Programming Fundamentals (COMP1112)
Lecture 4
Repetition Structure

Division of Science & Technology
University of Education, Lahore.

Repetition structure - Loops

- A loop consists of two parts, a body of a loop and a control statement. The control statement is a combination of some conditions that direct the body of the loop to execute until the specified condition becomes false.

Types of loop

- for loop
- while loop
- do-while loop

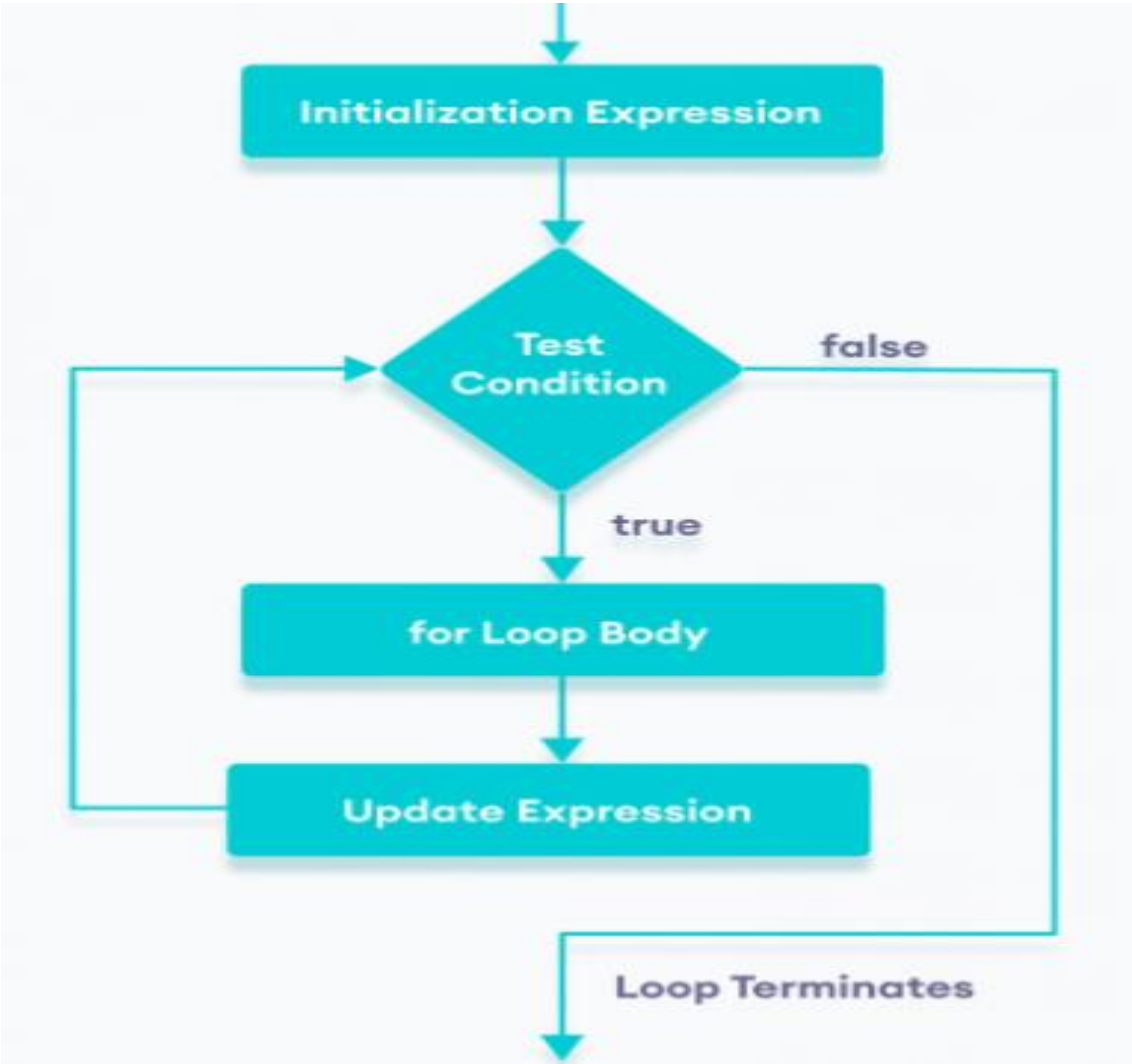
for loop

for (initial value; condition; increment or decrement statement)

{ statements; }

- The initial value of the for loop is performed only once.
- The condition is a Boolean expression that tests and compares the counter to a fixed value after each iteration, stopping the for loop when false is returned.
- The increment/decrement increases (or decreases) the counter by a set value.

For loop working flow



Examples

1)

```
for(int number=1;number<=10;number++)
cout<<number;
```

- We can skip the initial value expression, condition and/or increment by adding a semicolon.

2)

```
int i=0;
int max = 10;
for (; i < max; i++)
cout<<i;
```

Nested loops

- loops can also be nested where there is an outer loop and an inner loop.
- For each iteration of the outer loop, the inner loop repeats its entire cycle

Example

```
int table = 3;
int max = 5;

// outer loop
for (int i = 2; i <= table; i++)
        {
        for (int j =1 ; j <= max; j++)          // inner loop
                {
                cout<< i*j;
                }

        cout<<“\n”;
        }
}
```

While Loop

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

If a condition is true then and only then the body of a loop is executed. After the body of a loop is executed then control again goes back at the beginning, and the condition is checked if it is true, the same process is executed until the condition becomes false. Once the condition becom es false, the control goes out of the loop.

Example

```
int num =0;
while (num<=10)
{
cout<<num;
num++;
}
```

do while loop

```
do
{
Statements
} while (expression);
```

- A do-while loop is similar to the while loop except that the condition is always executed after the body of a loop. It is also called an exit-controlled loop.
- The body is executed if and only if the condition is true. In some cases, we have to execute a body of the loop at least once even if the condition is false.

Example

```
int num =1;


do {
cout<<2*num;
num++;
} while (num<=10);
```

Break Statement

- The break statement is used in the switch statement. It is also useful for immediately stopping a loop.

```
int main()
{
int num = 5;
 while (num > 0)
 {
   if (num == 3)
   break;
   cout<<num;
   num--;
 }
}
```

Continue Statement

- When you want to skip to particular iteration but remain in the loop, you should use the continue statement.

```
int main()
{
int nb = 7;
while (nb > 0)
{ nb--;
if (nb == 5)
continue;
cout<<nb;}
}
```

Example: C++ code to find the sum of first n natural numbers till the positive integer entered by user

```
int num, sum;
sum = 0;
cout << "Enter a positive integer: ";
cin >> num;

for (int i = 1; i <= num; ++i) {
    sum += i;
}

cout << "Sum = " << sum << endl;
```

Example: C++ code to display multiplication table of a number entered by user

```
int n;
cout << "Enter a positive integer: ";
 cin >> n;
 for (int i = 1; i <= 10; ++i) {
    cout << n << " * " << i << " = " << n * i << endl;
 }
```

Infinite for loop

If the condition is always true, the loop becomes infinite.

```
for(int i = 1; i > 0; i++) {
    // block of code
}
```

In order to ensure termination of loop, it needs to be checked that the condition for any iteration needs to be false.

Which loop to Select?

- Selection of a loop is always a tough task for a programmer; to select a loop do the following steps:
  - Analyze the problem and check whether it requires a pre-test or a post-test loop.
  - If pre-test is required, use a while or for loop.
  - If post-test is required, use a do-while loop.
- For and while loop are entry-controlled loops.
- Do-while is an exit-controlled loop.

References

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