

Nested Loops

Loops within loops are termed as nested loops.

Pattern Problems

The easiest way to understand the working of a nested loop is by solving pattern printing problems.

Print a solid rectangle

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

#include <iostream>

using namespace std;

int main() {
    int rows, columns;
    cout << "Enter the number of rows :\n";
    cin >> rows;
    cout << "Enter the number of columns :\n";
    cin >> columns;

    for (int i = 1; i <= rows; i++) {
        for (int j = 1; j <= columns; j++) {
            cout << "*";
        }
        cout << endl;
    }
    return 0;
}
```

Print a hollow rectangle

```
*****
```

```
*      *
```

```
*      *
```

```
*      *
```

```
*****
```

```
#include <iostream>
```

```
using namespace std;
```

```
int main() {  
    int rows, columns;  
    cout << "Enter the number of rows :\n";  
    cin >> rows;  
    cout << "Enter the number of columns :\n";  
    cin >> columns;  
  
    for (int i = 1; i <= rows; i++) {  
        for (int j = 1; j <= columns; j++) {  
            if (i == 1 || i == rows || j == 1 || j == columns) {  
                cout << "*";  
            } else {  
                cout << " ";  
            }  
        }  
        cout << endl;  
    }  
    return 0;  
}
```

Print Half Pyramid Pattern using Stars

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

```
#include <iostream>
```

```
using namespace std;
```

```
int main() {  
    int n;  
    cin >> n;  
  
    for (int i = 1; i <= n; i++) {  
        for (int j = 1; j <= i; j++) {  
            cout << "*";  
        }  
        cout << endl;  
    }  
    return 0;  
}
```

Print an Inverted Half pyramid

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

```
#include <iostream>
```

```
using namespace std;
```

```
int main() {  
    int n;  
    cin >> n;
```

```

for (int i = n; i >= 1; i--) {
    for (int j = 1; j <= i; j++) {
        cout << "* ";
    }
    cout << endl;
}
return 0;
}

```

Print Half Pyramid after 180 degree rotation

```

    *
   **
  ***
 ****
*****

#include <iostream>

using namespace std;

int main() {
    int n;
    cin >> n;

    for (int i = 1; i <= n; i++) {
        for (int j = 1; j <= n; j++) {
            if (j <= n - i) {
                cout << " ";
            } else {
                cout << "*";
            }
        }
        cout << endl;
    }
    return 0;
}

```

Print Half Pyramid using numbers

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

```
#include <iostream>
```

```
using namespace std;
```

```
int main() {
    int n;
    cin >> n;

    for (int i = 1; i <= n; ++i) {
        for (int j = 1; j <= i; ++j) {
            cout << j << " ";
        }
        cout << "\n";
    }
    return 0;
}
```

Print Inverted Half Pyramid using numbers

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

```
#include <iostream>
```

```
using namespace std;
```

```
int main() {
    int n;
    cin >> n;

    for (int i = n; i >= 1; --i) {
        for (int j = 1; j <= i; ++j) {
            cout << j << " ";
        }
        cout << endl;
    }
    return 0;
}
```

Print Half Pyramid using numbers - 2

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

```
#include <iostream>
```

```
using namespace std;
```

```
int main() {
```

```

int n;
cin >> n;
for (int i = 1; i <= n; i++) {
    for (int j = 1; j <= i; ++j) {
        cout << i << " ";
    }
    cout << endl;
}
return 0;
}

```

Print Inverted Half Pyramid using numbers - 2

```

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

```

```

#include <iostream>

using namespace std;

int main() {
    int n;
    cin >> n;
    for (int i = 1; i <= n; i++) {
        for (int j = 1; j <= n - i + 1; ++j) {
            cout << i << " ";
        }
        cout << endl;
    }
    return 0;
}

```

Print Floyd's Triangle

```
1
2 3
4 5 6
7 8 9 10
11 12 13 14 15
```

```
#include <iostream>
```

```
using namespace std;
```

```
int main() {
    int n;
    cin >> n;

    int number = 1;
    for (int i = 1; i <= n; i++) {
        for (int j = 1; j <= i; j++) {
            cout << number << " ";
            number++;
        }
        cout << endl;
    }
    return 0;
}
```

Print 0-1 pattern

Idea $\rightarrow (i+j)$

