**Tishk International University**
Faculty of Applied Science
Information Technology Department

# *Iterative Control Structures (nested loop)*

**Programming I**

Lecture 8

Fall 2025

Course Code: IT117

Grade 1

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# Outlines

- ✓ Introduction to Nested Loops
- ✓ Nested for Loop
  - Syntax and execution
  - Examples
- ✓ Nested while Loop
  - Syntax and execution
  - Examples

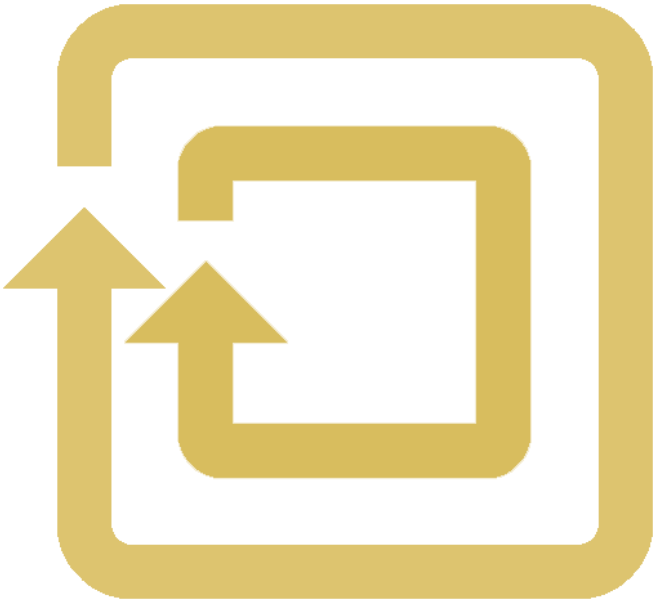
# Learning Outcomes

- **At the end of today's session, you will be able to:**

  - ✓ Define nested loops and their syntax
  - ✓ Explain how nested loops execute
  - ✓ Apply nested for and while loops to solve problems
  - ✓ Analyze the output of nested loop programs
  - ✓ Create C++ programs using nested loops

# Introduction to nested loop

- A **nested loop** is a loop placed inside another loop.
- The inner loop runs completely each time the outer loop executes.



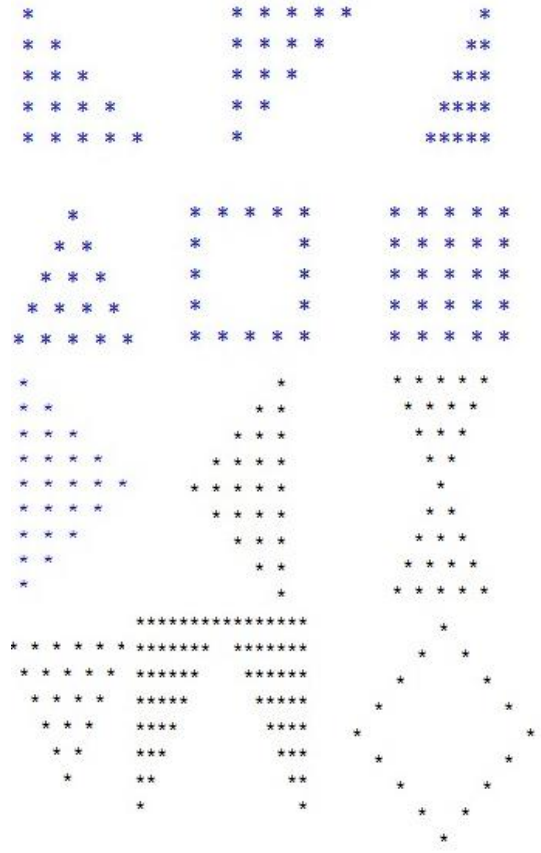
# Introduction to nested for loop

- A **nested for loop** is a for loop inside another for loop, used to repeat tasks in rows and columns.

