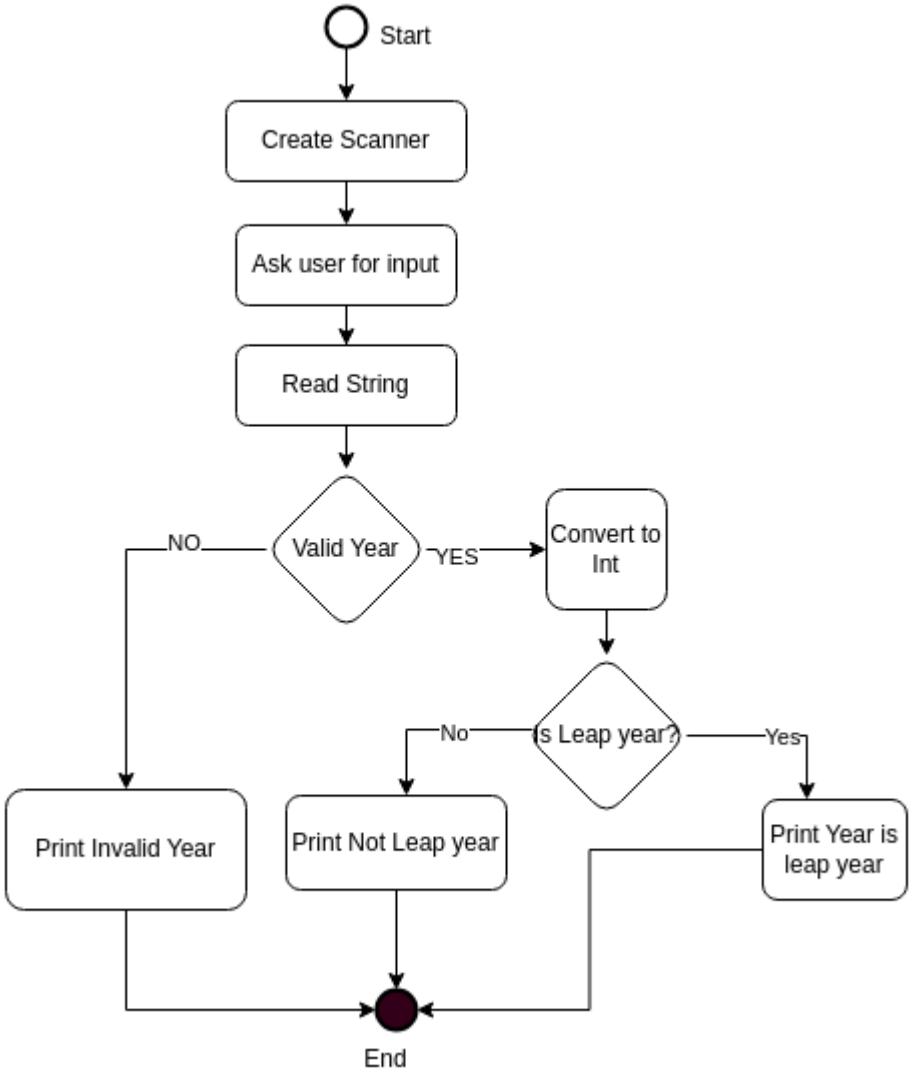
Program 1

Consider a particular year like 2015 and write a program in Java to check whether it is a leap year or not