```
1
0 1
1 0 1
0 1 0 1
1 0 1 0 1
```



```

#include<iostream>
using namespace std;

int main() {

    int i,j,r;

    cin>>r;

    for(i=1;i<=r;i++)
    {
        for(j=1;j<=i;j++)
        {
            if((i+j)%2==0)
                cout<<" 1";
            else
                cout<<" 0";
        }
        cout<<endl;
    }

    return 0;
}

```

Sum ✓ Pattern - 5 Palindromic pattern

```

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

```

```

#include<iostream>
using namespace std;

```

```

int main(){

```

```
int i,j,r;
```

```
cin>>r;
```

```
for(i=1;i<=r;i++)
{
    int k=i;
    for(j=1;j<=(r-i);j++)
    {
        cout<<" ";
    }
    for( ;j<=r;j++)
    {
        cout<<k<<" ";
        k--;
    }
    k=1;
    for( ;j<(r+i);j++)
    {
        k++;
        cout<<k<<" ";
    }
    for( ;j<=(2*r-1);j++)
    {
        cout<<" ";
    }

    cout<<endl;
}
```

```
return 0;
```

```
}
```

Advanced Pattern Problems

Print Diamond using Stars : Given n, print diamond with 2*n rows.

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

```
#include <iostream>

using namespace std;

int main() {
    int n;
    cin >> n;

    int space = (2 * n - 1) / 2;
    for (int i = 1; i <= n; i++) {
```

```

        for (int j = 1; j <= space; j++) {
            cout << " ";
        }
        for (int j = 1; j <= 2 * i - 1; j++) {
            cout << "*";
        }
        cout << endl;
        space--;
    }

    space = 0;
    for (int i = n; i >= 1; i--) {
        for (int j = 1; j <= space; j++) {
            cout << " ";
        }
        for (int j = 1; j <= 2 * i - 1; j++) {
            cout << "*";
        }
        cout << endl;
        space++;
    }
    return 0;
}

```

Print Hollow Diamond using Stars

```

      *
     * *
    *  *
   *   *
  *    *
 *     *
*      *
*      *
 *     *
  *    *
   *   *
    *  *
     * *
      *

```

```
#include <iostream>
```

```

using namespace std;

int main() {
    int n;
    cin >> n;

    int space = (2 * n - 1) / 2;
    for (int i = 1; i <= n; i++) {
        for (int j = 1; j <= space; j++) {
            cout << " ";
        }
        for (int j = 1; j <= 2 * i - 1; j++) {
            if (j == 1 || j == 2 * i - 1) {
                cout << "*";
            } else {
                cout << " ";
            }
        }
        cout << endl;
        space--;
    }

    space = 0;
    for (int i = n; i >= 1; i--) {
        for (int j = 1; j <= space; j++) {
            cout << " ";
        }
        for (int j = 1; j <= 2 * i - 1; j++) {
            if (j == 1 || j == 2 * i - 1) {
                cout << "*";
            } else {
                cout << " ";
            }
        }
        cout << endl;
        space++;
    }
    return 0;
}

```

Print Hollow Diamond Incribed in a Rectangle

***** → Notice odd no. of stars here.

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

```
#include <iostream>

using namespace std;

int main() {
    int n;
    cin >> n;

    int space = (2 * n - 1) / 2;
    for (int i = 1; i <= n; i++) {
        for (int j = 1; j <= space; j++) {
            cout << "*";
        }
        for (int j = 1; j <= 2 * i - 1; j++) {
            if (j == 1 || j == 2 * i - 1) {
                cout << "*";
            } else {
                cout << " ";
            }
        }
        for (int j = 1; j <= space; j++) {
            cout << "*";
        }
        cout << endl;
        space--;
    }
}
```

```

space = 0;
for (int i = n; i >= 1; i--) {
    for (int j = 1; j <= space; j++) {
        cout << "*";
    }
    for (int j = 1; j <= 2 * i - 1; j++) {
        if (j == 1 || j == 2 * i - 1) {
            cout << "*";
        } else {
            cout << " ";
        }
    }
    for (int j = 1; j <= space; j++) {
        cout << "*";
    }
    cout << endl;
    space++;
}
return 0;
}

```

Print Solid Rhombus

```

*****
*****
*****
*****
*****

#include <iostream>

using namespace std;

int main() {
    int n;
    cin >> n;

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

```

```

        cout << "*";
    }
    cout << "\n";
}
return 0;
}

```

Print Hollow Rhombus

```

    *****
      *   *
     *   *
    *   *
*****

#include <iostream>

using namespace std;

int main() {
    int n;
    cin >> n;

    for (int i = 1; i <= n; i++) {
        for (int j = 1; j <= n - i; j++) {
            cout << " ";
        }
        for (int j = 1; j <= n; j++) {
            if (i == 1 || i == n) {
                cout << "*";
            } else {
                if (j == 1 || j == n) {
                    cout << "*";
                } else {
                    cout << " ";
                }
            }
        }
        cout << "\n";
    }
    return 0;
}

```


Pyramid pattern for Numbers

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

