Today's agenda

↳ Patterns → {nested loop}

Q) Print N "*" in a single row.

Eg: N = 4 → * * * *

```
for (int i=1; i<=N; i++){
    System.out.print("*");
}
```

Q) Given integer N, Print square of N*N using "*".

N = 3

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

N = 5

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

N = 3

```
for (int i = 1; i <= N; i++){
    for (int j = 1; j <= N; j++){
        System.out.print("*");
    }
    System.out.println();
}
```

Output

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

i	i<=N	j	j<=N
1	+	1	+
		2	+
		3	+
		4	f → exit
2	+	1	+
		2	+
		3	+
		4	f → exit
3	+	1	+
		2	+
		3	+
		4	f → exit
4	f		

↳ exit

Q) Pattern 1:

↳ Print the following Pattern.

N = 2 :

```
*
* *
```

N = 4 :

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

N = 3

nst = ~~1 2 3~~ 4

N = 4

```
int nst = 1;
for (int i = 1; i <= N; i++) {
    for (int j = 1; j <= nst; j++) {
        System.out.print("*");
    }
    nst++;  or  nst = nst + 1;
    System.out.println();
}
```

(previous)

Print star

Step for next line

i	i <= N
1	t
2	f → exit

j	j <= nst
1	t
2	f → exit

j	j <= nst
1	t
2	t
3	f → exit

j	j <= nst
1	t
2	t
3	t
4	f → exit

4 f → exit

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

Q) Pattern 2:

Print the following Pattern.

N=3:
1
2 3
4 5 6

N=4:
1
2 3
4 5 6
7 8 9 10

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

N=4

i	i<=n
1	t

j	j<=nst
1	t
2	f → exit

count=1, nst=2

i	i<=n
2	t

j	j<=nst
1	t
2	t
3	f → exit

count=3, nst=3

i	i<=n
3	t

j	j<=nst
1	t
2	t
3	t
4	f → exit

count=6

i	i<=n
4	f → exit

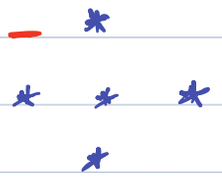
1
2 3
4 5 6

Break till 9:18 PM

Q) Pattern 3

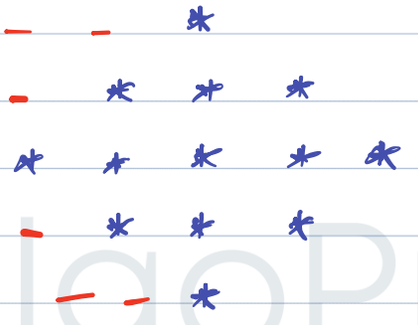
↳ Print the following Pattern.

N : 3 :



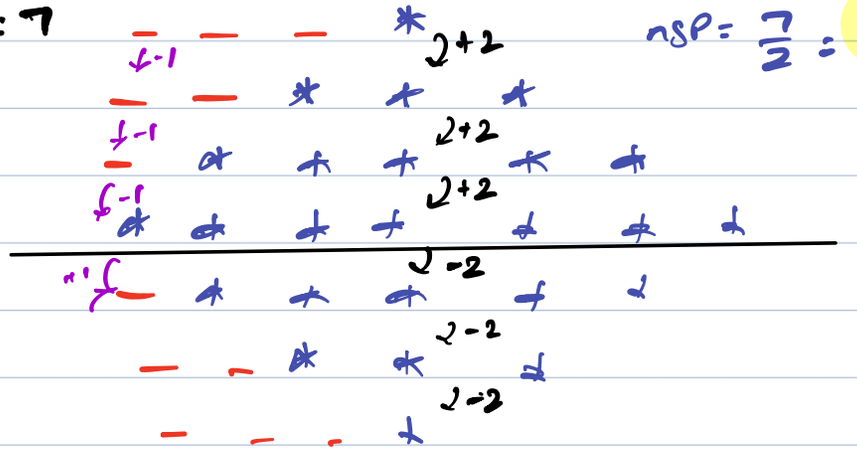
nSP = $\frac{3}{2}$ = 1 :