Terminal Out

Flow Diagram



Source Code

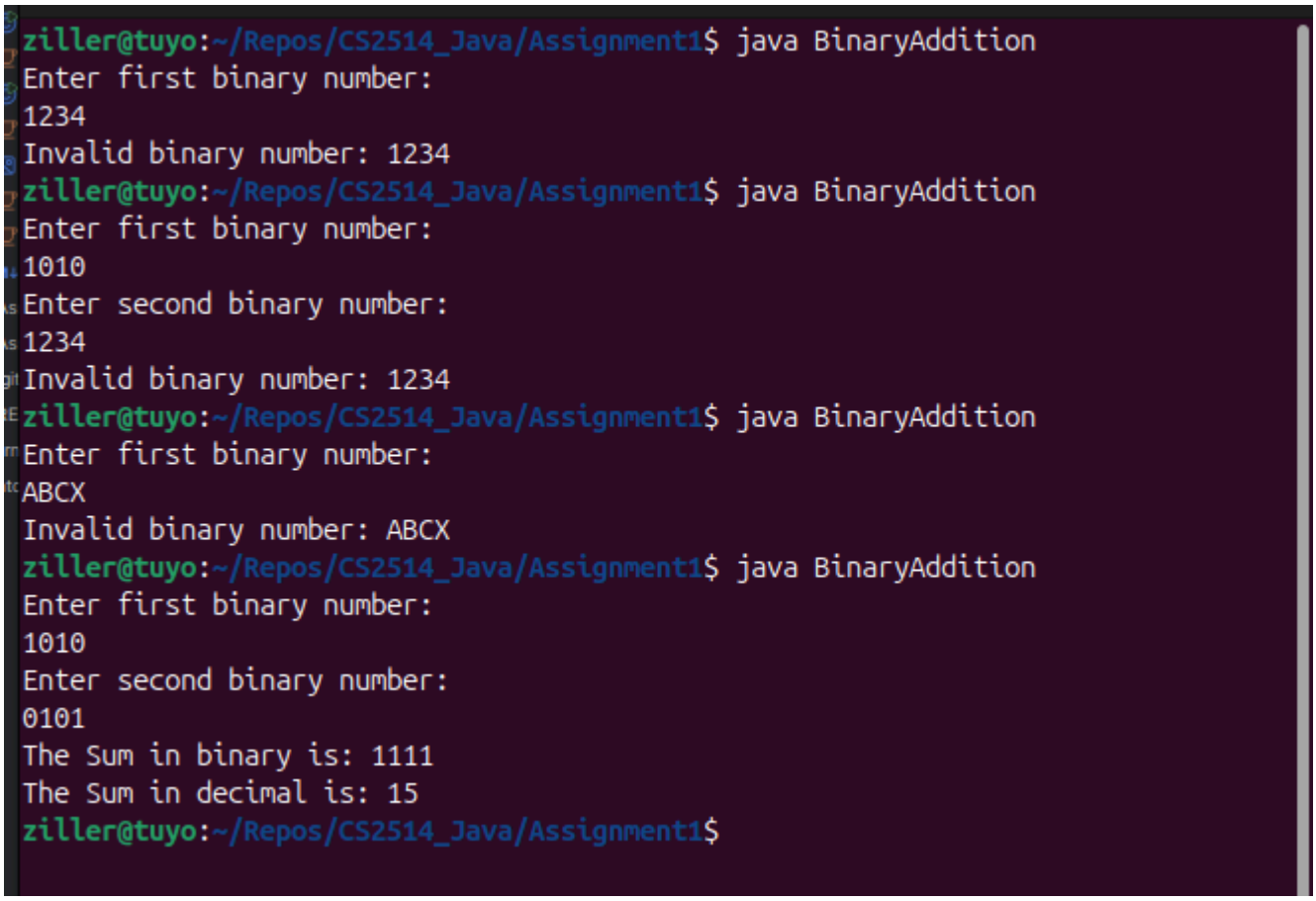
```java
import java.util.Scanner;

// Class to check if a user inputted year is leap or not.
public class CheckLeapYear {
    public static void main(String[] args){
        // Create a scanner object.
        Scanner myScanner = new Scanner(System.in);

        System.out.println("Please enter your year: ");
        // Read input as string to validate the format
        String yearStr = myScanner.nextLine();

        // Check if the input is a valid year
        if (isValidYear(yearStr)) {
            // and then convert the valid year string to an integer
            int year = Integer.parseInt(yearStr);

            // Now check if it's a leap year using the isLeapYear method
            if (isLeapYear(year)) {
```

```
                System.out.println(year + " is a leap year");
            } else {
                System.out.println(year + " is NOT a leap year");
            }
        } else {
            System.out.println("Invalid year format. Please enter a valid 4-digit year.");
        }
        // Close scanner.
        myScanner.close();
    }

    // Method to check if the year is a leap year
    // Returns a boolean true/false if its a leap year or not.
    // Assums the caller passes a correct into - 0000->9999

    public static boolean isLeapYear(int year) {
        // A year is a leap year if it is divisible by 4, but not divisible by 100 unless it is also d
        return (year % 4 == 0 && (year % 100 != 0 || year % 400 == 0));
    }

    // Need something to check if the input string is a valid year or not..
    // As the scanner might present any random string from the user we need
    // to ensure its in the year format before we can do anything iwth it.

    public static boolean isValidYear(String yearStr) {
        // Check if the string has exactly 4 characters
        if (yearStr != null && yearStr.length() == 4) {
            // Is everything a digit ???
            for (int i = 0; i < yearStr.length(); i++) {
                if (!Character.isDigit(yearStr.charAt(i))) {
                    return false; // Return false if any character is not a digit
                }
            }
            // At this point our yearStr is 4 digits between 0000 and 9999
            return true;
        }
        // If the string does not have exactly 4 characters, return false
        return false;
    }
}
```

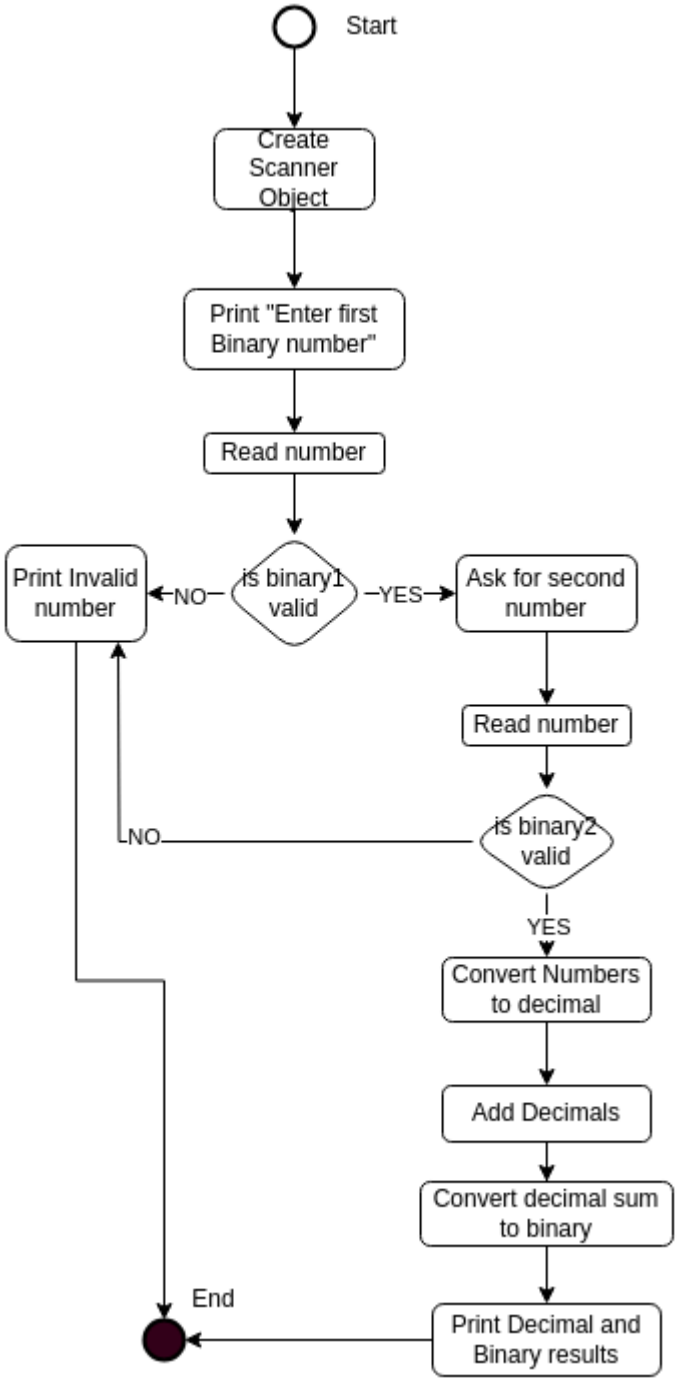
Program 2

Consider two binary numbers like 1010 and 1101 and write a program in Java to add the two numbers

Terminal Out



Flow Diagram



Source Code

```
import java.util.Scanner;

// Class to add two user inputted Binary numbers
public class BinaryAddition{
    public static void main(String[] args){
        // Open scanner object.
        Scanner myScanner = new Scanner(System.in);

        // Get first user defined input.
        System.out.println("Enter first binary number: ");
```

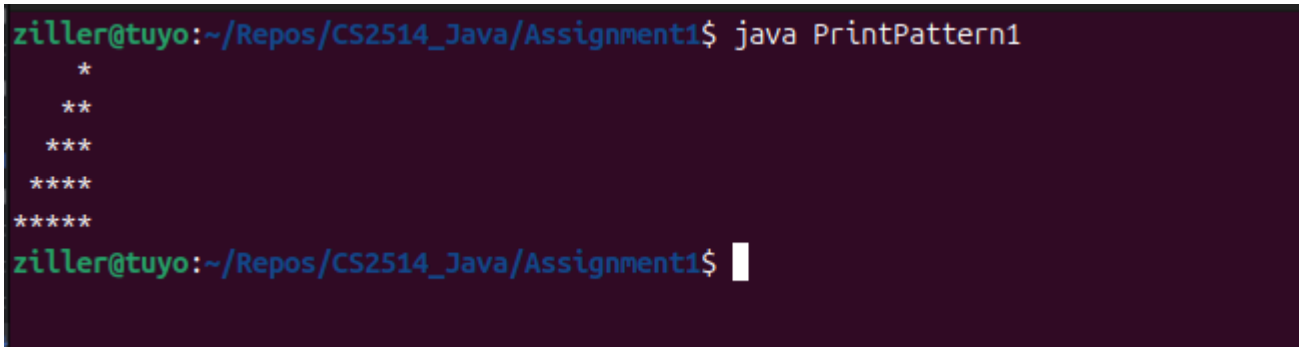
```
        String binary1 = myScanner.nextLine();

        // Check if the first input is a valid binary number
        if (!isValidBinary(binary1)) {
            System.out.println("Invalid binary number: " + binary1);
            myScanner.close();
            return;
        }

        // Get input 2.
        System.out.println("Enter second binary number: ");
        String binary2 = myScanner.nextLine();

        // Check if the second input is a valid binary number
        if (!isValidBinary(binary2)) {
            System.out.println("Invalid binary number: " + binary2);
            myScanner.close();
            return;
        }

        // Convert binary numbers to decimal
        int num1 = Integer.parseInt(binary1, 2);
        int num2 = Integer.parseInt(binary2, 2);

        // Calculate sum in decimal
        int sumDecimal = num1 + num2;

        // Convert the sum to binary
        String sumBinary = Integer.toBinaryString(sumDecimal);

        System.out.println("The Sum in binary is: " + sumBinary);
        System.out.println("The Sum in decimal is: " + sumDecimal);

        // Close scanner.
        myScanner.close();
    }

    // Ok, a string coming in, so need to check if its only 1's and O's
    public static boolean isValidBinary(String binary) {
        // Check each character in the string
        for (int i = 0; i < binary.length(); i++) {
            // If the character is neither '0' nor '1', return false
            if (binary.charAt(i) != '0' && binary.charAt(i) != '1') {
                return false;
            }
        }
        // If all characters are valid binary digits, return true
        return true;
    }
}
```