```
#include <iostream>
```

```
using namespace std;
```

```
int main() {
    int n;
    cin >> n;

    int space = n - 1;
    for (int i = 1; i <= n; i++) {
        for (int j = 1; j <= space; j++) {
            cout << " ";
        }
        space--;
        for (int j = 1; j <= i; j++) {
            cout << i << " ";
        }
        cout << "\n";
    }
    return 0;
}
```

Pyramid Pattern for Numbers - 2

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

```
#include <iostream>

using namespace std;

int main() {
    int n;
    cin >> n;

    int space = n - 1;
    for (int i = 1; i <= n; i++) {
        for (int j = 1; j <= space; j++) {
            cout << " ";
        }
        space--;
        for (int j = 1; j <= i; j++) {
            cout << j << " ";
        }
        cout << "\n";
    }
    return 0;
}
```

Print Sold Butterfly Pattern

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

```
#include <iostream>

using namespace std;

int main() {
    int n;
    cin >> n;

    for (int i = 1; i <= n; i++) {
        int empty_space = 2 * n - 2 * i;
        for (int j = 1; j <= i; j++) {
            cout << "*";
        }
        for (int j = 1; j <= empty_space; j++) {
            cout << " ";
        }
        for (int j = 1; j <= i; j++) {
            cout << "*";
        }
        cout << "\n";
    }

    for (int i = n; i >= 1; i--) {
        int empty_space = 2 * n - 2 * i;
        for (int j = 1; j <= i; j++) {
            cout << "*";
        }
    }
}
```

```

    }
    for (int j = 1; j <= empty_space; j++) {
        cout << " ";
    }
    for (int j = 1; j <= i; j++) {
        cout << "*";
    }
    cout << "\n";
}

return 0;
}

```

Print Hollow Butterfly Pattern

```

*           *
**          **
* *        * *
*  *      *  *
*    **   *
*    **   *
*  *      *  *
* *        * *
**          **
*           *

```

```

#include <iostream>

using namespace std;

int main() {
    int n;
    cin >> n;

    for (int i = 1; i <= n; i++) {
        int empty_space = 2 * n - 2 * i;
        for (int j = 1; j <= i; j++) {
            if (j == 1 || j == i) {
                cout << "*";
            }
        }
        cout << "\n";
    }
}

```

```

        } else {
            cout << " ";
        }
    }
    for (int j = 1; j <= empty_space; j++) {
        cout << " ";
    }
    for (int j = 1; j <= i; j++) {
        if (j == 1 || j == i) {
            cout << "*";
        } else {
            cout << " ";
        }
    }
    cout << "\n";
}

for (int i = n; i >= 1; i--) {
    int empty_space = 2 * n - 2 * i;
    for (int j = 1; j <= i; j++) {
        if (j == 1 || j == i) {
            cout << "*";
        } else {
            cout << " ";
        }
    }
    for (int j = 1; j <= empty_space; j++) {
        cout << " ";
    }
    for (int j = 1; j <= i; j++) {
        if (j == 1 || j == i) {
            cout << "*";
        } else {
            cout << " ";
        }
    }
    cout << "\n";
}

return 0;
}

```

Print Pascal's Triangle

```
      1
     1 1
    1 2 1
   1 3 3 1
  1 4 6 4 1
```

```
#include <iostream>

using namespace std;

int main() {
    int n;
    cin >> n;

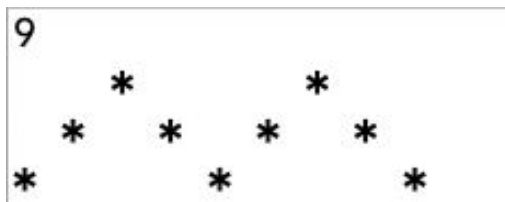
    int coef = 1;
    for (int i = 0; i < n; i++) {
        for (int space = 1; space <= n - i; space++)
            cout << " ";

        for (int j = 0; j <= i; j++) {
            if (j == 0 || i == 0) {
                coef = 1;
            } else {
                coef = (float)coef * (i - j + 1) / j;
            }
            cout << coef << " ";
        }
        cout << endl;
    }

    return 0;
}
```

Imp

Zig-Zag Pattern



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

```
int main(){
    int i,j,n;

    cin>>n;

    for(i=1;i<=3;i++){

        for(j=1;j<=n;j++){
            if(((i+j)%4==0)||((i==2)&&(j%4==0)))
                cout<<"* ";
            else
                cout<<" ";
        }
        cout<<endl;
    }

    return 0;
}
```

Apni Kaksha