



CC-301 Programming Fundamentals

Lecture 7

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Loops

In computer programming, loops are used to repeat a block of code

Loop is a sequence of instructions that is repeated until a certain condition is reached

For example

Let's say we want to print “Hello World” 10 times

- Then instead of writing the cout statement 10 times, we can use a loop

Types of Loops

- for loop
- while loop
- Do



For Loop

A for loop is a repetition control structure that allows us to write a loop that is executed a specific number of times

The loop enables us to perform 'n' number of steps together in one line

Syntax

```
for (initialization; condition; update)
{
    // body of-Loop
    // statements we want to execute
}
```

initialization - initializes variables and is executed only once

condition

- if true, the body of for loop is executed
- if false, the for loop is terminated

update - updates the value of initialized variables and again checks the condition

Working of For Loop

Initialization Expression

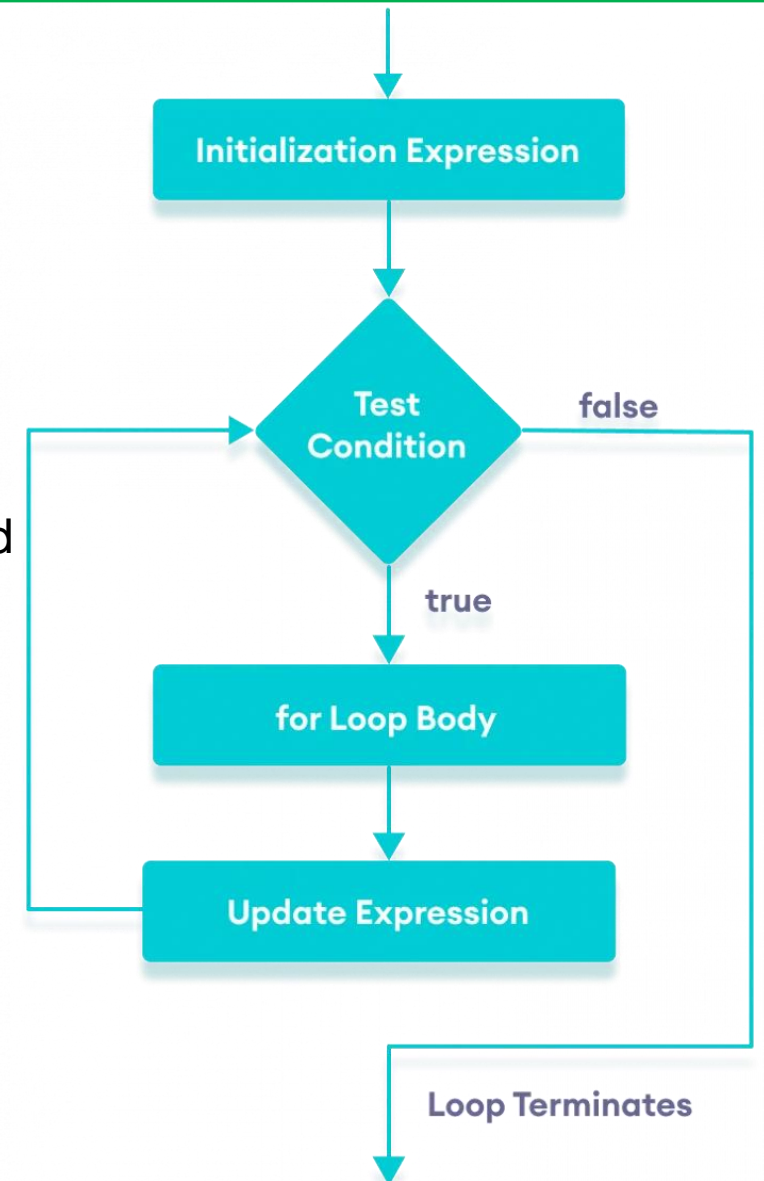
- initializes variables and is executed only once

Test Condition

- test expression is evaluated
- if test expression is evaluated true, the body of for loop is executed
- if test expression is evaluated false, the for loop is terminated

Update Expression

- updates the value of initialized variables
- and again the test expression is evaluated





Example

example_1.cpp

```
1 // Printing Numbers From 1 to 5
2
3 #include <iostream>
4 using namespace std;
5
6 int main()
7 {
8     for (int i = 1; i <= 5; ++i)
9     {
10         cout << i << " ";
11     }
12
13     return 0;
14 }
```

How this program works

Iteration	Variable	$i \leq 5$	Action
1 st	$i = 1$	true	1 is printed. i is increased to 2
2 nd	$i = 2$	true	2 is printed. i is increased to 3
3 rd	$i = 3$	true	3 is printed. i is increased to 4
4 th	$i = 4$	true	4 is printed. i is increased to 5
5 th	$i = 5$	true	5 is printed. i is increased to 6
6 th	$i = 6$	false	The loop is terminated

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```
1 2 3 4 5
-----
```



Example

Write a C++ program to find the sum of first n natural numbers using For Loop

example_2.cpp

```
1 // C++ program to find the sum of first n natural numbers using For Loop
2 // positive integers such as 1,2,3,...n are known as natural numbers
3
4 #include <iostream>
5 using namespace std;
6
7 int main() {
8     int num, sum = 0;
9
10    cout << "Enter a positive integer: ";
11    cin >> num;
12
13    for (int count = 1; count <= num; count++) {
14        sum += count;
15    }
16
17    cout << "Sum = " << sum << endl;
18
19    return 0;
20 }
```

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```
Enter a positive integer: 10
Sum = 55
```



Nested For Loop

A for loop within another for loop is called Nested For loop

The loop enables us to perform 'n' number of steps together in one line

Syntax

```
// Outer Loop
for (initialization; condition; update)
{
    // Inner Loop
    for (initialization; condition; update)
    {
        // body of inner for Loop
    }

    // body of outer for Loop
}
```

Example

Write a C++ program to display the output as shown below by using nested for loop

example_3.cpp

```
1 #include <iostream>
2 using namespace std;
3
4 int main()
5 {
6     int rows = 5;
7     for (int i = 1; i <= rows; i++)
8     {
9         for (int j = 1; j <= rows; j++)
10        {
11            cout << "*" << " ";
12        }
13        cout << endl;
14    }
15
16    return 0;
17 }
```



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Example

Write a C++ program to display the output as shown below by using nested for loop

```
example_4.cpp
1  #include <iostream>
2  using namespace std;
3
4  int main()
5  {
6      int rows = 5;
7      for (int i = 1; i <= rows; i++)
8      {
9          for (int j = 1; j <= i; j++)
10         {
11             cout << "* ";
12         }
13         cout << endl;
14     }
15
16     return 0;
17 }
```