Structure:

- **Outer loop** controls the iteration over **rows**.
- **Inner loop** manages the iteration over **columns**.

➢ Commonly used for tables, matrices, patterns, and grids



# Syntax

```
for (initialization; condition; update) {
    for (initialization; condition; update) {
        // statements
    }
}
```

# nested for loop (Ex.)

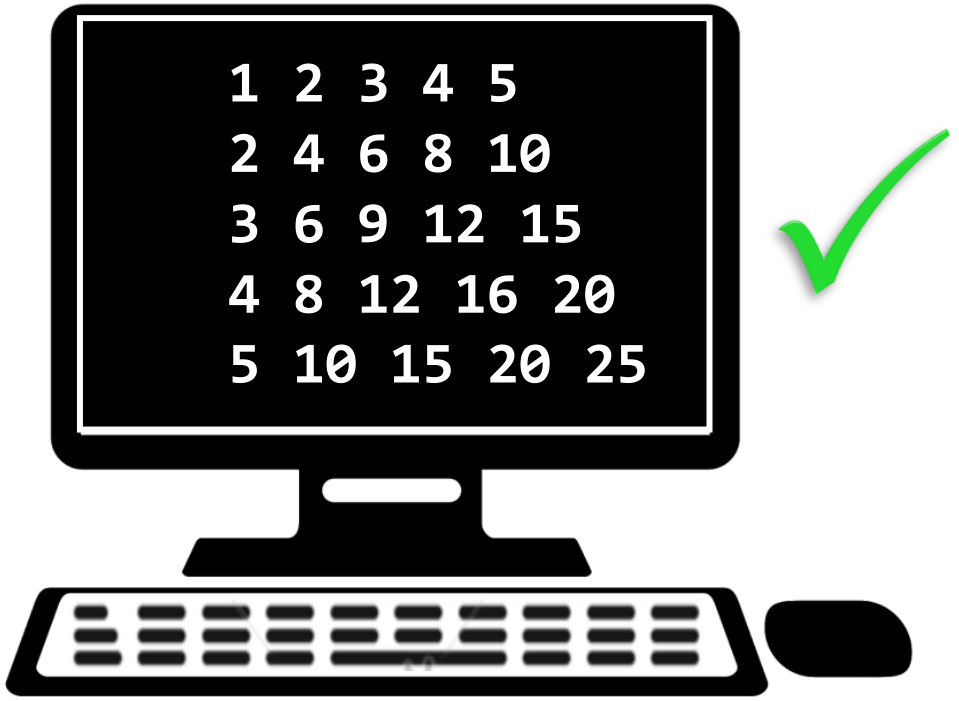
```
for (int i = 1; i <= 3; i++)
{
    for (int j = 1; j <= 3; j++)
    {
        cout << "* ";
    }
    cout << endl;
}
```

# nested for loop (Ex.)

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

# nested for loop (Ex.)

```
for (int i = 1; i <= 5; i++)
{
    for (int j = 1; j <= 5; j++)
    {
        cout << i * j << " ";
    }
    cout << endl;
}
```

