Pattern Printing

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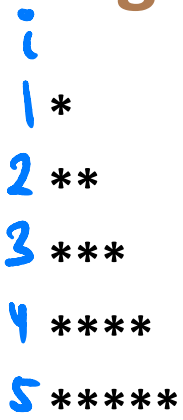
Revising Nested Loops

- Nested loops are **loops placed inside another loop**.
- **The inner loop** executes completely for **each iteration of the outer loop.**
- They are commonly used for tasks involving multi-dimensional data, such as **matrices or grids.**

Right Half Pyramid



Outer loop - print 5 times

inner loop - govern the diff in printing

5 rows

n rows

Code

```cpp
int rows = 5;
// first loop to print all rows
for (int i = 0; i < rows; i++)
{
    // first inner loop to print the * in each row
    for (int j = 0; j <= i; j++)
    {
        cout << "*";
    }
    cout << "\n";
}
```

Floyd's Triangle

1

2 3

4 5 6

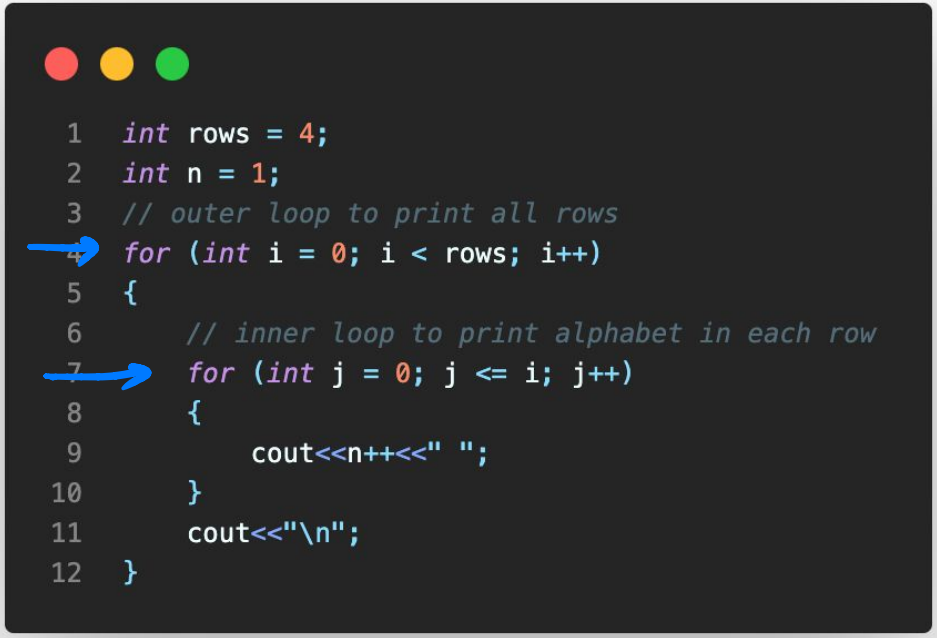
7 8 9 10

Same algo

but use a

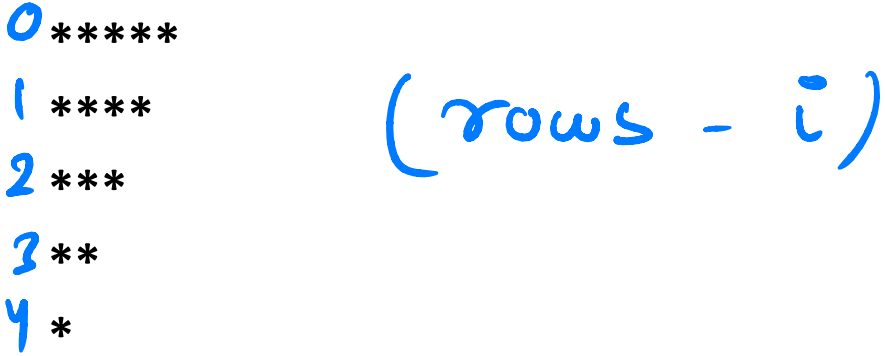
variable K = 1 → increment

Code



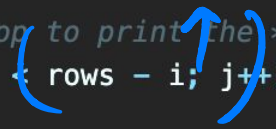
```
1   int rows = 4;
2   int n = 1;
3   // outer loop to print all rows
4   for (int i = 0; i < rows; i++)
5   {
6       // inner loop to print alphabet in each row
7       for (int j = 0; j <= i; j++)
8       {
9           cout<<n++<<" ";
10      }
11      cout<<"\n";
12  }
```

