and print out the radius and the area of each circle . Then draw the flow chart.

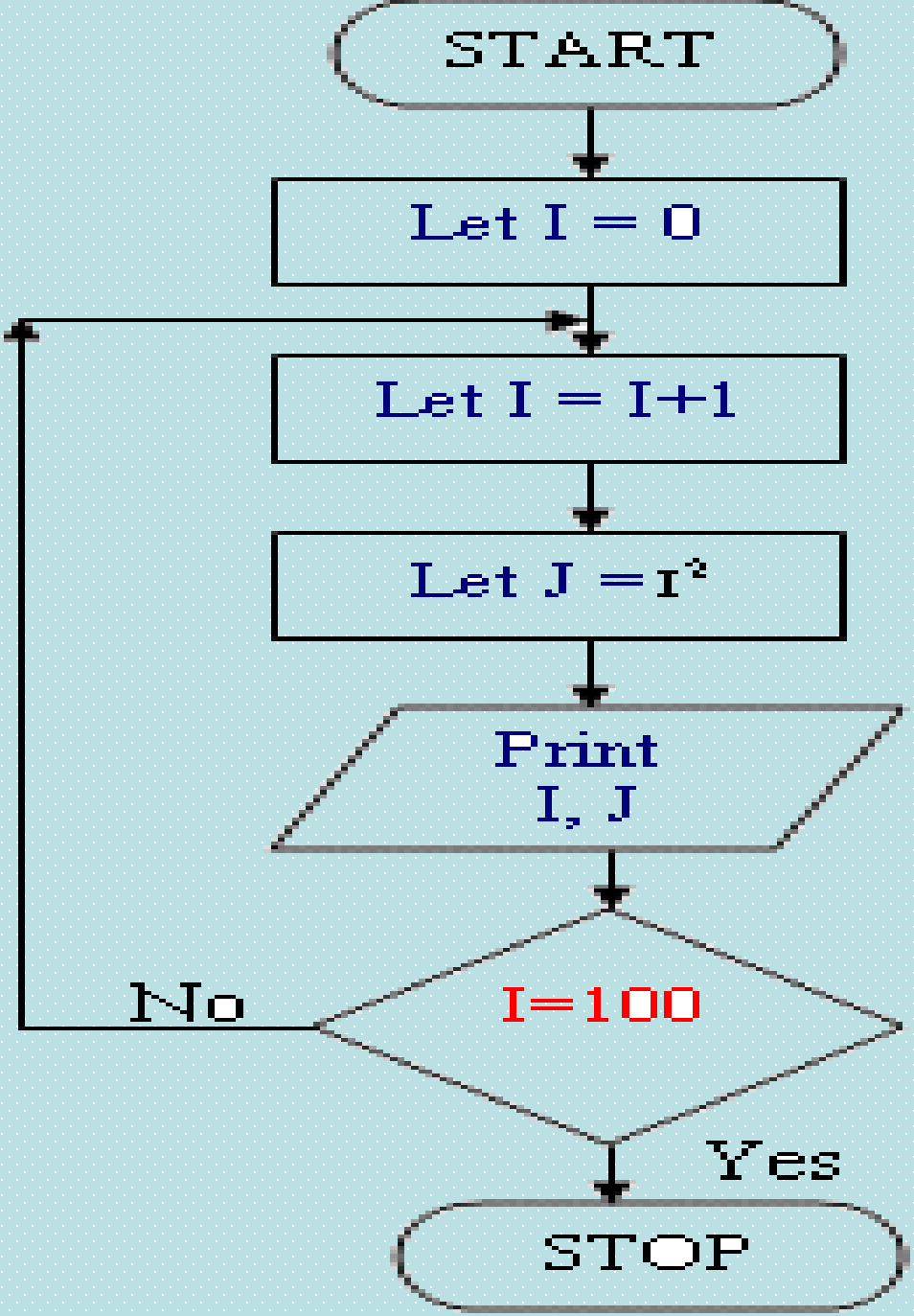
Solution :

1. Start
2. Let $\prod = 3.14$
3. Input r
4. Compute $A = \prod * r * r$
5. Print r, A
6. if more circle Goto 3 else Goto 7
7. Stop


START
Read
R
Let
A = 3.14 R²
Print
R, A
More
Circles
Yes
No
STOP

Example #7

Write an algorithm that can be used to find the sum of integer numbers 1,2,3,…,100 and their squares. Then draw the flow chart.


START
Let I = 0
Let I = I+1
Let J = I²
Print
I, J
I=100
No
Yes
STOP

Solution

1. Start
2. Let I = 0
3. Let I = I+1
4. Let J = I*I
5. Print I, J
6. if I = 100 Goto 3 else Goto 7
7. Stop