C++ while and do...while Loop

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In this tutorial, we will learn the use of while and do...while loops in C++ programming with the help of some examples.

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

For example, let's say we want to show a message 100 times. Then instead of writing the print statement 100 times, we can use a loop.

That was just a simple example; we can achieve much more efficiency and sophistication in our programs by making effective use of loops.

There are **3** types of loops in C++.

1. `for` loop
2. `while` loop
3. `do...while` loop

In the previous tutorial, we learned about the C++ for loop. Here, we are going to learn about `while` and `do...while` loops.

C++ while Loop

The syntax of the `while` loop is:

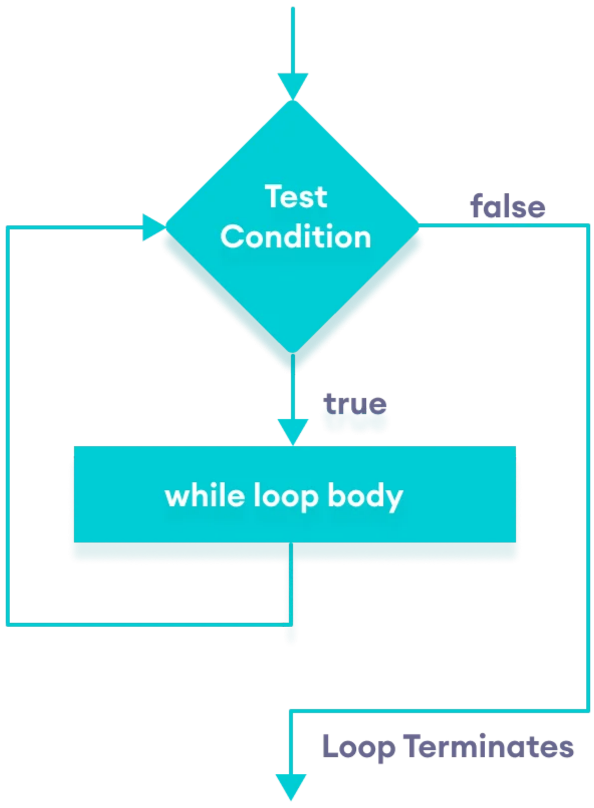
```
while (condition) {
    // body of the loop
}
```

Here,

- A `while` loop evaluates the `condition`
- If the `condition` evaluates to `true`, the code inside the `while` loop is executed.
- The `condition` is evaluated again.
- This process continues until the `condition` is `false`.
- When the `condition` evaluates to `false`, the loop terminates.

To learn more about the `conditions`, visit C++ Relational and Logical Operators.

Flowchart of while Loop



Flowchart of C++ while loop

Example 1: Display Numbers from 1 to 5

```
// C++ Program to print numbers from 1 to 5

#include <iostream>

using namespace std;

int main() {
    int i = 1;

    // while loop from 1 to 5
    while (i <= 5) {
        cout << i << " ";
        ++i;
    }

    return 0;
}
```

Output

```
1 2 3 4 5
```

Here is how the program works.

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

Example 2: Sum of Positive Numbers Only

```
// program to find the sum of positive numbers
// if the user enters a negative number, the loop ends
// the negative number entered is not added to the sum

#include <iostream>
using namespace std;

int main() {
    int number;
    int sum = 0;

    // take input from the user
    cout << "Enter a number: ";
    cin >> number;

    while (number >= 0) {
        // add all positive numbers
        sum += number;

        // take input again if the number is positive
        cout << "Enter a number: ";
        cin >> number;
    }

    // display the sum
    cout << "\nThe sum is " << sum << endl;

    return 0;
}
```

Output

```
Enter a number: 6
Enter a number: 12
Enter a number: 7
Enter a number: 0
Enter a number: -2

The sum is 25
```

In this program, the user is prompted to enter a number, which is stored in the variable *number*.

In order to store the sum of the numbers, we declare a variable *sum* and initialize it to the value of `0`.

The `while` loop continues until the user enters a negative number. During each iteration, the number entered by the user is added to the *sum* variable.

When the user enters a negative number, the loop terminates. Finally, the total sum is displayed.

C++ do...while Loop

The `do...while` loop is a variant of the `while` loop with one important difference: the body of `do...while` loop is executed once before the `condition` is checked.

