

Fundamentals of Computer Programming

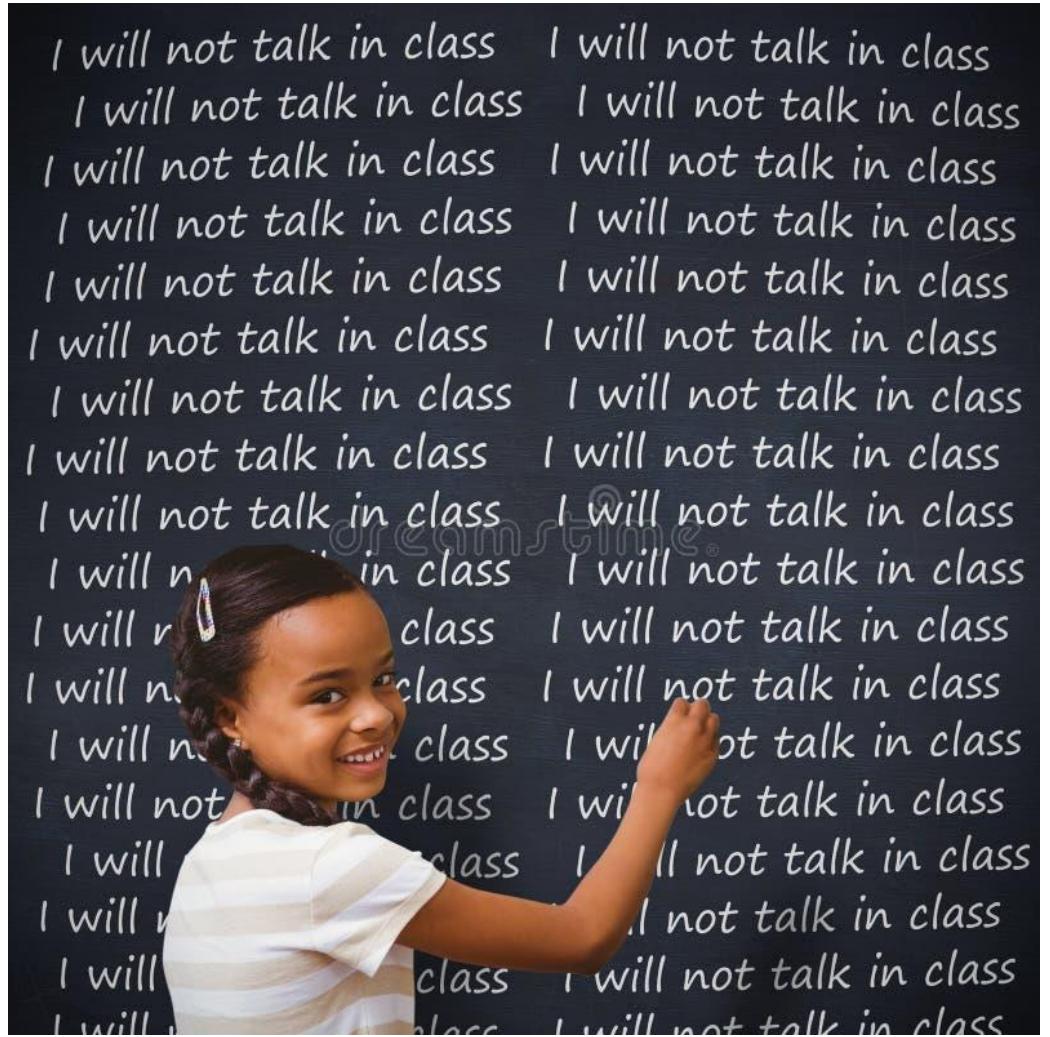
CS-110

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Nested Loops

Week 5



Learnning Objectives

01

To understand the syntax and semantics of Nested Loops

02

To practice pattern printing in C++

03

To implement Nested Loops

Nested Loops

A loop within another loop is called a nested loop.

C++ can take upto 256 levels of nesting.

The syntax for a **nested for loop** statement in C++ is as follows –

```
for ( init; condition; increment ) {  
    for ( init; condition; increment ) {  
        statement(s);  
    }  
    statement(s); // you can put more statements.  
}
```

Syntax

The syntax for a **nested while loop** statement in C++ is as follows –

```
while(condition) {  
    while(condition) {  
        statement(s);  
    }  
    statement(s); // you can put more statements.  
}
```

Syntax

The syntax for a **nested do...while loop** statement in C++ is as follows –

```
do {  
    statement(s); // you can put more statements.  
    do {  
        statement(s);  
    } while( condition );  
  
} while( condition );
```

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.

```
// C++ program to display 7 days of 3 weeks
#include <iostream>
using namespace std;

int main() {
    int weeks = 3, days_in_week = 7;

    for (int i = 1; i <= weeks; ++i) {
        cout << "Week: " << i << endl;

        for (int j = 1; j <= days_in_week; ++j)
            cout << "    Day:" << j << endl;
    }
    return 0;
}
```