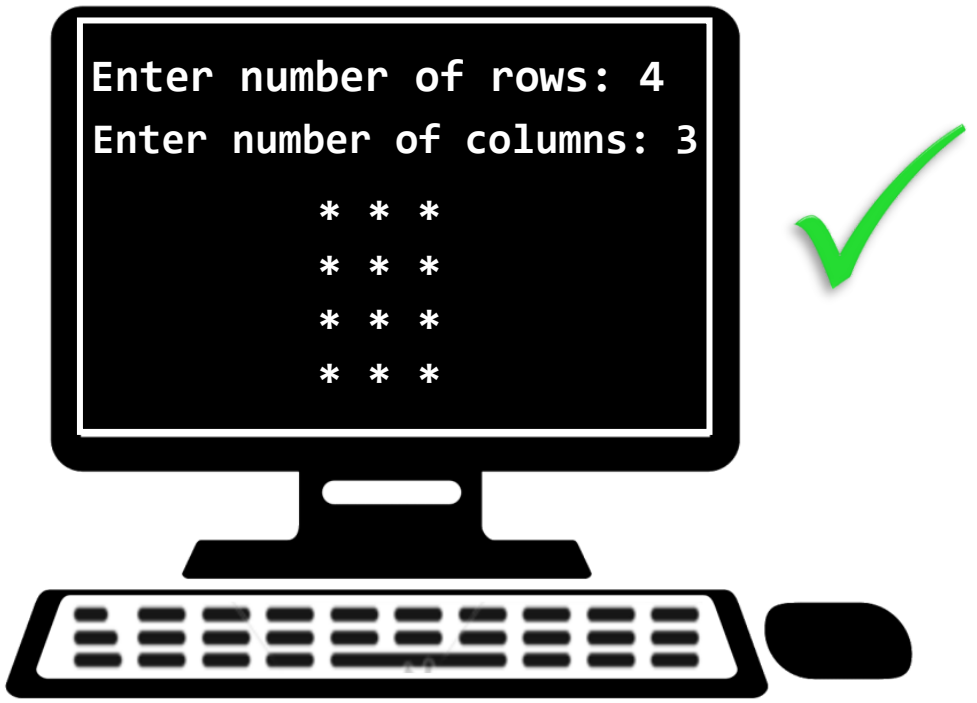


# nested for loop (Ex.)

- Write a C++ program that asks the user to enter the number of rows and columns, then uses nested for loops to display a rectangle pattern of asterisks (*) based on the entered values.

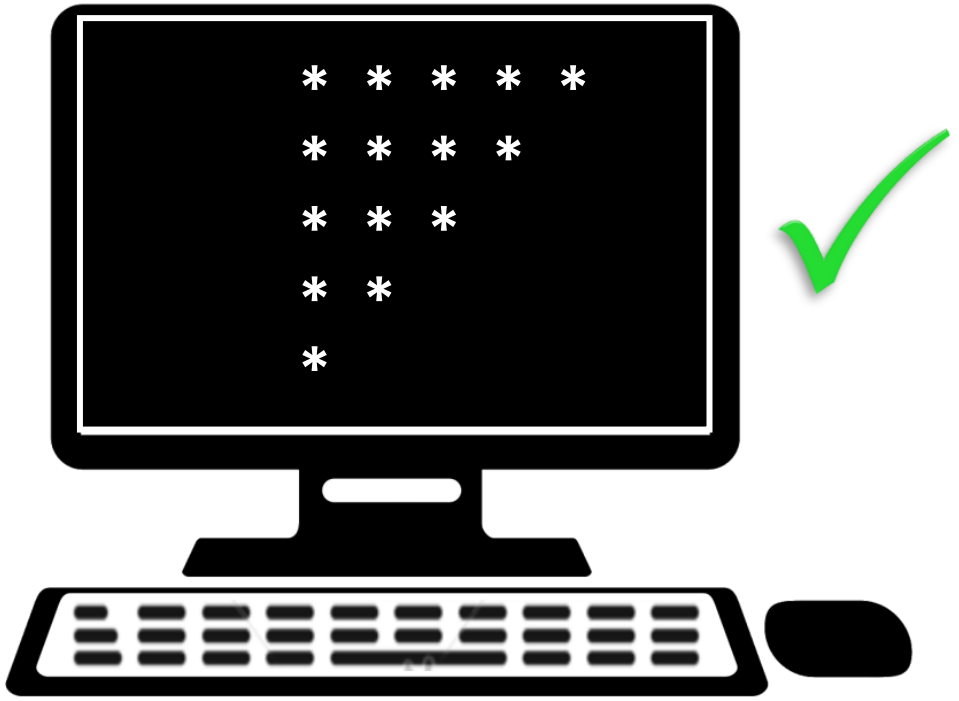
```
int rows, columns;
cout << "Enter number of rows: ";
cin >> rows;
cout << "Enter number of columns: ";
cin >> columns;

for (int i = 1; i <= rows; i++)
{
    for (int j = 1; j <= columns; j++)
    {
        cout <<"* ";
    }
    cout << endl;
}
```