Inverted Right Half Pyramid

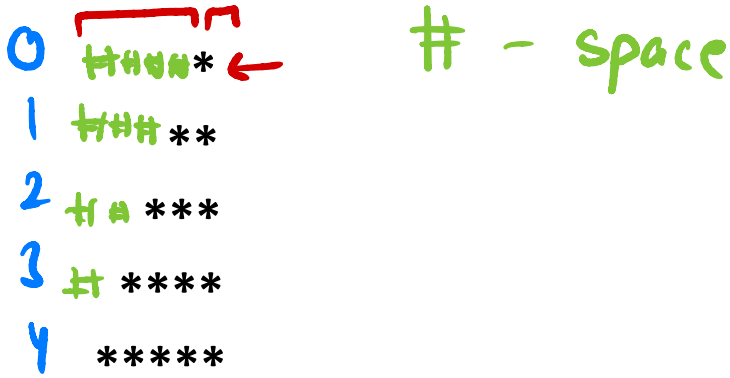


Code

```cpp
int rows = 5;
// first loop to print all rows
for (int i = 0; i < rows; i++)
{
    // first inner loop to print the * in each row
    for (int j = 0; j < rows - i; j++)
    {
        cout << "*";
    }
    cout << "\n";
}
```



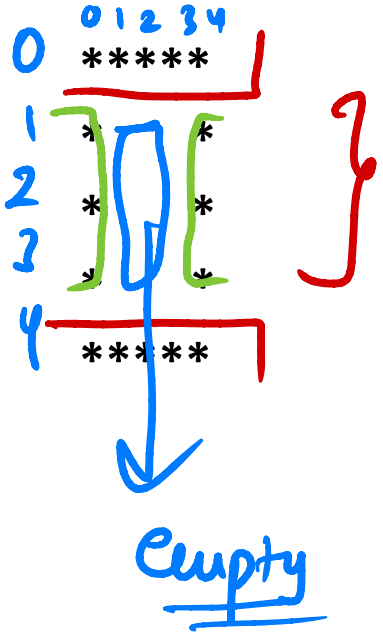
Left Half Pyramid



Code

```cpp
int rows = 5;
// First loop for printing rows
for (int i = 0; i < rows; i++)
{
    // Loop for printing leading whitespaces
    for (int j = 0; j < rows - i - 1; j++)
    {
        cout << " ";
    }
    // Loop for printing * character
    for (int k = 0; k <= i; k++)
    {
        cout << "*";
    }
    cout << "\n";
}
```

