

Pattern Printing



Types of Patterns

- 1) Squares and Rectangles
- 2) Triangles and Horizontally Flipped triangles
- 3) Special Patterns
- 4) Composite Patterns

Prerequisites:

Loops

Ques : Print the given pattern

m rows , n cols

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

rows = no. of lines

*cols = how much in
each line*

Star Rectangle

Ques : Print the given pattern

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

↑

n = 4

↓
User → n (side of square)

n = 3

```
x x x
```

```
x x x
```

```
x x x
```

Star Square

Ques : Print the given pattern

1 2 3 4

1 2 3 4

1 2 3 4

1 2 3 4

↑
n=4

n=3

1 2 3

1 2 3

1 2 3

n=6

1 2 3 4 5 6

1 2 3 4 5 6

1 2 3 4 5 6

1 2 3 4 5 6

1 2 3 4 5 6

1 2 3 4 5 6

Number Square

```
for(int i=1;i<=n;i++){ // rows
    for(int j=1;j<=n;j++){ // cols
        System.out.print(i+" ");
    }
    System.out.println();
}
```

$n = 5$

$i = 1 \rightarrow j = 1, 2, 3, 4, 5$

$i = 2 \rightarrow j = 1, 2, 3, 4, 5$

Ques: Print the given pattern

A B C D
A B C D
A B C D
A B C D

$n = 4$

1 2 3
1 2 3
1 2 3
 $j \rightarrow j+64$

65 66 67
65 66 67
65 66 67

A B C
A B C
A B C

$(j+64) \rightarrow (\text{char})(j+64)$

Alphabet Square

'A' \rightarrow 65

'B' \rightarrow 66

.

.

.

.

'Z' \rightarrow 90

'a' \rightarrow 97

'b' \rightarrow 98

.

.

.

.

'z' \rightarrow 122

'O' \rightarrow 78

'I' \rightarrow 74

.

.

.

'Q' \rightarrow 81

COLLEGE
WALLAH

HW - 1

$n = 4$

A A A A

B B B B

C C C C

D D D D

HW - 2

$n = 3$

a b c

a b c

a b c

COLLEGE
WALLAH

Ques: Print the given pattern

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

Star Triangle

```

1 * * * *
2 * * * *
3 * * * *
4 * * * *

```

↓

```

for(i=1 to n)
  for(j=1 to n)

```

```

1 *
2 * *
3 * * *
4 * * * *
↓
i

```

↓

```

for(i=1 to n)
  for(j=1 to i)

```

rows = n
cols = n

In the ' $\# \Delta$ ', in each line, the no of stars that are printed is equal to the row number

Ques: Print the given pattern

1
1 2
1 2 3
1 2 3 4

$n=4$

$n=6$

1
1 2
1 2 3
1 2 3 4
1 2 3 4 5
1 2 3 4 5 6

Number Triangle

HW : 1

$n = 4$

A

A B

A B C

A B C D

HW : 2

$n = 5$

1

2 2

3 3 3

4 4 4 4

5 5 5 5 5

* HW - 3

n = 5

```

1
A B
1 2 3
A B C D
1 2 3 4 5
    
```

n = 6

```

1
A B
1 2 3
A B C D
1 2 3 4 5
A B C D E F
    
```

Mixture Δ \rightarrow Number Δ Alphabet

Ques: Print the given pattern

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

$n=4$

$n=5$

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

$i=1 \rightarrow j=1 \text{ to } 5$

$i=2 \rightarrow j=1 \text{ to } 4$

$i=3 \rightarrow j=1 \text{ to } 3$

$i=4 \rightarrow j=1 \text{ to } 2$

$i=5 \rightarrow j=1 \text{ to } 1$

$i + j_{\max} = n + 1$

$j_{\max} = n + 1 - i$

$j \leq n + 1 - i$

Star Triangle Reverse



```
for (i = 1 to n)
  for (j = 1 to n)
```



```
for (i = 1 to n)
  for (j = 1 to i)
```



```
for (i = 1 to n)
  for (j = 1 to n + 1 - i)
```


H.W. 1

$n=4$

1 2 3 4

1 2 3

1 2

1

H.W. 2

$n=5$

A A A A A

B B B B

C C C

D D

E

COLLEGE
WALLAH

Ques: Print the given pattern

1
1 3
1 3 5
1 3 5 7

$n = 4$

$n = 5$

1
1 3
1 3 5
1 3 5 7
1 3 5 7 9

Hint

$j = 1, 2, 3, 4, 5, \dots$

↓ ↓ ↓ ↓ ↓

$2j - 1 = 1, 3, 5, 7, 9$

Odd Number Triangle

Method - 2

Q// Print first 'n' numbers of this AP :

1, 3, 5, 7, 9

$$a_n = 1 + (n-1) \cdot 2 = 2n-1$$

↓

```
for(int j=1 ; j<= 2*n-1 ; j+=2){
    cout<<j;
```

3

Ques: Print the given pattern

1 1
2 2 3
3 4 5 6
4 7 8 9 10

$n = 4$

$n = 3$

1 1
2 2 3
3 4 5 6

$n = 5$

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

Floyd's Triangle

Ques: Print the given pattern (n is odd)

1 2 3 4 5 → j

1	0	0	*	0	0
2	0	0	*	0	0
3	*	*	*	*	*
4	0	0	*	0	0
5	0	0	*	0	0

↓
i

n=5

n=3

1		*	
2	*	*	*
3		*	

$$mid = \frac{n}{2} + 1$$

Ques: Print the given pattern (n is odd)