Example

```
#include <iostream>
using namespace std;

int main() {
    // Outer loop
    for (int i = 1; i <= 2; ++i) {
        cout << "Outer: " << i << "\n"; // Executes 2 times

        // Inner loop
        for (int j = 1; j <= 3; ++j) {
            cout << "Inner: " << j << "\n"; // Executes 6 times (2 * 3)
        }
    }
    return 0;
}
```

```
Outer: 1
Inner: 1
Inner: 2
Inner: 3
Outer: 2
Inner: 1
Inner: 2
Inner: 3
```

Example

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

```
// C++ program to display a pattern
// with 5 rows and 3 columns

#include <iostream>
using namespace std;

int main() {

    int rows = 5;
    int columns = 3;

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

    return 0;
}
```

Example

```
#include <iostream>
using namespace std;

int main() {
    int weeks = 3, days_in_week = 7;

    for (int i = 1; i <= weeks; ++i) {
        cout << "Week: " << i << endl;

        for (int j = 1; j <= days_in_week; ++j) {
            // break during the 2nd week
            if (i == 2) {
                break;
            }
            cout << "    Day:" << j << endl;
        }
    }
}
```

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

Example

```
#include <iostream>
using namespace std;

int main() {
    int weeks = 3, days_in_week = 7;

    for (int i = 1; i <= weeks; ++i) {
        cout << "Week: " << i << endl;

        for (int j = 1; j <= days_in_week; ++j) {
            // continue if the day is an odd number
            if (j % 2 != 0) {
                continue;
            }
            cout << "    Day:" << j << endl;
        }
    }
}
```

Week: 1
Day:2
Day:4
Day:6
Week: 2
Day:2
Day:4
Day:6
Week: 3
Day:2
Day:4
Day:6

Example

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

```
#include <iostream>  
#include <conio.h>  
using namespace std;  
  
int main()  
{  
    int i=1,j;  
    while (i <= 5)  
    {  
        j=1;  
        while (j <= i )  
        {  
            cout <<j;  
            j++;  
        }  
        cout << endl;  
        i++;  
    }  
    getch();  
    return 0;  
}
```