Hollow Square



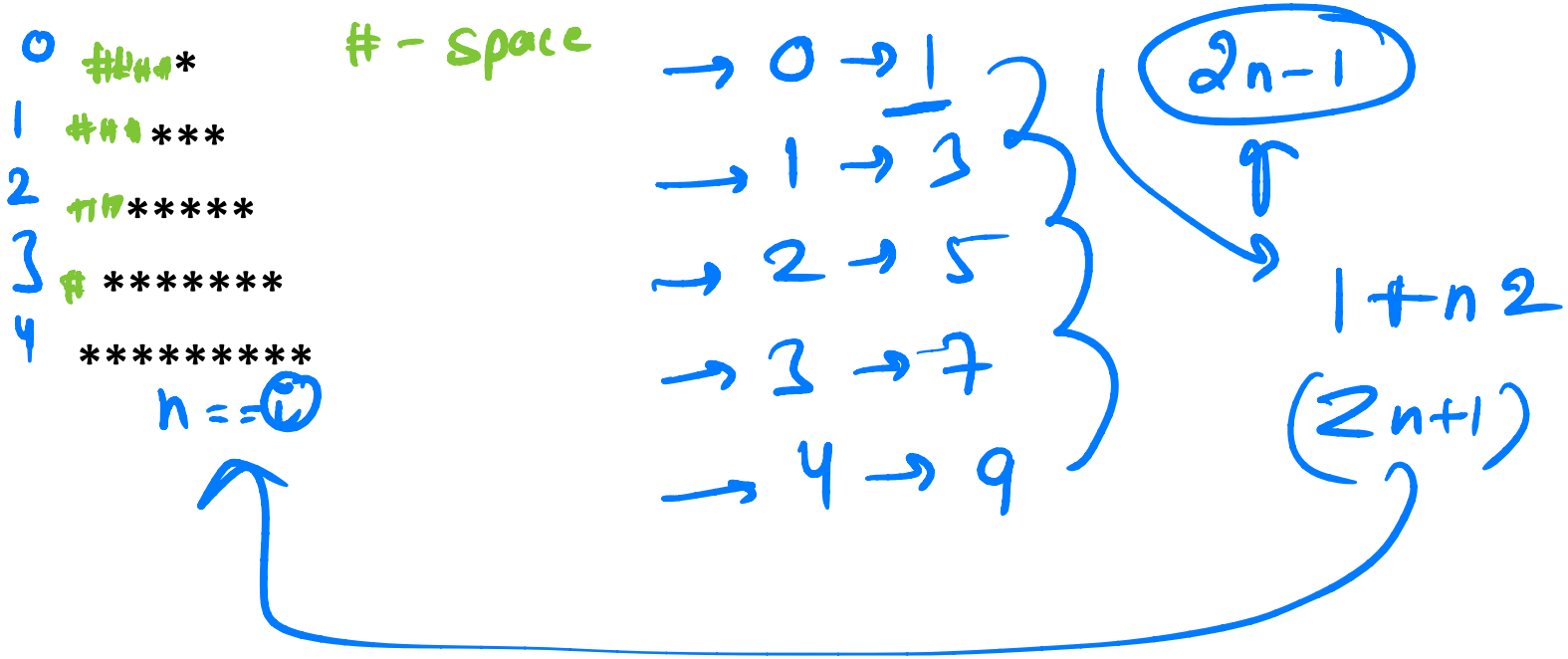
Code

```
int rows = 5;
// outer loop to iterate through each row
for (int i = 0; i < rows; i++)
{
    // inner loop to print * star in each row
    for (int j = 0; j < rows; j++)
    {
        // statement to check boundary condition
        if (i > 0 && i < rows - 1 && j > 0 && j < rows - 1)
        {
            cout << " ";
        }
        else
        {
            cout << "*";
        }
    }
    cout << "\n";
}
```

Full Pyramid

$t_n = a + (n-1)\,d$

$1 + (n-1)\,2$



$2i+1$

$a+(n-1)d$

$i=0 \rightarrow 1$

$=1 \rightarrow 3$

$=2 \rightarrow 5$

$\vdots$

i

$a+nd$

$a=1$

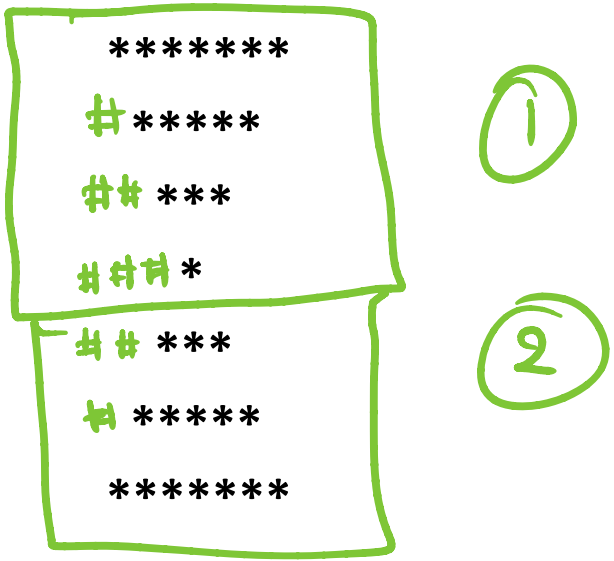
$d=2$

$2 \times n+1$ (i)

Code

```cpp
int rows = 5;
// first loop to print all rows
for (int i = 0; i < rows; i++)
{
    // inner loop 1 to print white spaces
    for (int j = 0; j < rows - i - 1; j++)
    {
        cout << " ";
    }
    // inner loop 2 to print star * character
    for (int k = 0; k < 2 * i + 1; k++)
    {
        cout << "*";
    }
    cout << "\n";
}
```

Hourglass



Code

1

```cpp
int rows = 5;
// Upper triangle
for (int i = rows - 1; i >= 0; i--)
{
    // Print leading spaces
    for (int j = 0; j < rows - i - 1; j++)
    {
        cout << " ";
    }
    // Print stars
    for (int k = 0; k < 2 * i + 1; k++)
    {
        cout << "*";
    }
    cout << "\n";
}
```

