Programming Fundamentals Lab

Lab # 11

Nested Loops in C

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Nested Loop:

Loop within the body of another loop is called nested loop.

C programming language allows to use one loop inside another loop.

```
Outer-Loop
{
   // body of outer-loop
   Inner-Loop
   {
       // body of inner-loop
   }
... ... ...
}
```

As you can see, the outer loop encloses the inner loop. The inner loop is a part of the outer loop and must start and finish within the body of outer loop.

On each iteration of outer loop, the inner loop is executed completely.

Let's take an example, Suppose we want to loop through each day of a week for 3 weeks.

To achieve this, we can create a loop to iterate three times (3 weeks). And inside the loop, we can create another loop to iterate 7 times (7 days). This is how we can use nested loops.

Example 1

```c
// C program to display 7 days of 3 weeks
#include <stdio.h>
int main() {
   int weeks = 3, days_in_week = 7;

   for (int i = 1; i <= weeks; ++i) {
       printf("Week: %d\n",i);

       for (int j = 1; j <= days_in_week; ++j) {
           printf("\tDay: %d\n",j);
       }
   }

   return 0;
}
```

Output

```
Week: 1
      Day: 1
      Day: 2
      Day: 3
      .. . ..
      .. . ..
Week: 2
      Day: 1
      Day: 2
      .. . ..
      .. . ..
```

We can create nested loops with **while** and **do**...**while** in a similar way.

A final note on loop nesting is that you can put any type of loop inside of any other type of loop.

For example a for loop can be inside a while loop or vice versa.

Example 2

If you were asked to create a C program that displayed the rectangle, you could

easily do it with a set of print statements. You can also create it with a FOR loop and a print

statement.

```c
// C program to display a pattern with 5 rows and 3 columns
#include <stdio.h>
int main() {
  int rows = 5;
  int columns = 3;

  for (int i = 1; i <= rows; ++i) {
     for (int j = 1; j <= columns; ++j) {
        printf("*  ");
     }
     printf("\n");
  }

  return 0;
}
```

Output

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

In this program, the outer loop iterates from 1 to rows.

The inner loop iterates from 1 to columns. Inside the inner loop, we print the character '*****'.

Example 3:

Program which make triangle using for nested loop with help of astrisk (*).

```c
// C program to display a triangle using asterik *
#include <stdio.h>
int main() {
  int rows = 5;
  for (int i = 1; i <= rows; ++i) {
     for (int j = 1; j <= i; ++j) {
        printf("*  ");
     }
     printf("\n");
  }
  return 0;
}
```

Output

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

When we use a break statement inside the inner loop, it terminates the inner loop but not the outer loop.

Example 4: break Inside Nested Loops

Program which make triangle using for nested loop with help of astrisk (*).

```c
#include <stdio.h>
int main() {
   int weeks = 3, days_in_week = 7;
   for (int i = 1; i <= weeks; ++i) {
       printf("Week: %d\n",i);
       for (int j = 1; j <= days_in_week; ++j) {
           // break during the 2nd week
           if (i == 2) {
               break;
           }
       printf("\tDay: %d\n",j);
       }
   }
   return 0;
}
```

Output

```
Week: 1
        Day: 1
        Day: 2
        Day: 3
        Day: 4
        Day: 5
        Day: 6
        Day: 7
Week: 2
Week: 3
        Day: 1
        Day: 2
        Day: 3
        Day: 4
        Day: 5
        Day: 6
        Day: 7
```

References:

https://www.programiz.com/cpp-programming/nested-loops