

|   |   |   |   |   |
|---|---|---|---|---|
| 1 | 1 | 2 | 3 | 4 |
| 1 | . | . | . | * |
| 2 | . | . | * | * |
| 3 | . | * | * | * |
| 4 | * | * | * | * |

①

1

2

3

4

② space.

...

...

...

for (int i=1; i ≤ n; i++)

{

for (int j=1; j ≤ n; j++)

{

if (j ≤ n-i)

cout << " ";

else

cout << "\*";

}

cout << endl;

}

①

②

$j \leq n-i$

space

$j \leq 4$

$j \leq 3$

$j \leq 2$

$j \leq 1$

①  
②  
③  
④  
⑤  
⑥  
⑦  
⑧  
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|   |   |   |   |
|---|---|---|---|
|   |   |   | 1 |
|   | 1 | 2 |   |
| 1 | 2 | 3 |   |
| 1 | 2 | 3 | 4 |

```

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

```

|   | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1 | * | * | * | * |
| 2 | * | * | * |   |
| 3 | * | * |   |   |
| 4 | * |   |   |   |

| (i) | (j) stars |
|-----|-----------|
| 1   | 1 2 3 4   |
| 2   | 1 2 3     |
| 3   | 1 2       |
| 4   | 1         |

```

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

```

(n) 4

| (i) | (j)     |
|-----|---------|
| 1   | 1       |
| 2   | 1 2 3 4 |
| 3   | 1 2 3 4 |
| 4   | 1 2 3 4 |

|   |   |   |   |
|---|---|---|---|
| * | * | * | * |
| * | * | * |   |
| * | * |   |   |
| * |   |   |   |

for stars  
 $n-i+1$   
 $4-1+1=4$   
 $4-2+1=3$   
 $4-3+1=2$

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
|   | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | . | . | . | 1 | . | . | . |
| 2 | . | . | 1 | 2 | 1 | . | . |
| 3 | . | 1 | 2 | 3 | 2 | 1 | . |
| 4 | 1 | 2 | 3 | 4 | 3 | 2 | 1 |

row

col

n

pos = i, val = i  
 // space  
 if (j ≤ n - i)

cout << " ";

else if (j ≤ n)  
 < cout << val\_pos; val\_pos++

else if (j ≤ n + i - 1)  
 < cout << val\_neg; val\_neg--

4 - 1  
 1 2 3  
 1 2  
 1  
 0

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

i n  
 1 4  
 2 9  
 3 7  
 4 4  
 n + i - 1

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



int val\_pos = 1, val\_neg = i - 1;

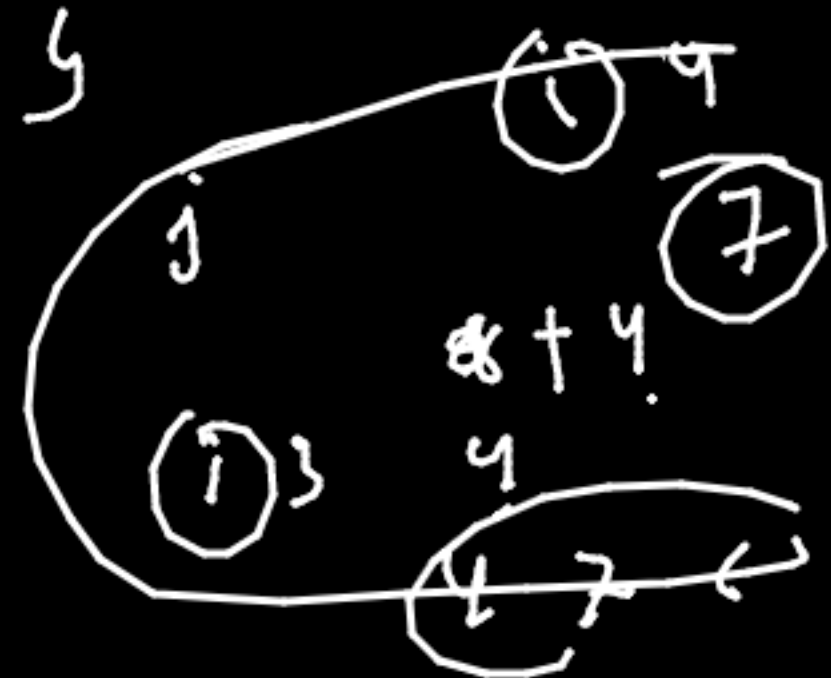
```
if (j ≤ n - i)
    cout << " ";
```

```
elseif (j ≤ n)
{
    cout << val_pos;
    val_pos++;
}
```

```
elseif (j ≤ n + i - 1)
{
    cout << val_neg;
    val_neg--;
}
```

```
for (j → n
    & for (j → 2n - 1
    }
```

```
    cout << endl;
```



0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99

```

. . . *
. . * * *
. * * * *
* * * * *

```

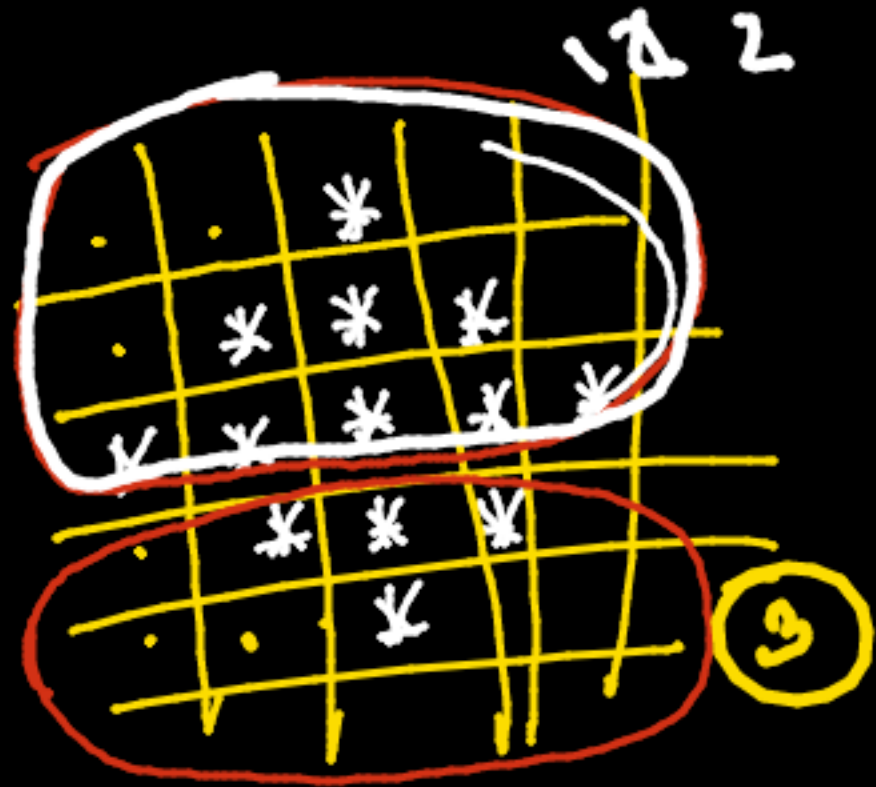
```

int i = 1;
while (i ≤ n) {
    int space = 1;
    while (space ≤ n - i)
    {
        cout << " ";
        space++;
    }

    int stars = 1;
    while (stars ≤ (2 * i - 1))
    {
        cout << " * ";
        stars++;
    }
    cout << endl;
    i++;
}

```





$n$   $\leftarrow$   $row$   $col$  Odd only

int i=1;

while ( $i \leq (n/2) + 1$ )

①

$2 * i$   $2 * (n/2) + 1$  ②  
 int star=1;  
 while (star  $\leq (2 * i) - 1$ )  
 cout << " \* ";  
 star++;

{ int space=1;  
 while (space  $\leq (n/2) + 1 - i$ )  
 cout << " "; space++  
 }

continue ...



```

3 while (i ≤ n) {
    int space = 1;
    while (space ≤ s)
        cout << " "; space++;
    int star = 1;
    while (star ≤ j)
        cout << "*";
        star++;
    }
    i++; j = j - 2;
    cout << endl;
    s++;
}

```

int j = n - 2, s = 1

s++;