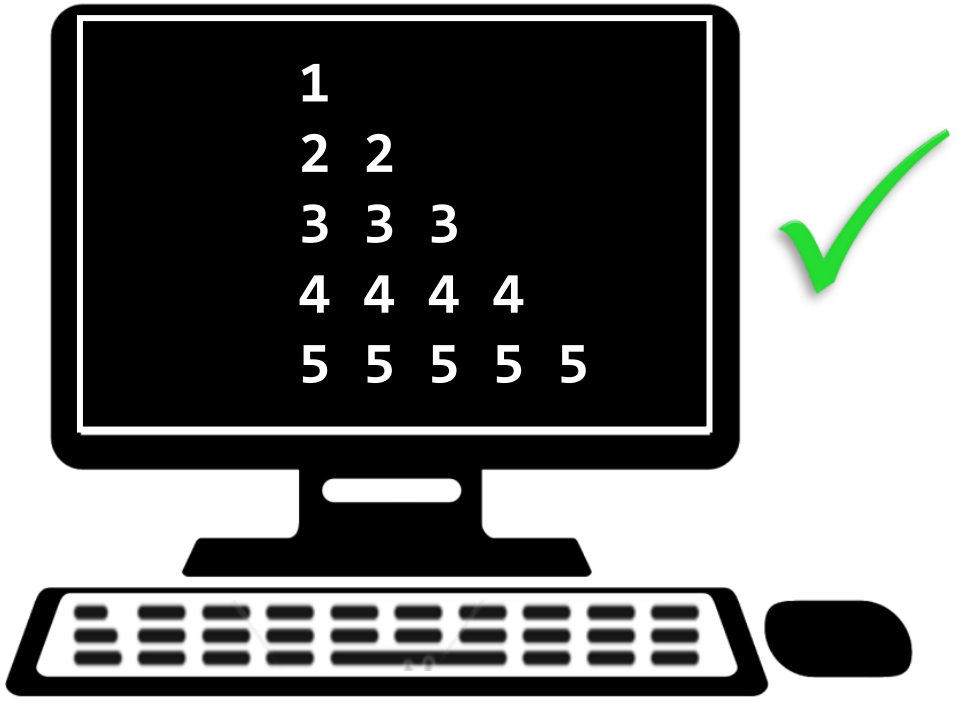
# nested for loop (Ex.)

```
for (int i = 5; i >= 1; i--)
{
    for (int j = 1; j <= i; j++)
    {
        cout <<"* ";
    }
    cout << endl;
}
```



# nested for loop (Ex.)

```
for (int i = 1; i <= 5; i++)
{
    for (int j = 1; j <= i; j++)
    {
        cout << i << " ";
    }
    cout << endl;
}
```



# Introduction to nested while loop

- A **nested while loop** is a while loop placed inside another while loop.
- The inner loop runs completely each time the outer loop executes once.

**Syntax**

```
while (condition1) {
    while (condition2) {
        // Statements
    }
}
```

# How It Works

- The outer loop is checked first.
- If its condition is true, the inner loop starts.
- The inner loop runs repeatedly until its condition becomes false.
- Once the inner loop finishes, control returns to the outer loop.
- This process repeats until the outer loop condition becomes false.

