Lecture # 7

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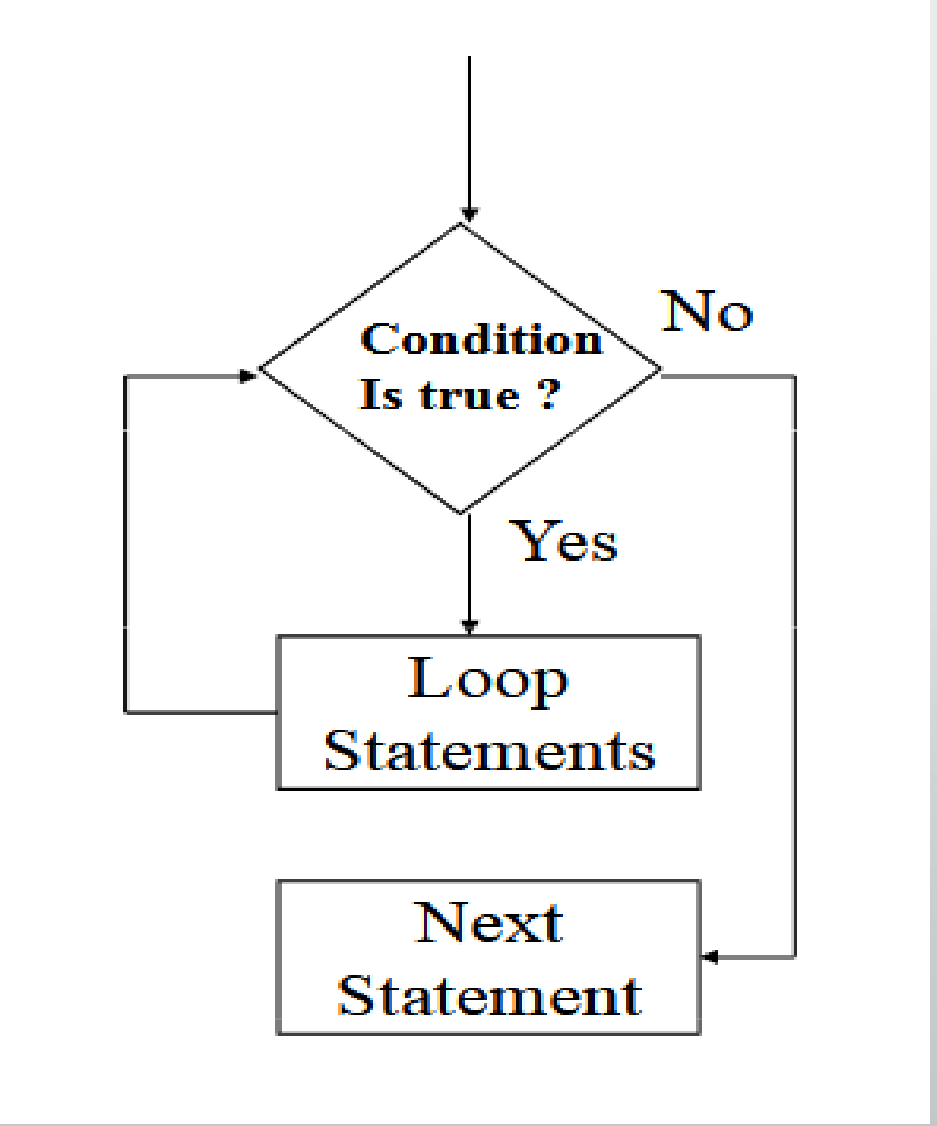
Iteration Statements in C++

Iteration statements (also called loops) allow a set of instructions to be executed repeatedly until a certain instructions to be executed repeatedly until a certain condition is reached.

- for loop
- while loop
- do while loop
- Nested loops

The while loop

```
while (condition)
{
    Iteration statements
}
Next statement
```



