

L5

Nested Loops

For Discord email - support@learnyard.com

What are Nested Loops ?

```
for (int i = 1; i <= 5; i = i + 1)
{
    for (int j = 1; j <= 5; j = j + 1)
    {
        s.o. Print("Hello");
    }
}
```

$i = 1$ ($j = 1, 2, 3, 4, 5$)

↓ Hello → 5 times

✓
i 2 1
i 2 2
i 2 3
i 2 4
i 2 5

i → 5 times → 5 times Hello

5 + 5 + 5 + 5 + 5

25 times

What are Nested Loops ?

```
for (int i = 1; i <= N; i = i + 1)
{
    for (int j = 1; j <= M; j = j + 1)
    {
        s.o. Print("Hello");
    }
}
```

N times

M times

$N * M$

$i = 1$ ($j = 1, 2, 3, 4, 5$)

\downarrow Hello $\rightarrow 5$ times

What are Nested Loops ?

↑ row

```
for (int i = 1; i <= N; i = i + 1)
{
    for (int j = 1; j <= M; j = j + 1)
    {
        s.o. Print("Hello");
    }
}
```

outer loop

inner loop

Pattern

*			→	1
*	*		→	2
*	*	*	→	3

Dry run of basic Nested Loop

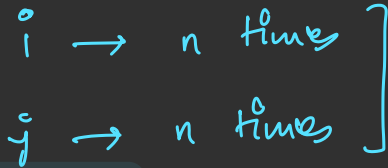
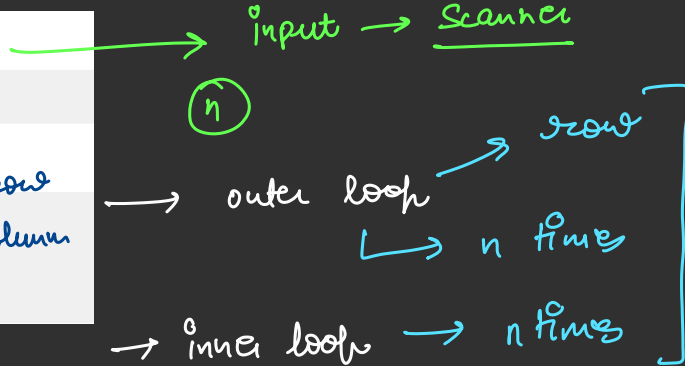
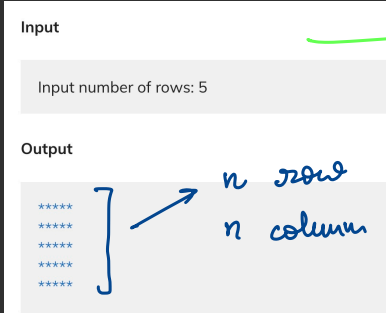
```
for (int i = 1; i <= 3; i = i + 1)
{
    for (int j = 1; j <= 2; j = j + 1)
    {
        S.O.println("Hello");
    }
}
```

$i = 1, j = 1 \rightarrow \text{Hello}$
 $j = 2 \rightarrow \text{Hello}$ $\rightarrow 2$

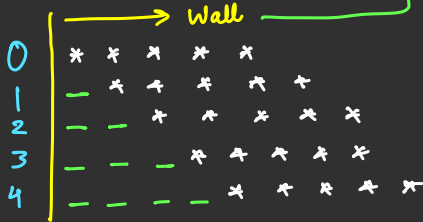
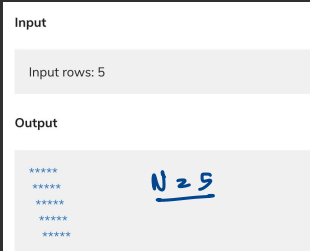
$i = 2, j = 2 \rightarrow \text{Hello}$
 $j = 2 \rightarrow \text{Hello}$ $\rightarrow 2$

$i = 3, j = 1 \rightarrow \text{Hello}$
 $j = 2 \rightarrow \text{Hello}$ $\rightarrow 2$

Square Pattern



Rhombus Pattern



N

Starting count space

outer loop
↳ N row

inner loop

variable

space = 0

like space

space
0, 1, 2, 3, 4

star
↳ N
↓
fixed

int space = 0;

for (int i = 1; i <= N; i = i + 1)

{

↳ N times

space

{ for (int j = 1; j <= space; j = j + 1)

{ S.O.P (" ");

star

{ for (int j = 1; j <= N; j = j + 1)

{ S.O.P (" * ");

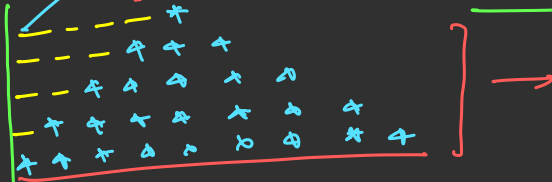
S.O.Pln (); space = space + 1;

