Introduction to Computing – Lab

Faculty of Information Technology & Computer Science

Lab 08

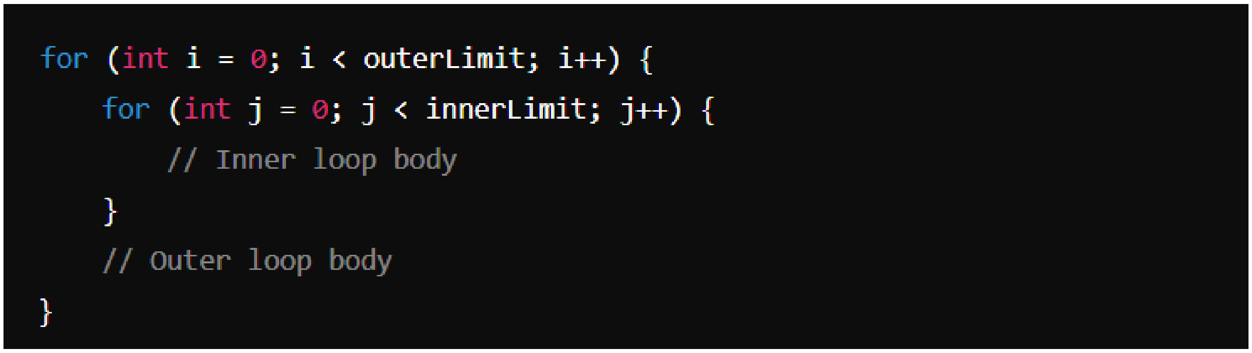
Topics: Nested Loops, Shapes Printing

Instructions:

- Create separate C++ source files for each task, named as “task1.cpp”, “task2.cpp”, and so on depending on the task number.
- After completing all tasks, place all .cpp files into a folder. Name the folder with your university registration number (e.g., L1F20BSCS0999). Compress the folder into a .zip file and upload it on the portal.
- Ensure that the work you submit is entirely your own. Avoid copying from peers, online sources, or any other unauthorized material. Plagiarism will not be tolerated.
- If you encounter difficulties, feel free to reach out to the instructor. Collaboration and discussion are encouraged, but the final implementation should be your own work.
- Write clean and well-structured code. Use comments to explain key sections of your code to make it easier for others (and yourself) to understand.
- These tasks are designed to help you strengthen your logical thinking and problem-solving skills. Think through each problem carefully before starting to code. The aim is to develop a deep understanding of the problem and to devise solutions independently.
- Learning programming is about practice and perseverance—genuine effort in solving the problems will contribute significantly to your learning.

Nested Loops

A nested loop is a loop inside another loop. In C++, a nested loop is used when a task requires multiple iterations for each iteration of an outer loop. This is often used for multi-dimensional tasks such as matrix manipulation, table generation, or shape printing.



```
for (int i = 0; i < outerLimit; i++) {
    for (int j = 0; j < innerLimit; j++) {
        // Inner loop body
    }
    // Outer loop body
}
```

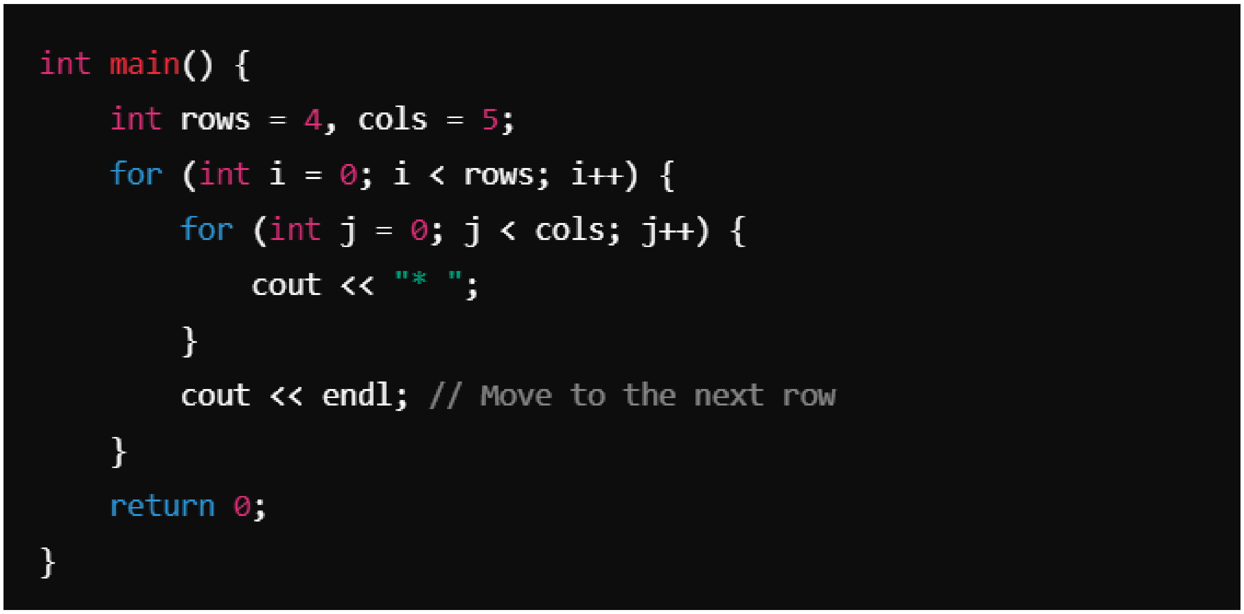
In nested loops:

