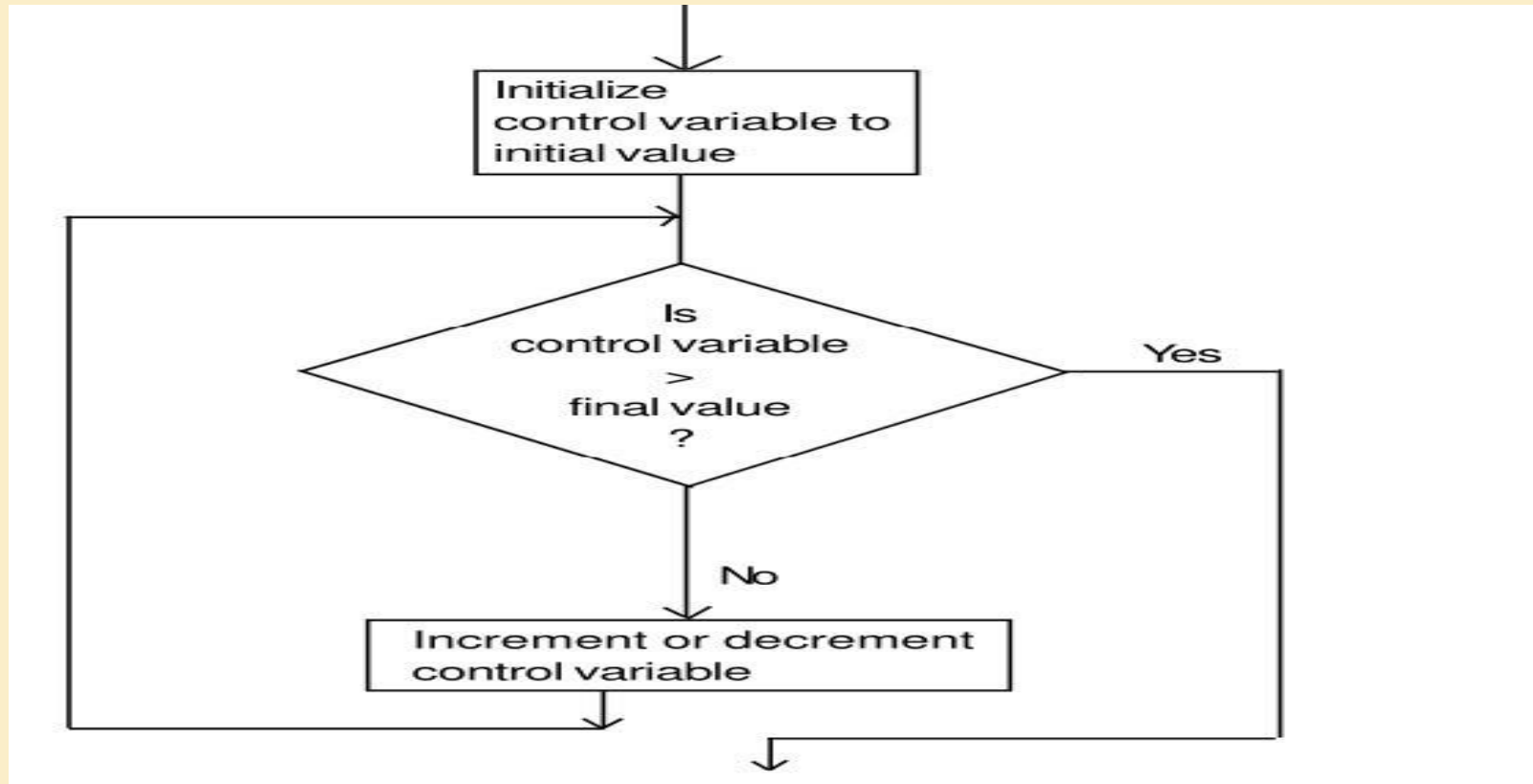# Loop Statements

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Iteration structures

Loops causes program to execute the certain block of code repeatedly until some conditions are satisfied, i.e., loops are used in performing repetitive work in programming. Suppose you want to execute some code/s 100 times. You can perform it by writing that code/s only one time and repeat the execution 100 times using loop.

There are 3 types of loops in C++ programming:

1. for loop

2. while loop

3. do...while loop

for Loop Syntax

for (initial expression; test expression; update expression)
  { code/s to be executed;
  }

How for loop works in C programming?