Diamond star Pattern

```
Enter N: 5
  *
 ***
*****
*****
*****
*****
 ***
  *
```

input $\rightarrow N \rightarrow$ upper $\rightarrow N$
lower $\rightarrow N-1$

Upper
Row $\rightarrow N \rightarrow$ simple for loop
Column



$$0 + (N-1) + 1 = \underline{\underline{N-1}}$$

Diamond star Pattern

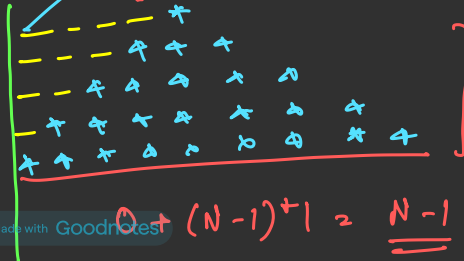
```

Enter N: 5
  *
 ***
*****
*****
*****
*****
  ***
   *
  
```

input $\rightarrow N \rightarrow$ upper $\rightarrow N$
 \downarrow lower $\rightarrow N-1$

Upper
 \downarrow Row $\rightarrow N \rightarrow$ simple for loop

\downarrow Column \rightarrow Space = $N-1$, -1
 Star = 1, $+2$



int space = N-1;

int star = 1;

for (int i = 1; i <= N; i++)

{ for (int j = 1; j <= space; j++)

{ S.O.P(" ");

}

for (int j = 1; j <= star; j++)

{ S.O.P(" * ");

}

space = space - 1;

star++ = 2; →

i = 1,

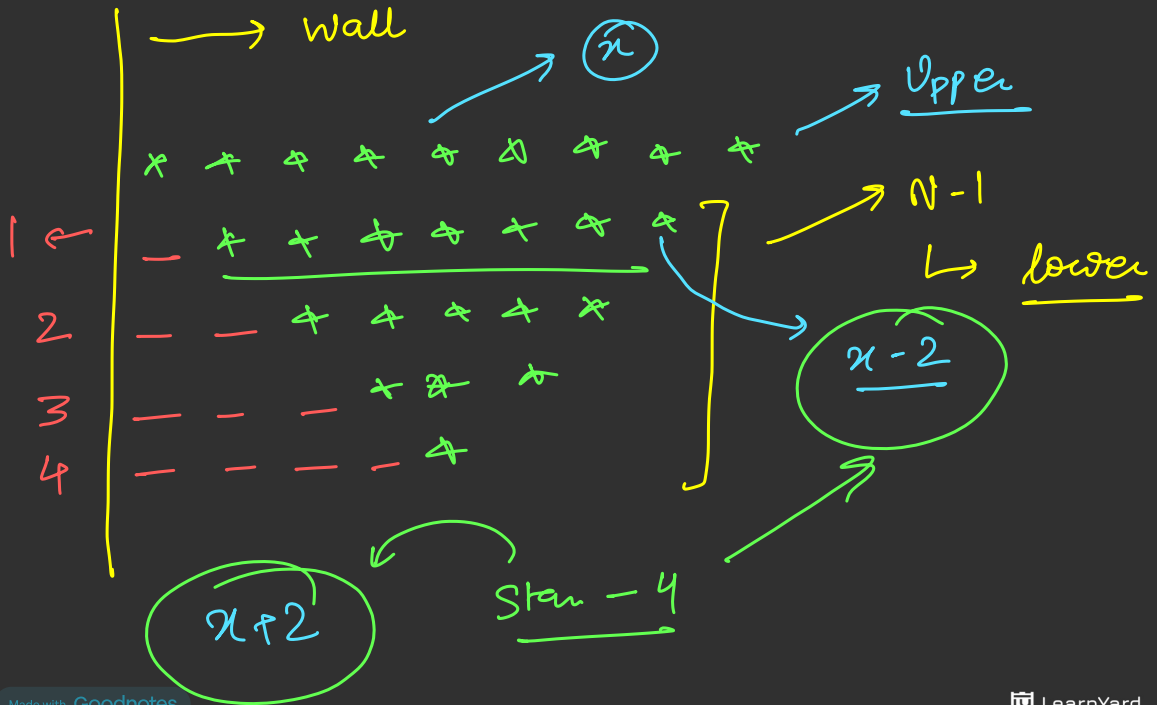
4 -, 1 *

3 -, 3 *

2 -, 5 *

1 -, 7 *

0 -, 9 *



Discussion on Number Patterns

1
12
123
1234
12345

1
21
321
4321
54321

Input

Input N: 5

Output

5
44
333
2222
11111

N row

Scanner

User input

j 24 - - -

1 2 4

1

21

3 2 1

4 3 2 1

für $C_{int} \quad j = 1; \quad j > 2; \quad j = \dots$

3

→ reverse loop

```
for (int i = 1; i <= N; i++)
{
```

```
    for (int j = 1; j <= i; j++)
```

```
    {
```

```
        S.O.P(j);
```

```
    }
```

```
    S.O.Pln();
```

```
}
```

i = 1, j = 1
i = 3, j = 1, 2, 3

→

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

int number = 5;

for (int i = 1; i <= N; i++)

{

for (int j = 1; j <= i; j++)

{

S.O.P(number);

}

number = number - 1;

S.O.P(n);

}

number = 3

i = 3, j = 3

[

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

]

Practice and Homework Questions

Homework questions -

<https://codeforwin.org/c-programming/c-program-to-print-number-pattern-with-1-0-at-alternate-columns>

<https://codeforwin.org/c-programming/number-pattern-22-in-c>

<https://codeforwin.org/c-programming/equilateral-triangle-star-pattern-program-in-c>

<https://codeforwin.org/c-programming/c-program-to-print-x-star-pattern>

Thank You!

Please practice more questions and examples as above !!