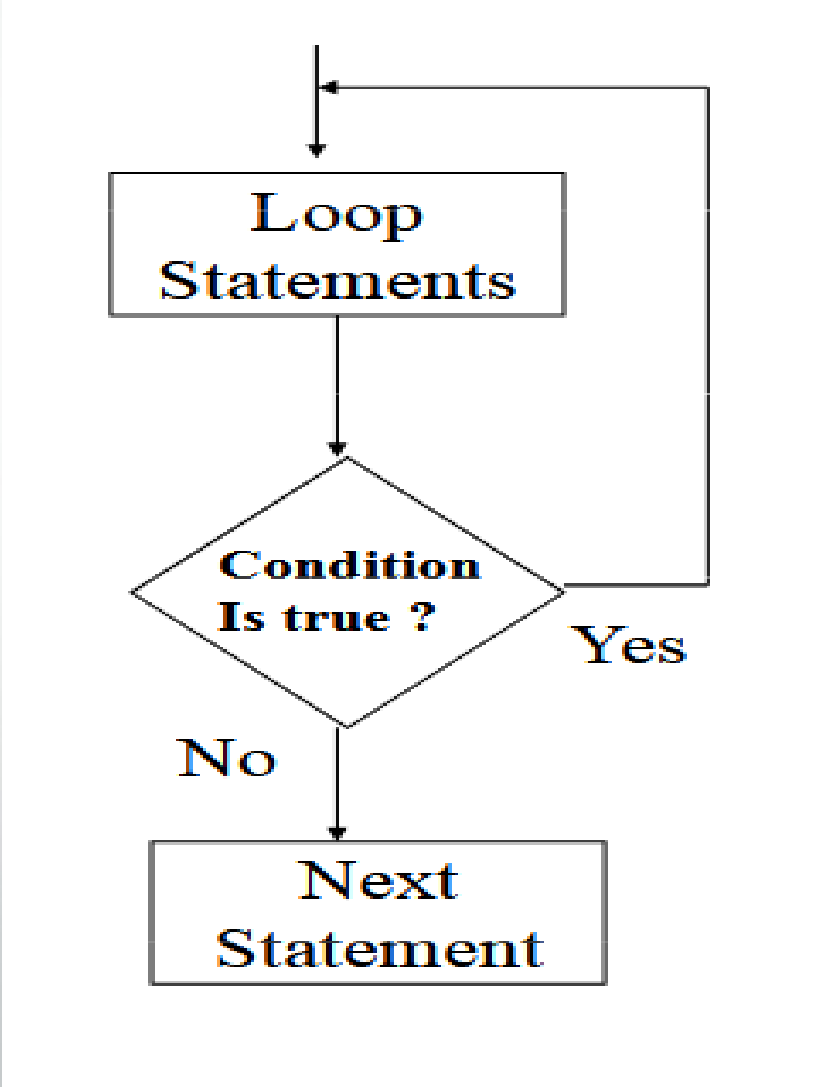
Example

Calculate the sum of first 100 numbers using the while loop

```
int i = 0, sum =0;
while (i <= 100)
{
        sum += i;
        i++;
}
cout << "The sum is " << sum << endl;
```

The do while Loop

```
do
{
      loop statements
} while ( condition);
```



Example

Calculate the sum of first 100 numbers using the do-while loop

```
int i = 0, sum =0;
do
{
        sum += i;
        i++;
} while (i <= 100);

cout << "The sum is " << sum << endl;
```

Main Difference Condition Checking

The main difference between while and do-while loops is the place at which the condition is checked.

In the while loop, the condition is checked at the very start, hence it is very much possible that the loop doesn't even execute once as in the following example. However, in do-while, the loop will definitely run at least once.

Another Example

```
#include <iostream>
using namespace std;
void main()
{
	int iNumber = 0, iSum = 0, iCounter = 0; char cChoice; float fAverage;
	do
	{
		cout << "Enter a Number: ";
		cin >> iNumber;
		iSum += iNumber;
		iCounter++;
		cout << "Do you want to enter another number? (y/n): ";
		cin >> cChoice;
	}while(cChoice == 'y');
	fAverage = float(iSum) / iCounter;
	cout << "The Average is: " << fAverage << endl;
}
```