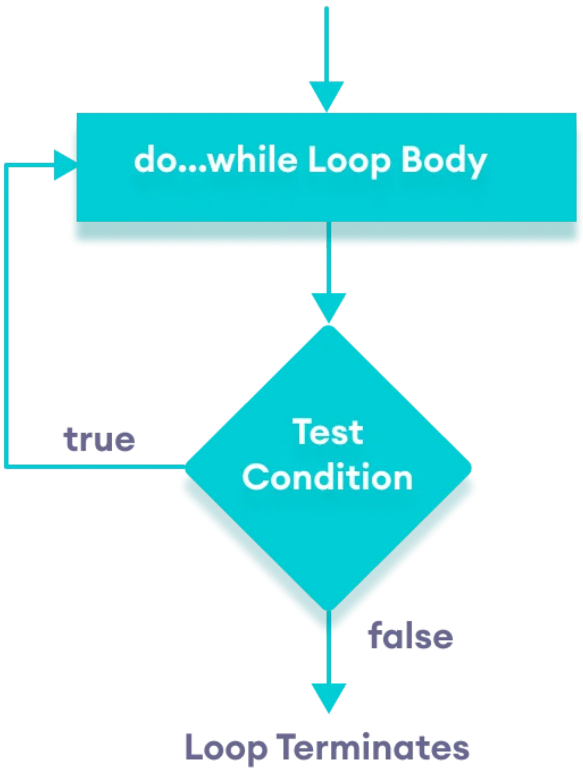
Its syntax is:

```
do {
   // body of loop;
}
while (condition);
```

Here,

- The body of the loop is executed at first. Then the `condition` is evaluated.
- If the `condition` evaluates to `true`, the body of the loop inside the `do` statement is executed again.
- The `condition` is evaluated once again.
- If the `condition` evaluates to `true`, the body of the loop inside the `do` statement is executed again.
- This process continues until the `condition` evaluates to `false`. Then the loop stops.

Flowchart of do...while Loop



Flowchart of C++ do...while loop

Example 3: Display Numbers from 1 to 5

```
// C++ Program to print numbers from 1 to 5

#include <iostream>

using namespace std;

int main() {
    int i = 1;

    // do...while loop from 1 to 5
    do {
        cout << i << " ";
        ++i;
    }
    while (i <= 5);

    return 0;
}
```

Output

```
1 2 3 4 5
```

Here is how the program works.

Iteration	Variable	i <= 5	Action
	`i = 1`	not checked	1 is printed and `i` is increased to 2
1st	`i = 2`	`true`	2 is printed and `i` is increased to 3
2nd	`i = 3`	`true`	3 is printed and `i` is increased to 4
3rd	`i = 4`	`true`	4 is printed and `i` is increased to 5
4th	`i = 5`	`true`	5 is printed and `i` is increased to **6**
5th	`i = 6`	`false`	The loop is terminated

Example 4: Sum of Positive Numbers Only

```
// program to find the sum of positive numbers
// If the user enters a negative number, the loop ends
// the negative number entered is not added to the sum

#include <iostream>
using namespace std;

int main() {
    int number = 0;
    int sum = 0;

    do {
        sum += number;

        // take input from the user
        cout << "Enter a number: ";
        cin >> number;
    }
    while (number >= 0);

    // display the sum
    cout << "\nThe sum is " << sum << endl;

    return 0;
}
```

Output 1

```
Enter a number: 6
Enter a number: 12
Enter a number: 7
Enter a number: 0
Enter a number: -2

The sum is 25
```

Here, the `do...while` loop continues until the user enters a negative number. When the number is negative, the loop terminates; the negative number is not added to the `sum` variable.

Output 2

```
Enter a number: -6
The sum is 0.
```

The body of the `do...while` loop runs only once if the user enters a negative number.

Infinite while loop

If the `condition` of a loop is always `true`, the loop runs for infinite times (until the memory is full). For example,

```
// infinite while loop
while(true) {
    // body of the loop
}
```

Here is an example of an infinite `do...while` loop.

```
// infinite do...while loop

int count = 1;

do {
   // body of loop
}
while(count == 1);
```

In the above programs, the `condition` is always `true`. Hence, the loop body will run for infinite times.

for vs while loops

A `for` loop is usually used when the number of iterations is known. For example,

```
// This loop is iterated 5 times
for (int i = 1; i <=5; ++i) {
   // body of the loop
}
```

Here, we know that the for-loop will be executed 5 times.

However, `while` and `do...while` loops are usually used when the number of iterations is unknown. For example,

```
while (condition) {
    // body of the loop
}
```

Check out these examples to learn more: