

Question - 3. You are developing a software for an advanced math visualization tool. One of the features is to generate complex patterns that combine mathematical concepts with visual representations. Specifically, you need to create a pattern that combines Pascal's Triangle and a half-diamond shape.

Task: Write a Java program that prints a half-diamond pattern where each row contains elements from Pascal's Triangle up to the middle row. For a given integer n , generate a pattern with $2n-1$ rows. The first n rows should display the elements of Pascal's Triangle in increasing order, while the next $n-1$ rows should display them in decreasing order, forming a half-diamond.

Pascal's Triangle is a triangular array of binomial coefficients. The value at position (i, j) in Pascal's Triangle is computed as $C(i, j)$, where $C(i, j) = i! / (j! * (i - j)!)$.

Example for $n = 4$:

Pattern Explanation:

- Row 1: $C(0,0)$
- Row 2: $C(1,0)$ $C(1,1)$
- Row 3: $C(2,0)$ $C(2,1)$ $C(2,2)$
- Row 4: $C(3,0)$ $C(3,1)$ $C(3,2)$ $C(3,3)$
- Row 5: Repeat Row 3
- Row 6: Repeat Row 2
- Row 7: Repeat Row 1

Test Cases:

Sample Input 1:

Input: $n = 3$

Sample Output 1:

Output:

1

1 1

1 2 1

1 1

1

Sample Input 2:

Input: n = 4

Sample Output 2:

Output:

1

1 1

1 2 1

1 3 3 1

1 2 1

1 1

1

Sample Input 3:

Input: n = 5

Sample Output 3:

Output:

1

1 1

1 2 1

1 3 3 1

1 4 6 4 1

1 3 3 1

1 2 1

1 1

1

Explanation:

1. Pascal's Triangle Calculation:

- o The triangle is built row by row, where each element is the binomial coefficient calculated using factorials.
- o For example, $C(3,2)$ is calculated as $3! / (2! * (3-2)!) = 3$.

2. Pattern Construction:

- o The first n rows display Pascal's Triangle in an expanding manner.
- o The next n-1 rows reverse the pattern, forming a symmetric half-diamond.

Coding:

```
import java.io.*;
```

```
import java.util.*;
```

```
public class gfg2 {
```

```
    public static void main(String[] args) {
```

```
        Scanner s = new Scanner(System.in);
```

```
        int num = s.nextInt();
```

```
        int m = 1;
```

```
// First half Pascal's triangle in pyramid form

do {

    // Print leading spaces

    for (int space = 1; space <= num - m; space++) {

        System.out.print(" ");

    }

    int number = 1;

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

        System.out.print(number + " ");

        number = number * (m - i) / i;

    }

    System.out.println();

} while (++m <= num);
```

```
// Reverse half Pascal's triangle in pyramid form

m = num - 1;

do {

    // Print leading spaces

    for (int space = 1; space <= num - m; space++) {

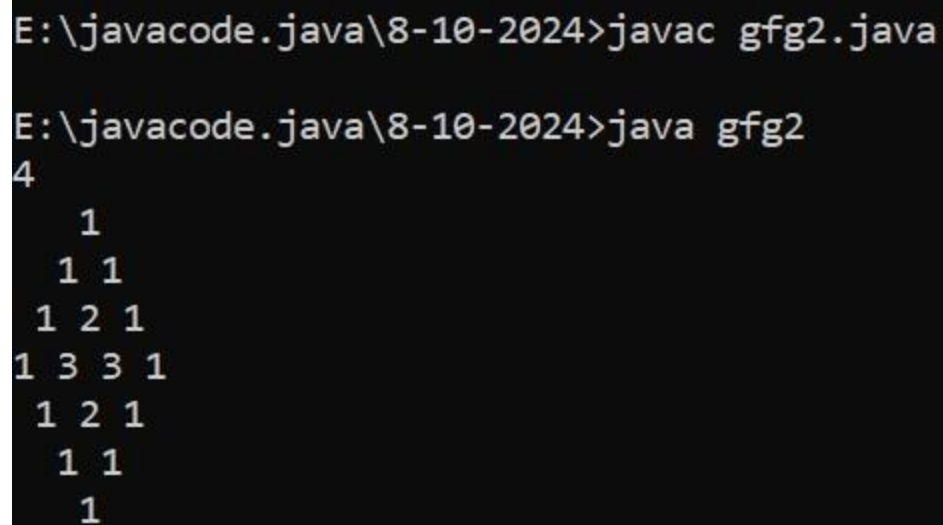
        System.out.print(" ");

    }

    int number = 1;
```

```
        for (int i = 1; i <= m; i++) {  
            System.out.print(number + " ");  
            number = number * (m - i) / i;  
        }  
        System.out.println();  
    } while (--m > 0);  
}  
}
```

Output:



```
E:\javacode.java\8-10-2024>javac gfg2.java  
E:\javacode.java\8-10-2024>java gfg2  
4  
    1  
  1 1  
1 2 1  
1 3 3 1  
  1 2 1  
    1 1  
      1
```