N : 5 :



nSP = $\frac{5}{2}$ = 2

N : 7



nSP = $\frac{7}{2}$ = 3

N : 6 : incorrect input

N : 5 :

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

```
int nst = 1;
int nsp = n/2;
```
think for 1st row

```
for (int i=1; i<=N; i++ ) {   // no. of rows
    for (int j=1; j<=nsp; j++) {
        System.out.print (" ");
    }
    for (int k=1; k<=nst; k++){
        System.out.print ("*");
    }
    if (i<=n/2){
        nsp--;
        nst = nst+2;
    }
    else{
        nsp++;
        nst = nst-2;
    }
```

print for every row

nsp for next line

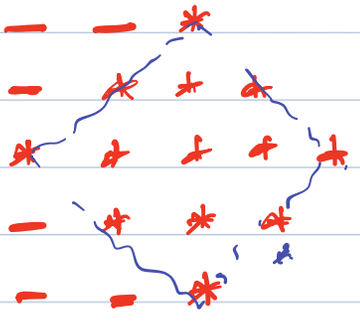
```
}
}
System.out.println();
}
```

```
int nst = 1;
int nsp = n/2;
```
think for 1st row

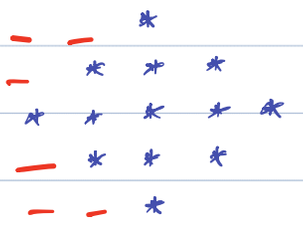
```
for (int i=1; i<=N; i++) {        <- no. of rows
    for (int j=1; j<=nsp; j++) {
        System.out.print(" ");
    }
    for (int k=1; k<=nst; k++){
        System.out.print("*");
    }
    if (i<=n/2){
        nsp--;
        nst = nst+2;
    }
    else{
        nsp++;
        nst = nst-2;
    }
    System.out.println();
}
```

print for every row

prep for next line



N = 5:



N=5

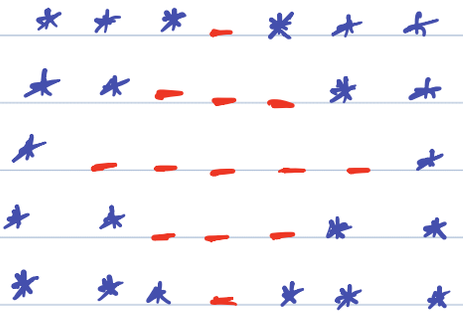
nst = 1 nsp = 5/2 = 2

i	i<=n/2	
1	→ t	→ nst = 3, → nsp = 1
2	→ 2<=5/2 f	→ nst = 5, → nsp = 0
3	→ 3<=5/2 f	→ nst = 3, → nsp = 1
4	→ 4<=5/2 f	→ nst = 1, → nsp = 2
5	→ 5<=5/2 f	→ nst = -1, → nsp = 3
6	→ exit	

Q) Pattern 4

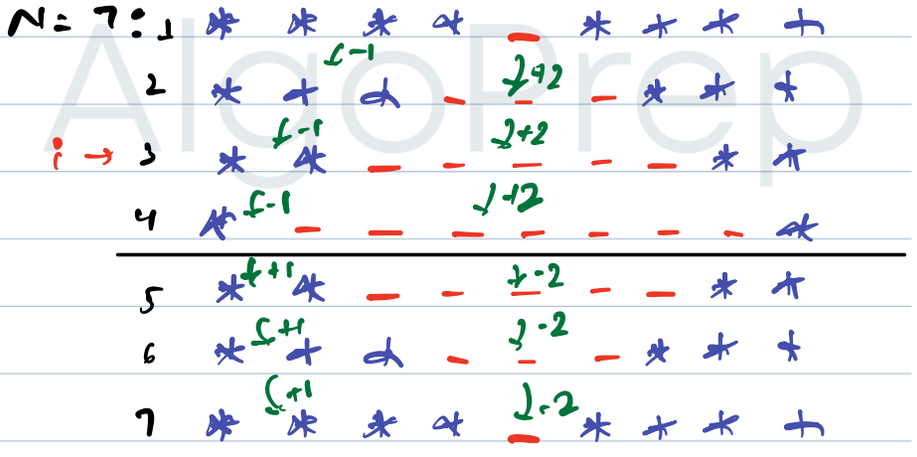
Print the following Pattern.