Program 3

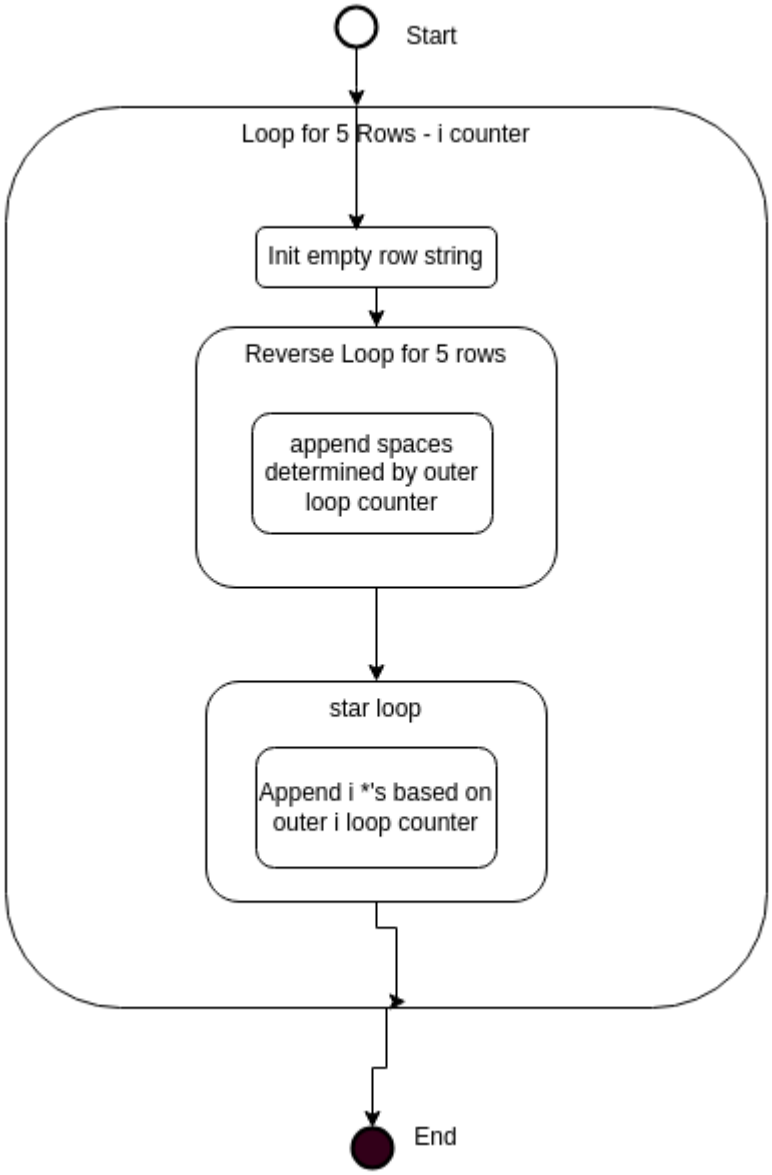
Print Pattern

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

Terminal Out



Flow Diagram



Source Code

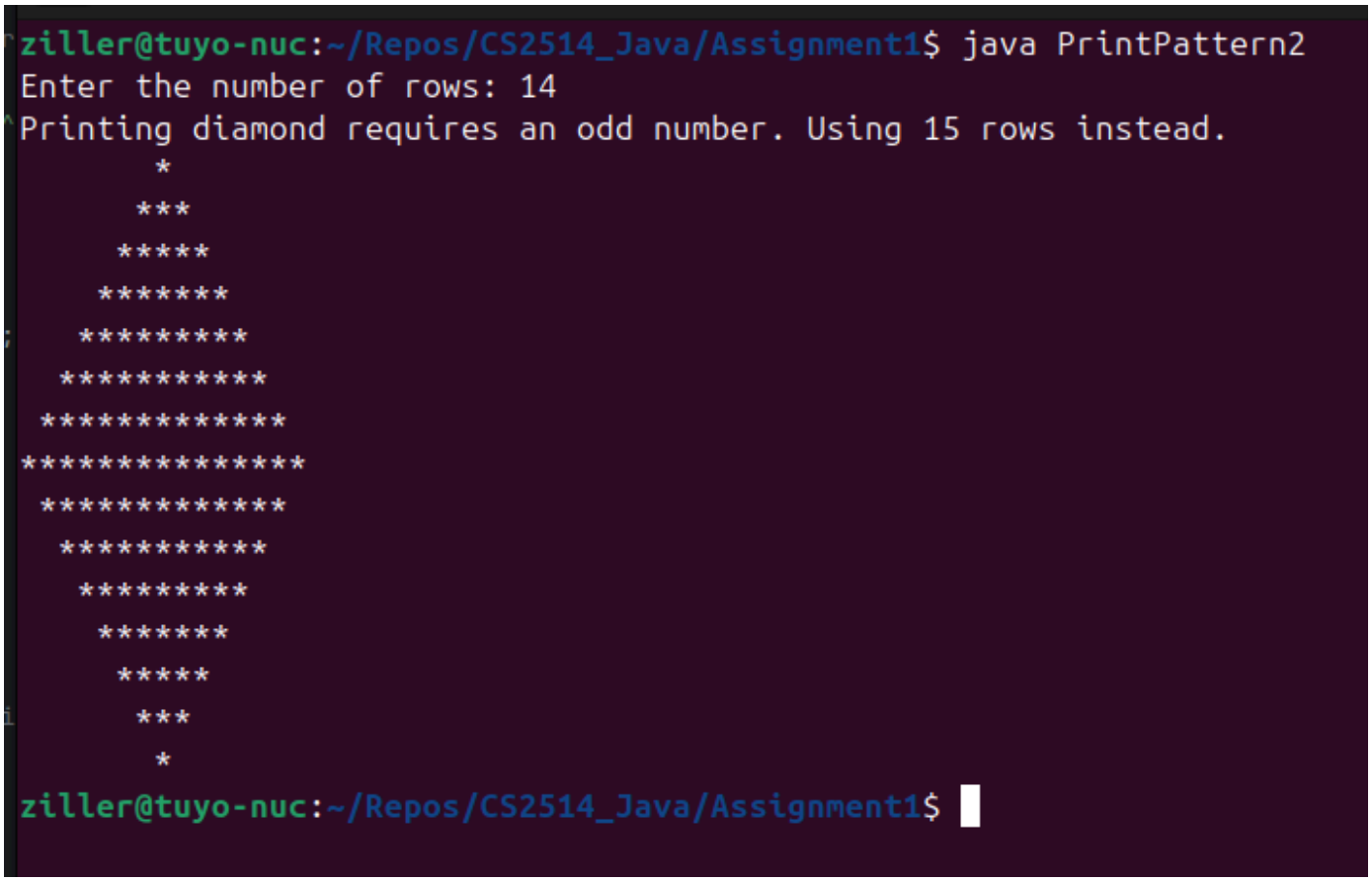
```
//PrintPattern Class to print a right orientated triangle
public class PrintPattern1{
        public static void main(String[] args){

                // Number of rows to print
                int rows = 5;

                for (int i = 1; i <= rows; i++){
                        // String buffer for each row.
                        String rowString = "";

                        // loop for spaces (going backwards)
                        for (int j = rows + -i; j > 0; j--){
                                rowString = rowString + ' ';
                        }

                        // Loop for stars
```

```
                        for (int k = 1; k <= i; k++){
                                rowString = rowString + '*';
                        }

                        // Print buffer
                        System.out.println(rowString);
                }

        }
}
```