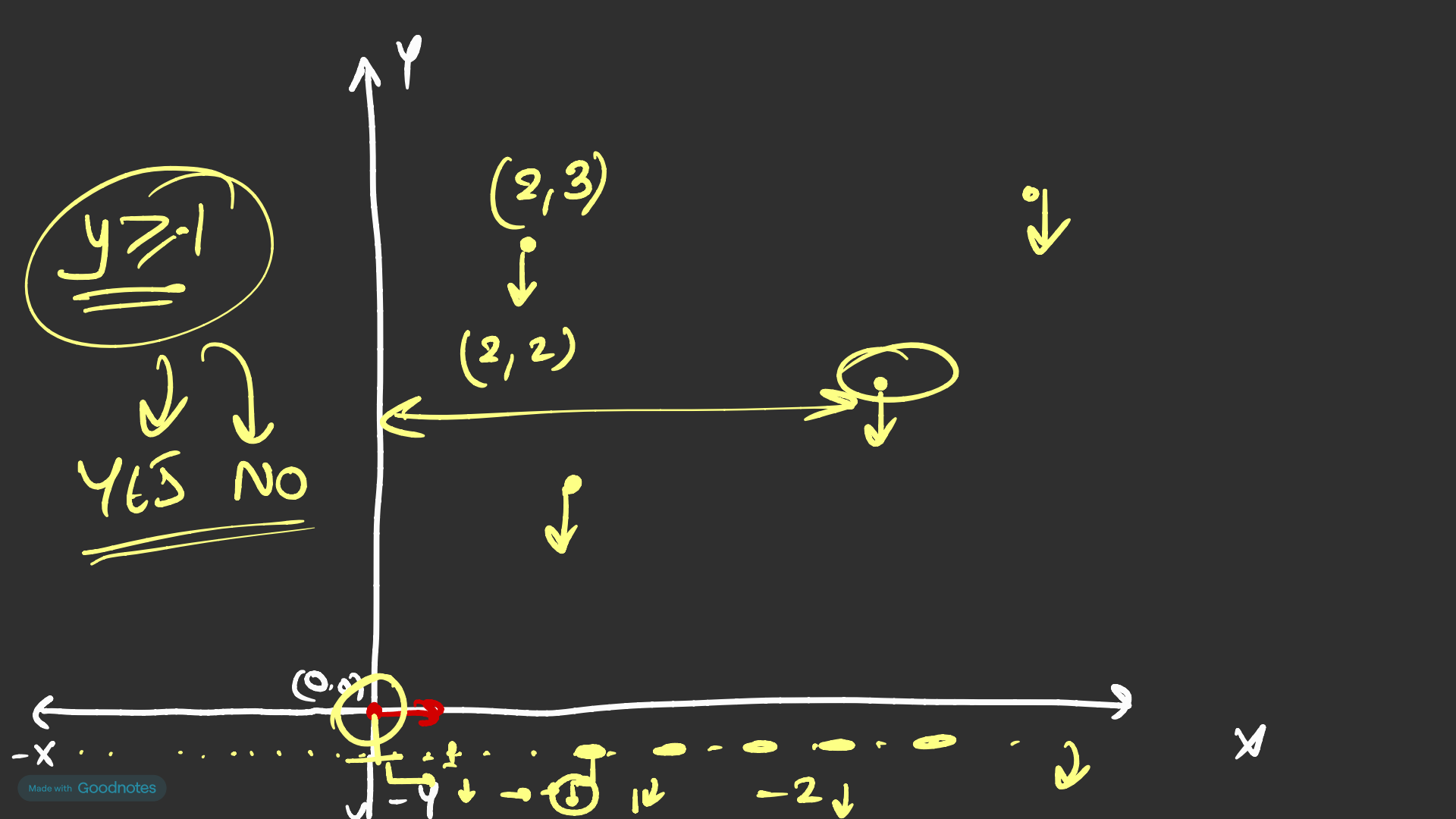
2

```cpp

// Lower triangle (excluding the middle row)
for (int i = 1; i < rows; i++)
{
    // Print leading spaces
    for (int j = 0; j < rows - i - 1; j++)
    {
        cout << " ";
    }
    // Print stars
    for (int k = 0; k < 2 * i + 1; k++)
    {
        cout << "*";
    }
    cout << "\n";
}
```

Pattern Printing and Game Links

- https://www.geeksforgeeks.org/pattern-programs-in-c/
- https://www.codingame.com/ (clash of code)


Y
(2,3)
(2,2)
y≥1
YES
NO
(0,0)
-X
X
-1
-2