   The initial expression is initialized only once at the beginning of the for loop. Then, the test expression is checked by the program. If the test expression is false, for loop is terminated. But, if test expression is true then, the codes are executed and update expression is updated. Again, the test expression is checked. If it is false, loop is terminated and if it is true, the same process repeats until test expression is false. The following flowchart describes the working of for loop in C++ programming.
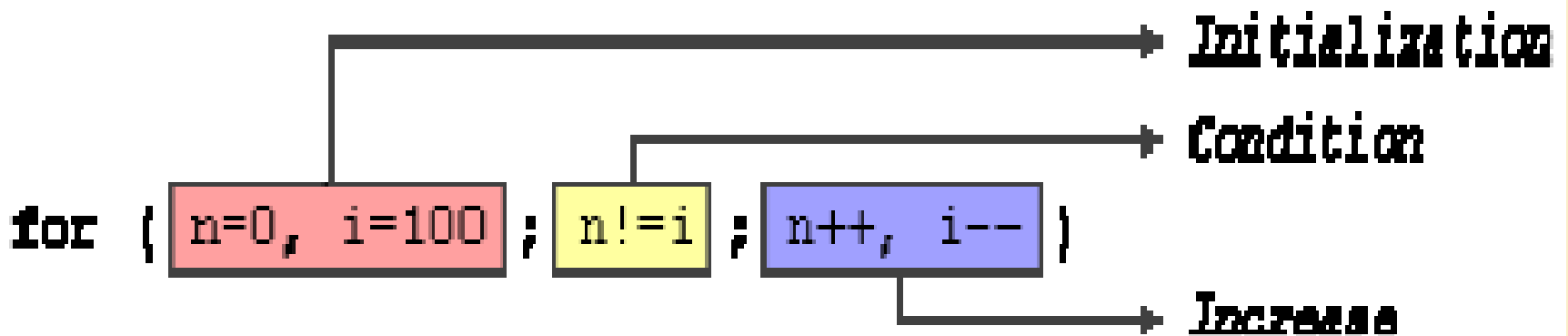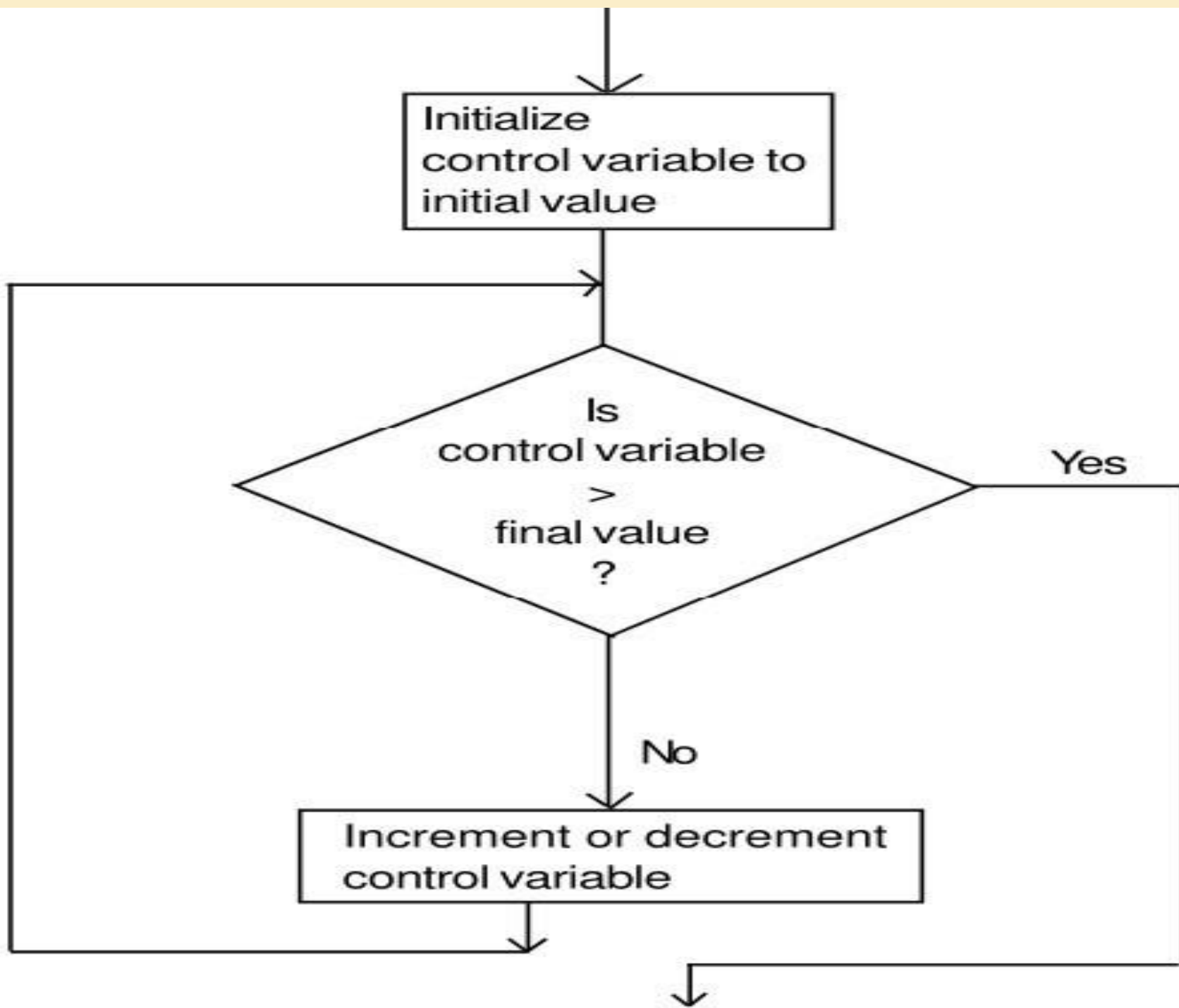
Examples