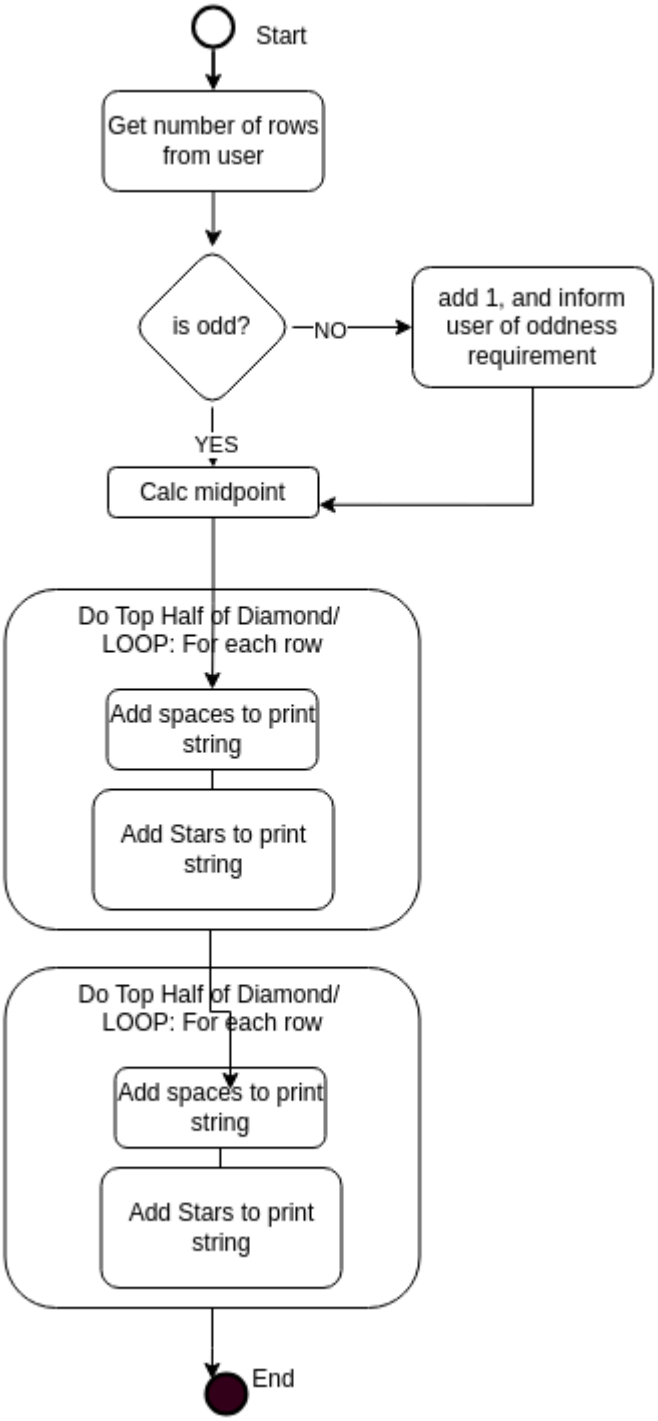
Program 4

Enter number of rows from the user and display a diamond shaped pattern

Terminal Out



Flow Diagram



Source Code

```
import java.util.Scanner;

// Class to print a diamond.
public class PrintPattern2 {
        public static void main(String[] args) {

                // Create a Scanner object to get user input
                Scanner scanner = new Scanner(System.in);
```

```
// Ask the user for the number of rows
System.out.print("Enter the number of rows: ");
int rows = scanner.nextInt();

// Close the scanner after use
scanner.close();

// If the number of rows is even, rounding to nearest odd number (rows + 1)
if (rows % 2 == 0) {
        System.out.println("Printing diamond requires an odd number. Using " + (rows +
        rows = rows + 1;  // Increase by 1 to make it odd
}

// This is why I need odd rows....
int mid = rows / 2;  // Midpoint to split the diamond

// Going to break this into two parts - the top half of the diamond
// then the bottom part of the diamond...

// Top part of the diamond (including the middle row)
// i drives down to the middle, including the middle
for (int i = 0; i <= mid; i++) {
        String rowBuffer = "";

        // Add spaces before the stars
        for (int j = 0; j < mid - i; j++) {
                rowBuffer = rowBuffer + ' ';
        }

        // Add stars. I need stars to increment in odd numbers
        // so row 1 will have *
        // row 2 will have *** (3)
        // row 3 will have **** (5)
        // i, the row index here drives the above via (2*i+1)
        for (int k = 0; k < 2 * i + 1; k++) {
                rowBuffer = rowBuffer + '*';
        }

        // Print the row
        System.out.println(rowBuffer);
}

// Bottom part of the diamond
// i here drives down the remainder of the diamond, but the
// middle is handled earlier.
for (int i = mid - 1; i >= 0; i--) {
        String rowBuffer = "";

        // Add spaces before the stars
        for (int j = 0; j < mid - i; j++) {
                rowBuffer = rowBuffer + ' ';
        }

        // Add stars
        // Add stars. I need stars to increment in odd numbers
        // row 3 will have **** (5)
        // row 2 will have *** (3)
        // so row 1 will have *

        // i, the row index here drives the above via (2*i+1)
        for (int k = 0; k < 2 * i + 1; k++) {
```

```
                        rowBuffer = rowBuffer + '*';
                    }

                    // Print the row
                    System.out.println(rowBuffer);
                }
            }
        }
```