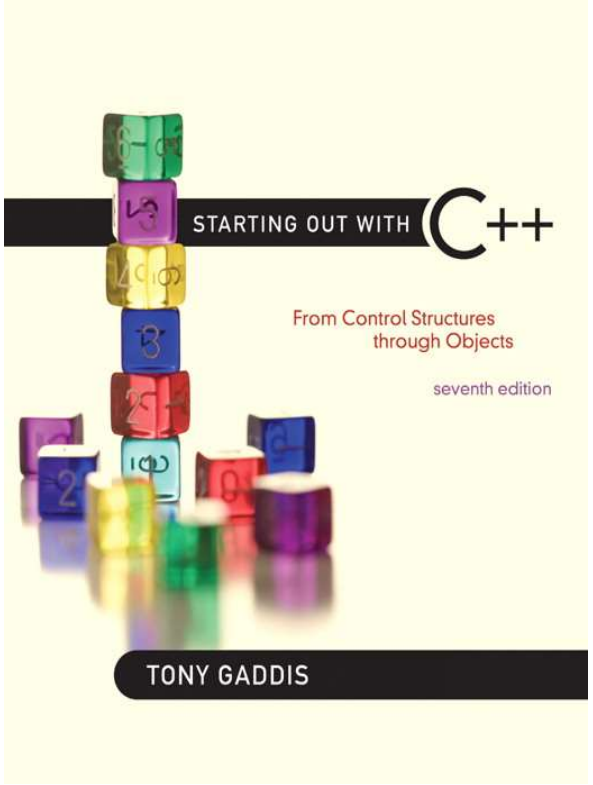
20 - 10 - 2022



Nesting of loops:

When we want to perform ***repeated*** task ***repeatedly***

Review

- Repetition structure
  - ***While loops (pretest loop)***
  - ***For loops (pretest loop)***
  - ***Do while loops (posttest loop)***
- Counter control loops
- Sentinel loops
- Conditional loops
- Code conversion and Dry run
- Increment and decrement operators (post and pre)
- Break and continue statement

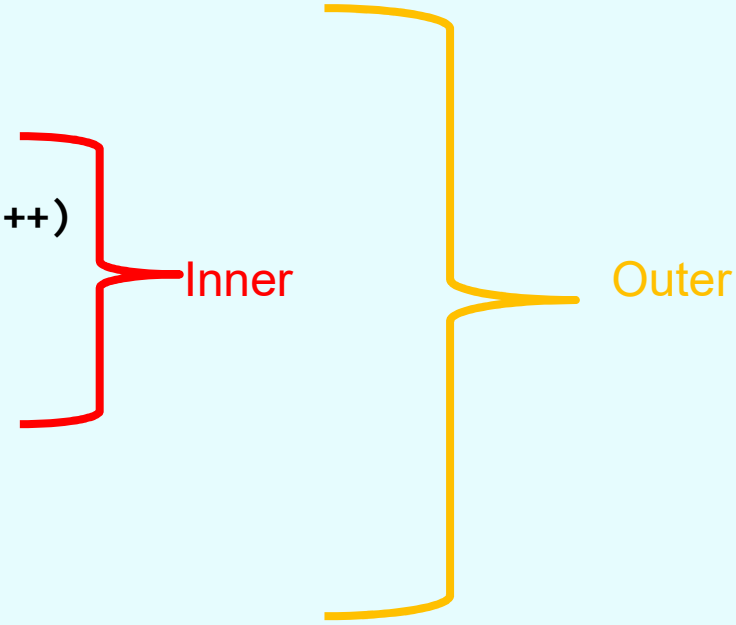
Nesting of loops

- A **nested loop** is a **loop** within a **loop**
- An inner **loop** within the body of an outer one.

```
for (int i = 1; i <= 4; i++)
{

     for (int j = 1; j <= 4; j++)
     {
              cout << "*";
     }

     Cout << endl;
}
```



output

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

Nesting of loops

- Use to perform repeated tasks repeatedly
- i.e. on every iteration of outer loop inner loop perform its all iterations.
- So repeated task (performed by inner loop) is repeated with the help of outer loop.
- Nested loop is break from outer loop

Code 2:

```
for (int i = 1; i <= 4; i++)
{

    for (int j = 1; j <= 4; j++)
    {
          cout << i;
    }

    Cout << endl;
}
```

Code 3:

```
for (int i = 1; i <= 4; i++)
{

    for (int j = 1; j <= 4; j++)
    {
          cout << j;
    }

    Cout << endl;
}
```

Code 4:

```
for (int i = 1; i <= 4; i++)
{

    for (int j = 1; j <= i; j++)
    {
          cout << i;
    }

    Cout << endl;
}
```

Output: wrong

```
1
1 2
1 2 3
1 2 3 4
```

Write code for following output 1:

1

2 1

3 2 1

4 3 2 1

```
for (int i = 1; i <= 4; i++)
        {

                for (int j = i; j >= 1; j--)
                {
                        cout << j;
                }

                cout << endl;
        }
```

Write code for following output 2:

```
4 3 2 1
3 2 1
2 1
1
```

```
for (int i = 4; i >= 1; i--)
        {

                for (int j = i; j >= 1; j--)
                {
                        cout << j;
                }

                cout << endl;
        }
```

Write code for following output 3:

```
   1
  1 2
 1 2 3
1 2 3 4
```

```
for (int i = 1; i <= 4; i++)
{
     for (int k = 1; k <= 4-i; k++)// print spaces
     and shrink
     {
          cout << " ";
     }
     for (int j = 1; j <= i; j++)//Print numbers
     and expand
     {
          cout << j;
     }

     cout << endl;
}
```

Write code for following output 4:

```
1 2 3 4
  1 2 3
    1 2
      1
```

Devise and write its code by your self

Combining all these patterns

```
      1   1
    1 2   2 1
  1 2 3   3 2 1
1 2 3 4   4 3 2 1
1 2 3 4   4 3 2 1
  1 2 3   3 2 1
    1 2   2 1
      1   1
```

Nested Loops

- A nested loop is a loop inside the body of another loop
- Inner (inside), outer (outside) loops:

```
for (row=1; row<=3; row++)  //outer
  for (col=1; col<=3; col++)//inner
     cout << row * col << endl;
```

Nested `for` Loop in Program 5-14

```
26    // Determine each student's average score.
27    for (int student = 1; student <= numStudents; student++)
28    {
29       total = 0;       // Initialize the accumulator.
30       for (int test = 1; test <= numTests; test++)
31       {
32          double score;
33          cout << "Enter score " << test << " for ";
34          cout << "student " << student << ": ";
35          cin >> score;
36          total += score;
37       }
38       average = total / numTests;
39       cout << "The average score for student " << student;
40       cout << " is " << average << ".\n\n";
41    }
```

Inner Loop

Outer Loop

Nested Loops - Notes

- Inner loop goes through all repetitions for each repetition of outer loop
- Inner loop repetitions complete sooner than outer loop
- Total number of repetitions for inner loop is product of number of repetitions of the two loops.

THE END