- The outer loop runs first, and for each iteration of the outer loop, the inner loop runs completely.
- The total number of iterations is the product of the iterations of the outer and inner loops.

Shape Printing Using Nested Loops

Nested loops are particularly useful for printing patterns and shapes. By controlling the inner and outer loops, we can manipulate rows and columns in shapes.

Example 1: Printing a Rectangle

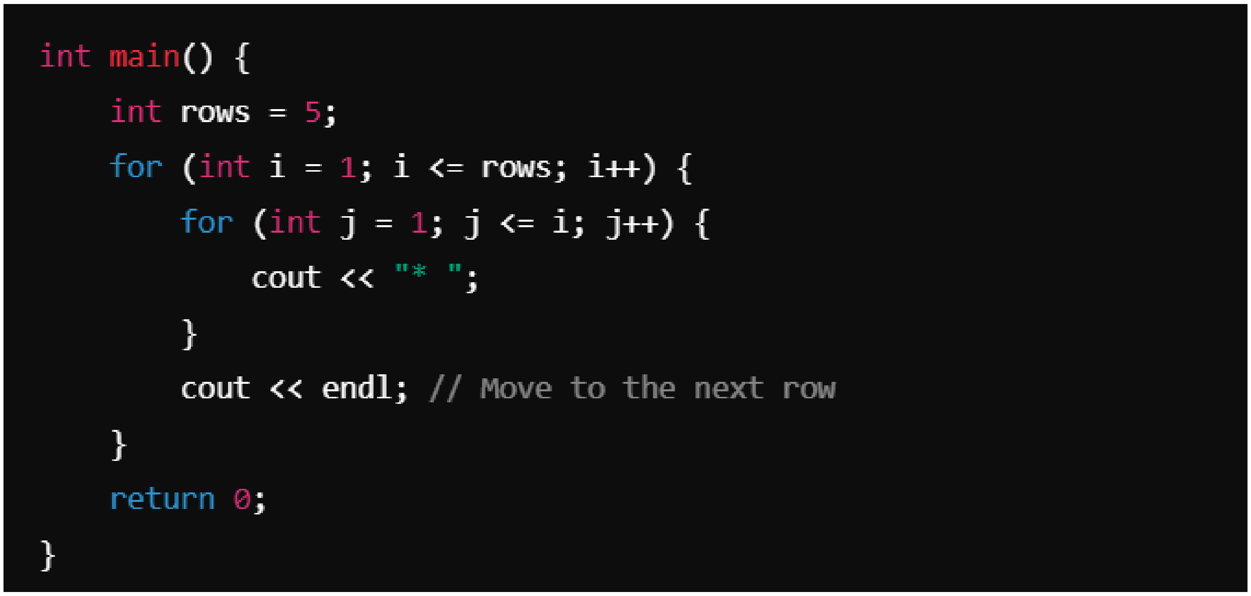


```
int main() {
    int rows = 4, cols = 5;
    for (int i = 0; i < rows; i++) {
        for (int j = 0; j < cols; j++) {
            cout << "* ";
        }
        cout << endl; // Move to the next row
    }
    return 0;
}
```

Output:

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

Example 2: Printing a Right-Angled Triangle



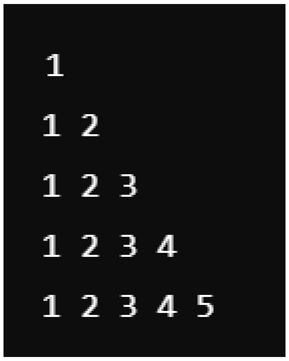
```cpp
int main() {
    int rows = 5;
    for (int i = 1; i <= rows; i++) {
        for (int j = 1; j <= i; j++) {
            cout << "* ";
        }
        cout << endl; // Move to the next row
    }
    return 0;
}
```