for (int i = 0 ; i < 5 ; i ++)

  cout << i <<" ";

The output of the above program is

0 1 2 3 4

Loop1: int i=0; i=0<5 T
Cout<< i=0; i++ (i=1)
Loop2: i=1<5 T
Cout<< i= 1; i++ (i=2)
Loop3: i=2<5 T
Cout<<i=2; i++ (i=3)
Loop4: i=3 < 5 T
Cout<< i = 3; i++ (4)
Loop5: i=4< 5 T
Cout<< i= 4; i++ (i=5)
Loop6: i=5< 5 F

for (char i = 'A'; i < 'E' ; i + +)

  cout < < i ;

The output of the above program is

A B C D

Loop1:i='A'; i='A'<'E' true, cout<<i=A; i++ (i=B)
Loop2:i='B'; i='B'<'E' true, cout<<i=B; i++ (i=C)
Loop3:i='C; i='C'<'E' true, cout<<i=C; i++ (i=D)
Loop4:i='D'; i='C'<E' true, cout<<i=D; i++ (i=E)
Loop5:i='E'; i='E'<'E; false;

1) Write a program to find the sum of first n natural numbers where n is entered by user. Note: 1,2,3... are called natural numbers.

```cpp
# include <iostream>
using namespace std;

int main()
{
    int n, count, sum = 0;
    cout << "Enter the value of n.";
    cin >> n;
    for (count = 1; count <= n; count++)
    {
        sum += count; /* this statement
         is equivalent to sum=sum+count */
        cout << "Sum=" << sum<< endl;
    }

    cout << "Sum=" << sum;
    return 0;
}
```

In this program, the user is asked to enter the value of *n*. Suppose you entered 19 then, count is initialized to 1 at first. Then, the test expression in the for loop, i.e., (count<= n) becomes true. So, the code in the body of for loop is executed which makes *sum* to 1. Then, the expression ++count is executed and again the test expression is checked, which becomes true. Again, the body of for loop is executed which makes *sum* to 3 and this process continues. When count is 20, the test condition becomes false and the for loop is terminated.

2) Write a program to find the average of first n natural numbers where n is entered by user. Note: 1,2,3... are called natural numbers. (H.W)

3) Write a program to find the largest number of n integer numbers where n is entered by user.

```cpp
# include <iostream>
using namespace std;
int main()
{
    int count, n, max, no;
    cout << "Enter the value of n." << endl;
    cin >> n;
    cout << "Enter no." << endl;
    cin >> no;
    max = no;
    for (count = 2;count <= n; count++)
    {
        cout << "Enter no." << endl;
        cin >> no;
        if (no > max)
            max = no;
    }
    cout << "max = " << max;
        return 0;
}
```

4) Write a program that finds the smallest of several integers. Assume that the first value read specifies the number of values remaining and that the first number is not one of the integers to compare.

```cpp
# include <iostream>
using namespace std;
int main()
{
    int n, value, smallest;
    cout << "Enter the number of integers to be processed: ";
    cin >> n;
    cout << "Enter an integer: ";
    cin >> value;
    smallest = value;
    for (int i = 2; i <= n; i++)
    {
    cout << "Enter next integer: ";
    cin >> value;
    if (value < smallest)
    smallest = value;
    }
    cout << "\nThe smallest integer is: " << smallest << endl;
    return 0;
}
```

5) Write a program that calculates and prints the product of the odd integers from 1 to 15.

```cpp
# include <iostream>
using namespace std;
int main()
{
    int product, i;
    product = 1;

    for (i = 3; i <= 15; i += 2)
        product *= i;


    cout << "Product of the odd integers from 1 to 15 is: " << product << endl;
    return 0;
}
```