Nested Loop Flow Chart

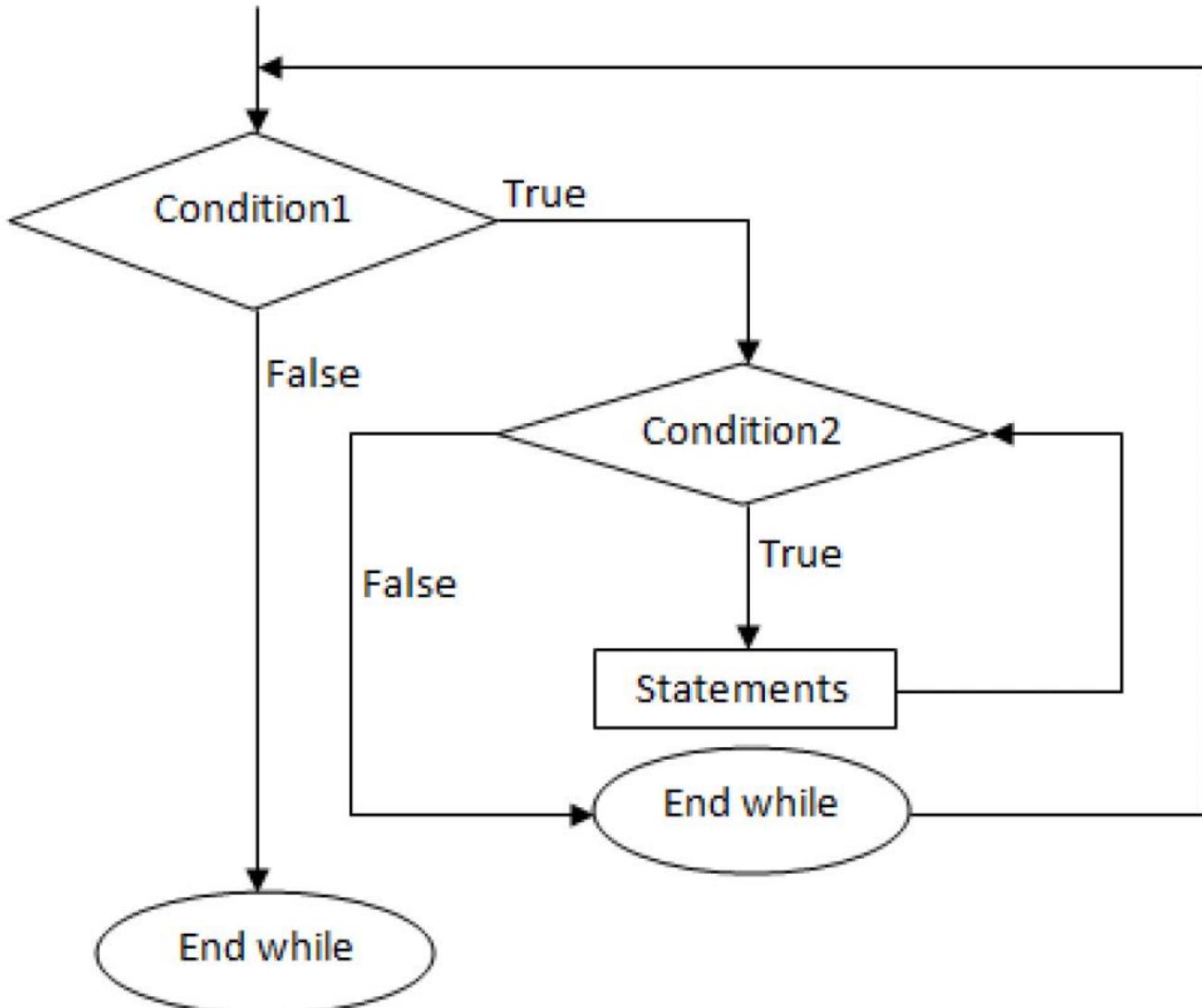


fig: Flowchart for nested while loop

Nested Loop Flow Chart

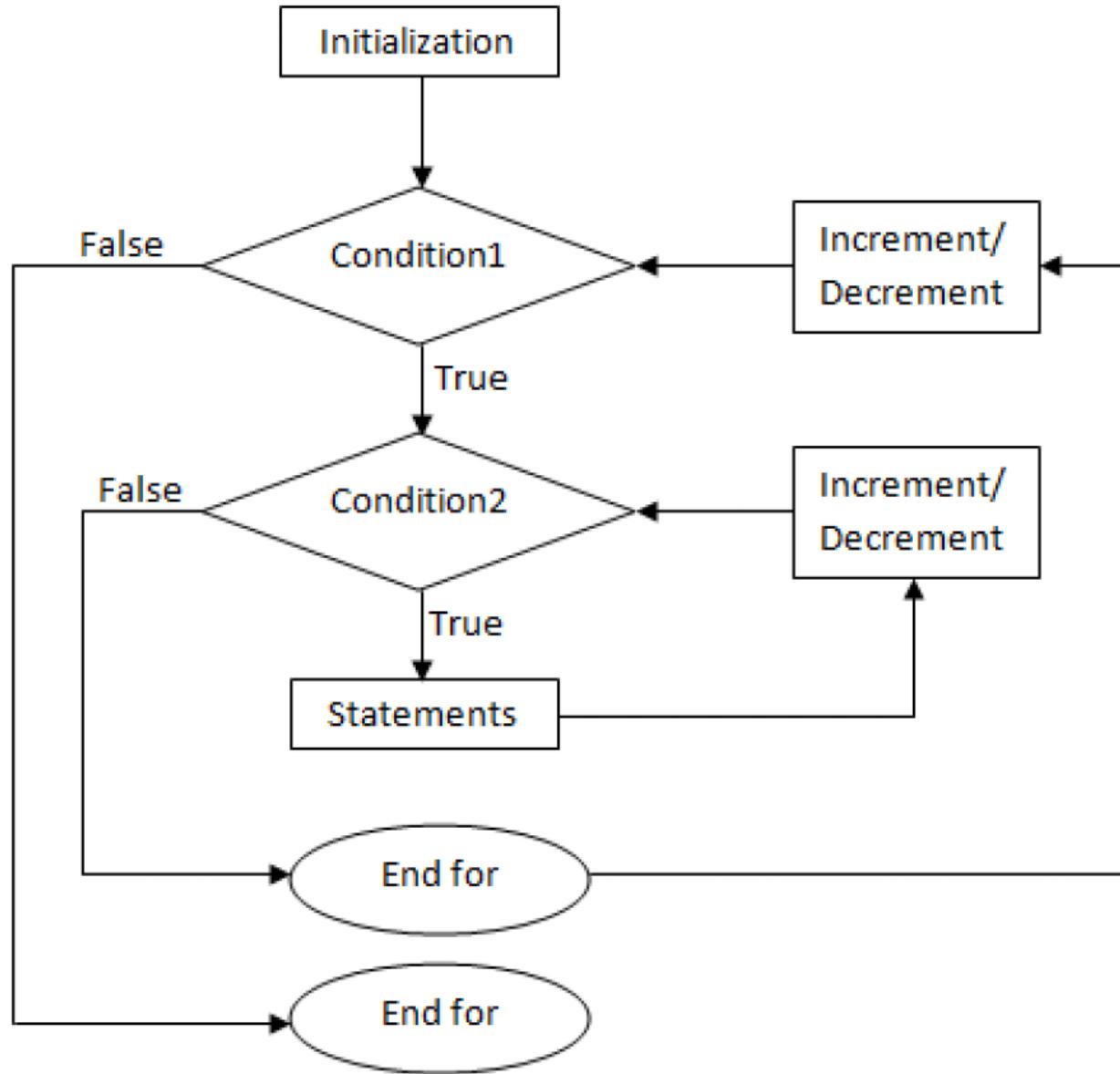


Fig: Flowchart for nested for loop

Nested Loop Flow Chart