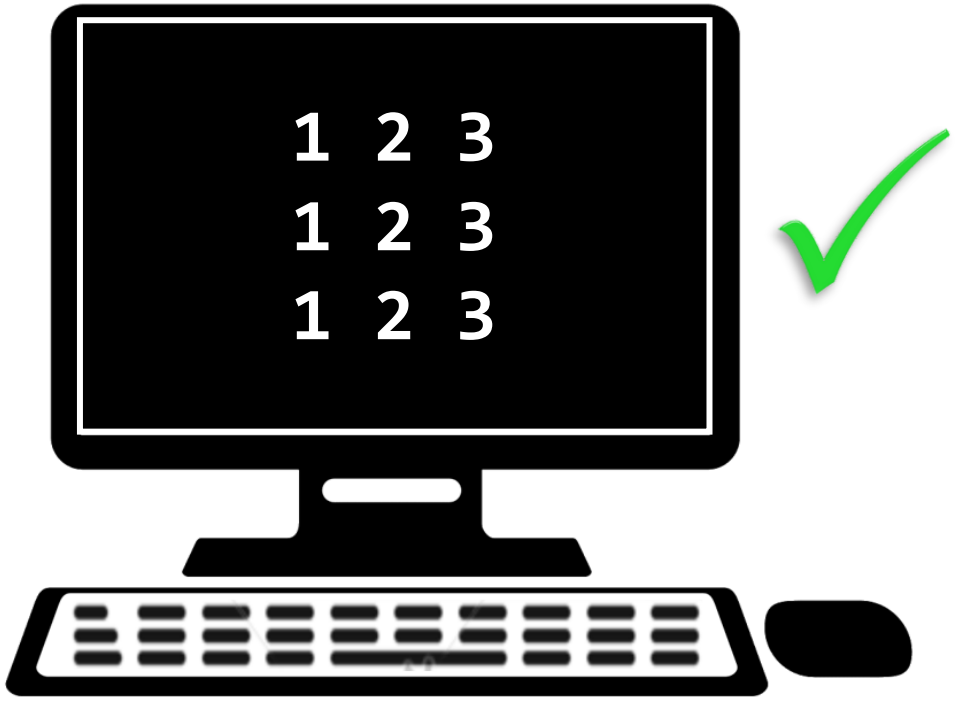
# nested while loop (Ex.)

```
int i = 1;

while (i <= 3) {
    int j = 1;

    while (j <= 3) {
        cout << j << " ";
        j++;
    }

    cout << endl;
    i++;
}
```



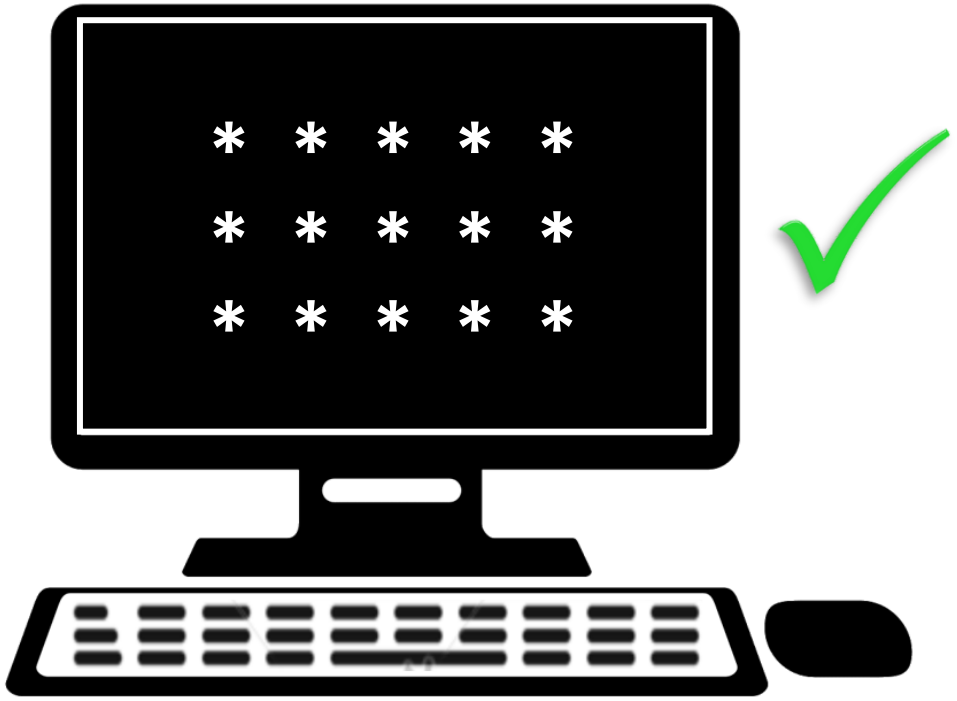
# nested while loop (Ex.)

```
int row = 1;

while (row <= 3) {
    int col = 1;

    while (col <= 5) {
        cout << "* ";
        col++;
    }

    cout << endl;
    row++;
}
```