N=5 :



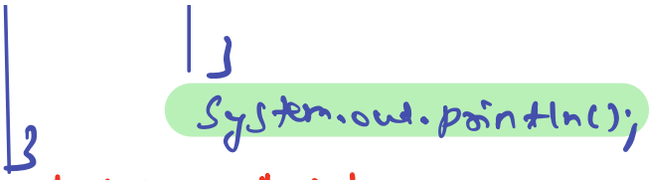
$\frac{N+2}{2} \Rightarrow \frac{n}{2} + 1$

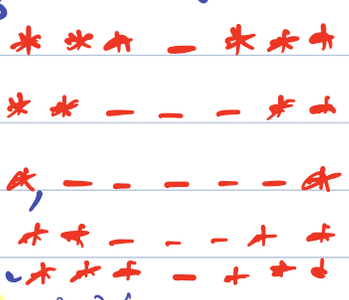
N = 7 :



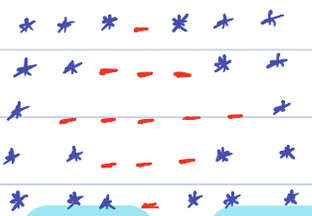
//Pseudo code

```
int nsp = 1;
int nst = n/2 + 1

for (int i=1; i<=n; i++){

    for (int j=1; j<=nst; j++){
        System.out.print("*");
    }

    for (int k=1; k<=nsp; k++){
        System.out.print(" ");
    }

    for (int l=1; l<=nst; l++){
        System.out.print("*");
    }

    if (i<=n/2){
        nst--;
        nsp = nsp+2;
    }
    else{
        nst++;
        nsp = nsp-2;
```





N=5 :



```
//Pseudo code
int nsp = 1;
int nst = n/2 + 1;
for (int i=1; i<=N; i++) {
    for (int j=1; j<=nst; j++) {
        System.out.print("*");
    }
    for (int k=1; k<=nsp; k++) {
        System.out.print(" ");
    }
    for (int l=1; l<=nst; l++) {
        System.out.print("*");
    }
    if (i<=n/2) {
        nst--;
        nsp = nsp+2;
    }
    else {
        nst++;
        nsp = nsp-2;
    }
    System.out.println();
}
```

nst = 3 nsp = 1

1 → nst = 2, nsp = 3

2 → nst = 1, nsp = 5

3 → 3 <= 5/2 → nst = 2, nsp = 3

4 → 4 <= 5/2 → nst = 3, nsp = 1

5 →

6 → exit

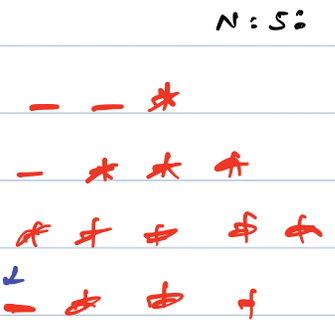
```
int nst = 1;
int nsp = n/2;
```
think for 1st row

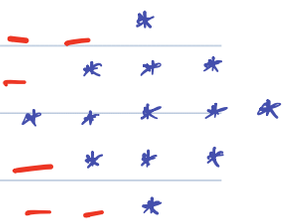
```
for (int i=1; i<=N; i++) {        // no. of rows
    for (int j=1; j<=nsp; j++) {
        System.out.print(" ");
    }
    for (int k=1; k<=nst; k++) {
        System.out.print("*");
    }
    if (i<=n/2) {
        nsp--;
        nst = nst+2;
    }
    else {
        nsp++;
        nst = nst-2;
    }
    System.out.println();
}
```

Print for every row

Logic for next line

N : 5 :





nst : 1
nsp : 2

i

1 → 1 <= 5/2 → + → nst : 3, nsp : 1

2 → 2 <= 5/2 → + → nst : 5, nsp : 0

3 → 3 <= 5/2 → 6 → nst : 3, nsp : 1

4