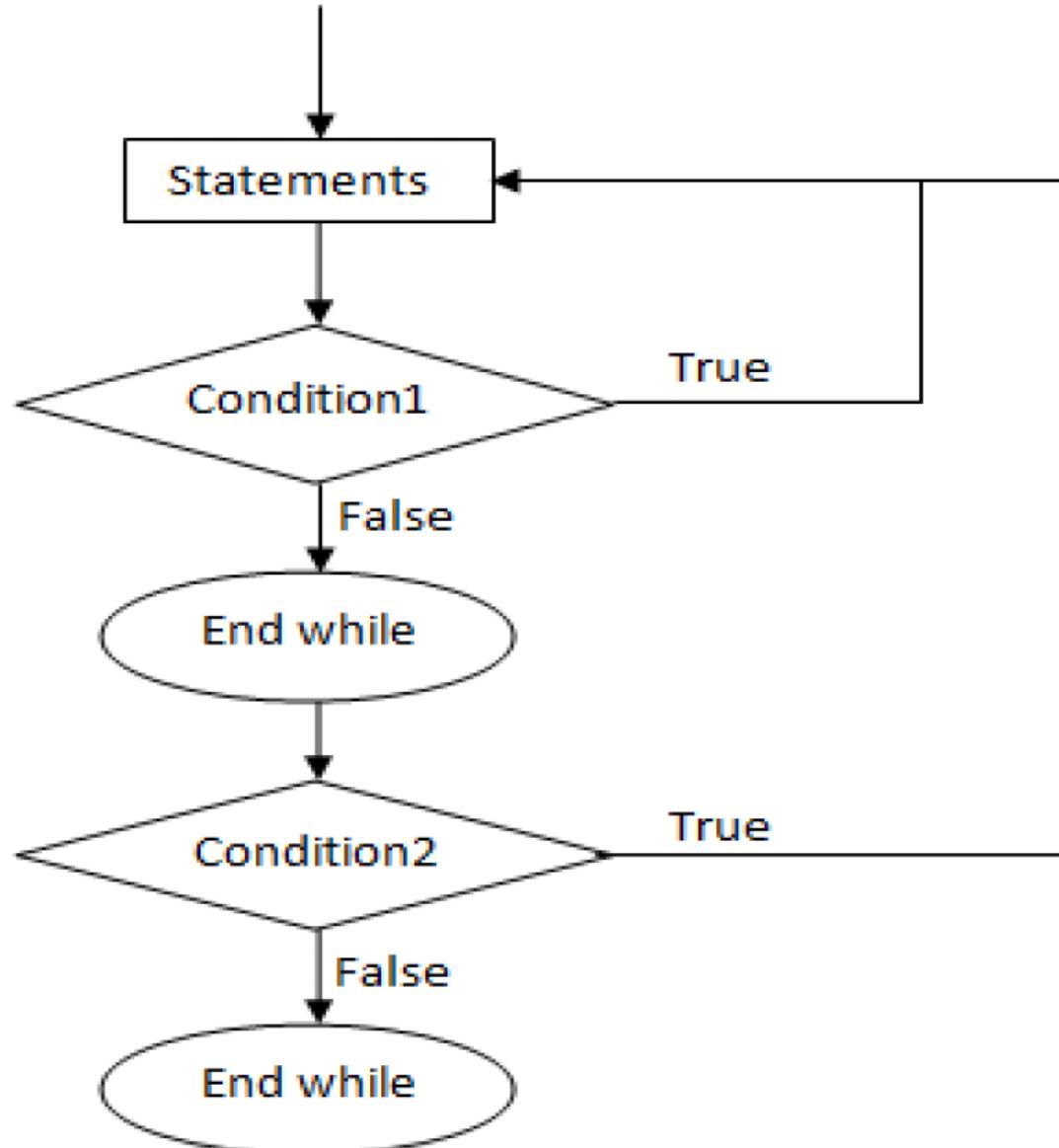


Fig: Flowchart for nested do-while loop



Acknowledgment

- Content of these slides are taken from:
 - <https://www.geeksforgeeks.org/>
 - <https://www.tutorialspoint.com/>
 - <https://www.programiz.com/>