1 2 3 4 5 $\rightarrow j$

1 * _ _ _ *
2 _ * _ * _
3 _ _ * _ _
4 _ * _ * _
5 * _ _ _ *

\downarrow
 i

$n=5$

$\text{if}(i==j \parallel i+j==n+1) \rightarrow x$

else -

Star Cross

***Ques:** Print the given pattern

```
1 1
2 01
3 101
4 0101
```

$n=4$

	1	2	3	4	5	→ j
1	1					
2	0	1				
3	1	0	1			
4	0	1	0	1		
5	1	0	1	0	1	

i ↓
n=5

```
if(i%2 == 1){
    if(j%2 == 1) → 1
    else → 0
}
else { // i%2 == 0
    if(j%2 == 0) → 1
    else → 0
}
```

Binary Triangle

***Ques:** Print the given pattern

```
— — — *
— — **
— ***
****
```

$n=4$

$\hookrightarrow n=5$

	1	2	3	4	5	$\rightarrow j$
1	#	#	#	#	*	
2	#	#	#	*	*	
3	#	#	*	*	*	
4	#	*	*	*	*	
5	*	*	*	*	*	

\downarrow
 i

if $(i+j > n) \rightarrow *$
else —

Star Triangle Flipped

***Ques:** Print the given pattern

$n=4$

1	###*		1	###		1	*
2	##**		2	##		2	* *
3	#***	=	3	#	+	3	* * *
4	****		4	.		4	* * * *
↓							
i							

2 loops inside 1 loop

Star Triangle Flipped

Ques: Print the given pattern

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

Number Triangle Flipped

***Ques : Print the given pattern**

1	_ _ _ * * * *	1	_ _ _	1	x x x x
2	_ _ * * * *	2	_ _	2	x x x x
3	_ * * * *	3	_	3	x x x x
4	* * * *	4	.	4	x x x x

Rhombus

***Ques : Print the given pattern**

1 _ _ _ *		1 _ _ _		1 x
2 _ _ ***	=	2 _ _	+	2 x x x
3 _ *****		3 _		3 x x x x x
4 *****		4 .		4 x x x x x x x

$n=4$

$j \leq 2^i - 1$

Star Pyramid

***Ques : Print the given pattern**

M-2 : Extra Variables

$n=4$

```
1  _ _ _ *
2  _ _ ***
3  _ ****
4  *****
i. d
```

$nsp = n-1;$

$nst = 1;$

$nsp--$

$nst += 2$

$n=3$

















```
_ _ x
_ x x x
x x x x x
```

$n=2$

```
_ x
x x x
```

Star Pyramid

Ques : Print the given pattern

1		1		1		1				
2		=	2		+	2		+	2	
3			3			3			3	
4			4			4			4	
	$n=4$		$j \leq n-i$			$j \leq i$			$j \geq 1, j = i-1$	

Number Pyramid Palindrome

Ques : Print the given pattern

1 *** _ ****
2 ** _ _ _ **
3 * _ _ _ _ *

=
1 x x x 1 _
2 x x + 2 _ _ _
3 x 3 _ _ _ _
+
1 x x x
2 x x
3 x

$n=4$

~~$n=n-1=3$~~

$n--;$

$nsp=1, nsp+=2$

Star Bridge

***Ques** : Print the given pattern

1 2 3 4 5 6 7

1	1	2	3	—	5	6	7
2	1	2	—	—	—	6	7
3	1	—	—	—	—	—	7

$n=3$

$m=n$
 $n--$

Number Bridge

$n=5$

1	2	3	4	5	6	7	8	9
1	2	3	4		6	7	8	9
1	2	3				7	8	9
1	2						8	9
1								9

*Ques : Print the given pattern

```
1  _ _ _ *
2  _ _ ***
3  _ ****
4  *****
```

```
1  _ ****
2  _ _ ***
3  _ _ _ *
```

n = 4

nsp = n-1 , nsp--
nst = 1 , nst += 2

nsp = 1 , nsp++
nst = ? , nst -= 2
↓
nst -= 4

n = 1

*

n = 2

```
  *
 * * *
```

n = 3

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

Star Diamond

****Ques: Print the given pattern**

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

$n = 4$

Number SPIRAL

2	2	2
2	1	2
2	2	2

$n = 2$

3	3	3	3	3
3	2	2	2	3
3	2	1	2	3
3	2	2	2	3
3	3	3	3	3

$n = 3$

****Ques: Print the given pattern**

$$b = 2n - j$$

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

3 2 1 → b
 1 2 3 4 5 6 7 → j
 1 1 1 1 1 1 1
 2 1 2 2 2 2 1
 3 1 2 3 3 3 1
 4 1 2 3 4 3 1
 3 5 1 2 3 3 2 1
 2 6 1 2 2 2 2 1
 1 7 1 1 1 1 1 1
 ↓ ↓
 a i

$$a = 2n - i$$

min(i, j)

Number SPIRAL

****Ques: Print the given pattern**

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



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

$$K = n+1 - \min(a,b) \quad n=4$$

$$\min(a,b)$$

Number SPIRAL

$$K + \min(a,b) = n+1$$

What's in the next lecture?

A head start to modern programming: Arrays!

What's in the next lecture?

More patterns!

More interesting and with more fun!



SKILLS