Output:

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

Task 1

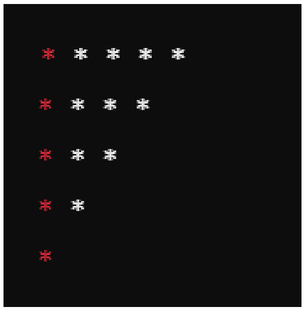
Write a program that prints the following shape through nested loops.



```
1
1 2
1 2 3
1 2 3 4
1 2 3 4 5
```

Task 2

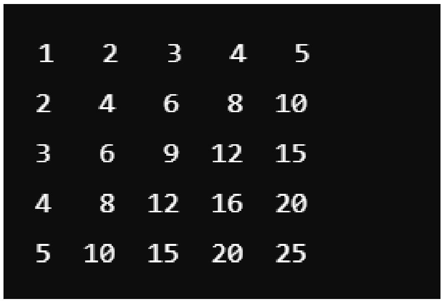
Write a program that prints the following shape through nested loops.



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

Task 3

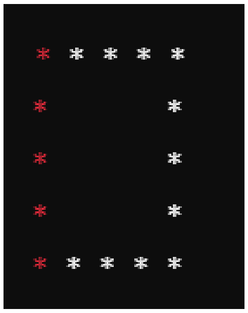
Write a program that prints the following shape through nested loops.



```
 1   2   3   4   5
 2   4   6   8  10
 3   6   9  12  15
 4   8  12  16  20
 5  10  15  20  25
```

Task 4

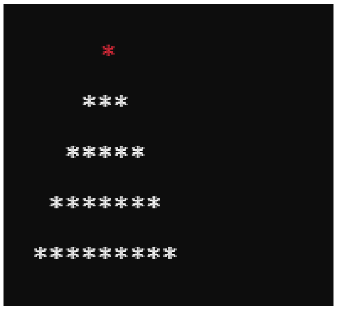
Write a program that prints the following shape through nested loops.



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

Task 5

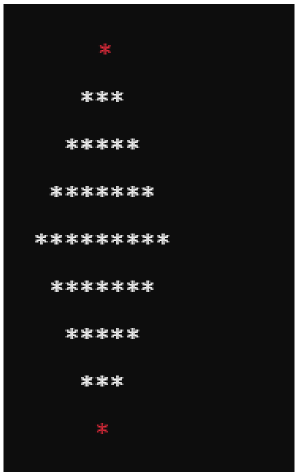
Write a program that prints the following shape through nested loops.



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

Task 6

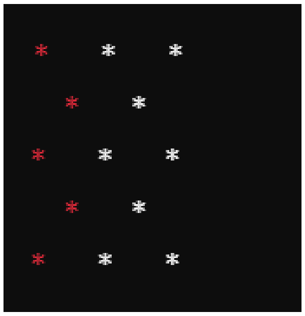
Write a program that prints the following shape through nested loops.



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

Task 7

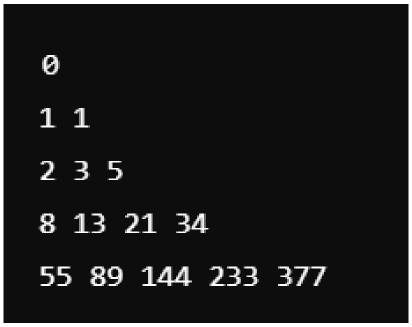
Write a program that prints the following shape through nested loops.



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

Task 8

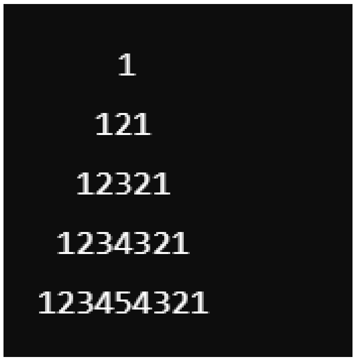
Write a program that prints the following shape through nested loops.



```
0
1 1
2 3 5
8 13 21 34
55 89 144 233 377
```

Task 9

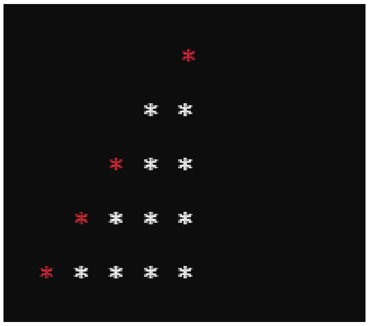
Write a program that prints the following shape through nested loops.



```
    1
   121
  12321
 1234321
123454321
```

Task 10

Write a program that prints the following shape through nested loops.



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