Multiple Conditions

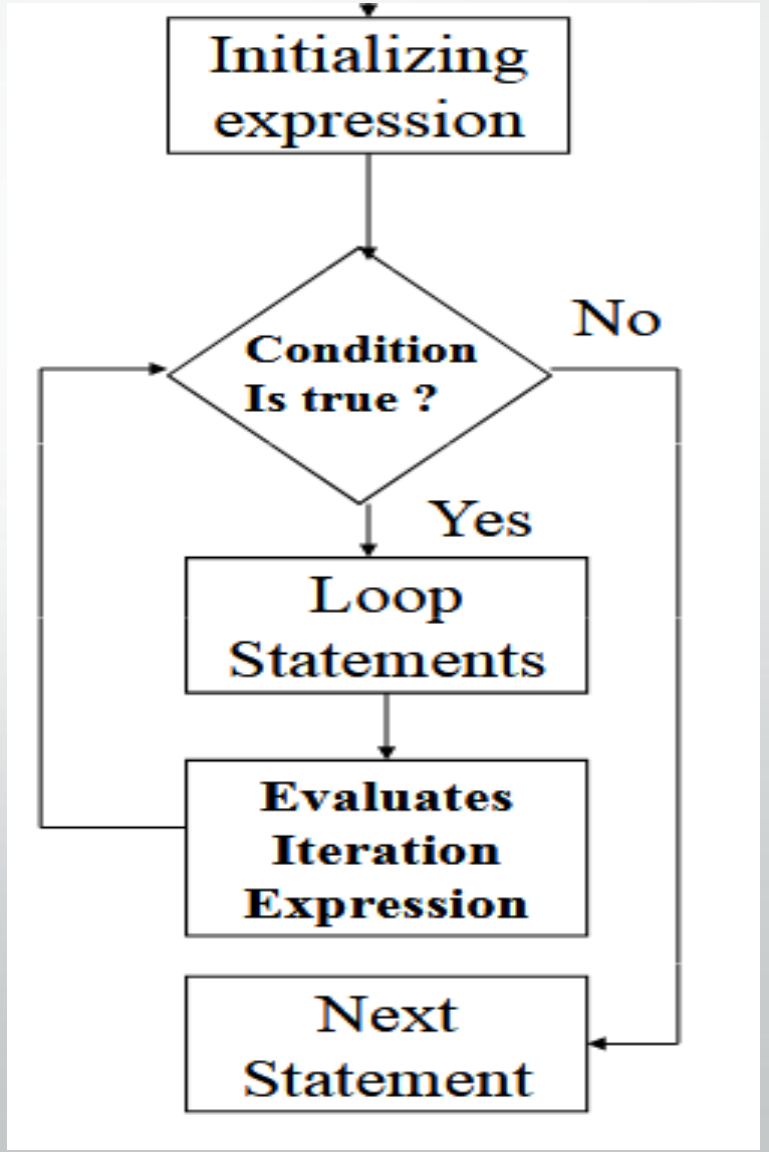
- These loops also support multiple conditions that can be combined together through logical operators && and || combined together through logical operators && and ||.

Example

```
#include <iostream>
using namespace std;
int main()
{
    int iNumber = 0, iSum = 0, iCounter = 0; char cChoice; char cChoice; float fAverage;
        do
        {
                cout << "Enter a Number:";
                cin >> iNumber;
                iSum += iNumber;
                iCounter++;
                cout<< "Do you want to enter another number? (y/n):";
                cin >> cChoice;
        }
        while((cChoice == 'y') && (iSum < 25));
        fAverage = float(iSum) / iCounter;
        cout<< "The Average is:"<<fAverage<<endl;
}
```

The for Loop

```
for (initialization; condition; iteration)
{
      loop statements
}
Next statement
```



The for Loop

- The initialization (also called initialization expression) is used to set the loop control variable.
- A loop control variable is the one who is usually controlling the execution of loop by being a part of the condition
- The condition is a relational expression that determines when the loop exits.
- The iteration (also called iteration expression) defines how the loop control variable changes each time the loop is repeated.

All these three sections must be separated by semicolon ";".

Example

Displays the squares of first 15 numbers.

```
#include <iostream>
using namespace std;
int main()
{
    int iNumber;
    for(iNumber = 1; iNumber < 16; iNumber++)
    {
       cout << "The Square of " << iNumber << " is: " << (iNumber * iNumber) <<endl;
    }
}
```

Nested Loops

- A loop can be placed inside other loops.
- Different types of loops can be nested inside each other e.g. a for loop within a while etc.

Nested Loops

Pattern:

```
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
```

- What would be the code to draw this pattern on screen?

Code

```
#include <iostream>
using namespace std;
int main()
{
    for(int i=1;i<=5;i++)
    {
       for(int j=1; j<=5; j++)
       {
              cout << "*";
       }
       cout << endl;
    }
}
```

Nested Loops

Pattern:

```
*
* *
* * *
* * * *
* * * * *
```

- What would be the code to draw this pattern on screen?

- Solution: Performed in class

Nested Loops

Pattern:

```
* * * * *
* * * *
* * *
* *
*
```

- What would be the code to draw this pattern on screen?

- Solution: Performed in class

End.