# nested while loop (Ex.)

```cpp
int i = 1;

while (i <= 3) {
    int j = 1;

    while (j <= 5) {
        cout << i << " x " << j << " = " << i * j << endl;
        j++;
    }

    cout << endl;
    i++;
}
```

```
1 x 1 = 1
1 x 2 = 2
1 x 3 = 3
1 x 4 = 4
1 x 5 = 5

2 x 1 = 2
2 x 2 = 4
2 x 3 = 6
2 x 4 = 8
2 x 5 = 10

3 x 1 = 3
3 x 2 = 6
3 x 3 = 9
3 x 4 = 12
3 x 5 = 15
```

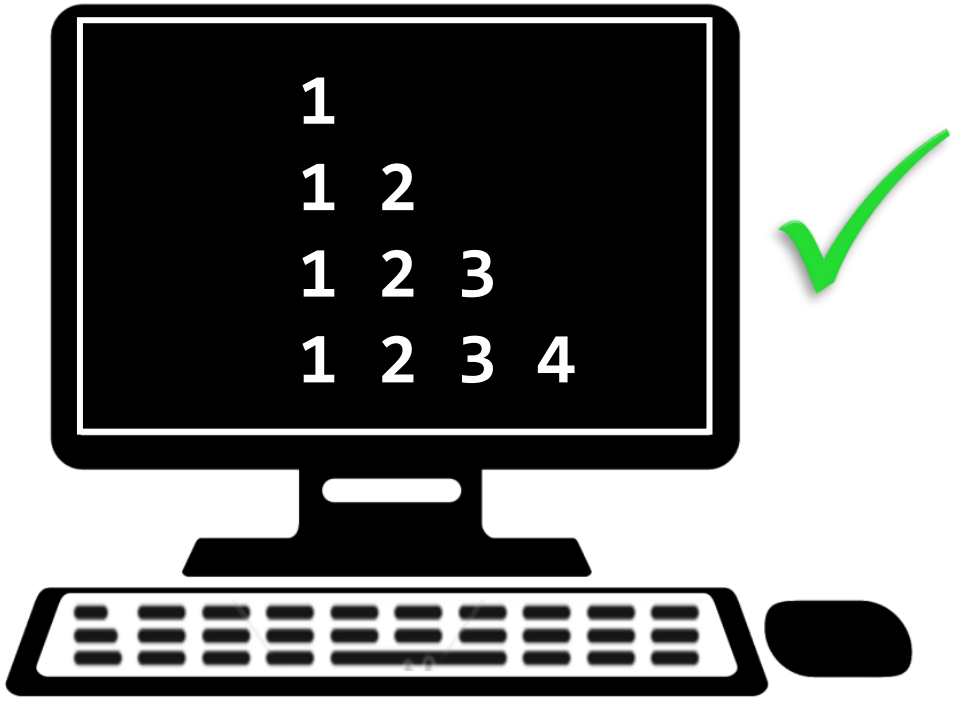
# nested while loop (Ex.)

```
int i = 1;

while (i <= 4) {
    int j = 1;

    while (j <= i) {
        cout << j << " ";
        j++;
    }

    cout << endl;
    i++;
}
```



# Activities

## Activities

- Review this lecture note
- Practice

# References


- Gaddis, T. (2014). Starting out with C++: Early objects (7th ed.). Pearson Education.

# Thank You!