Number Conversion: Decimal to Binary and Decimal to Hexadecimal

**Problem statement:** Write a program that converts decimal numbers to the corresponding binary representation. Write another program that converts decimal numbers to the corresponding hexadecimal representation.

DecimalToBinary.java

```java
public class DecimalToBinary {
    public static void main(String[] args) {
        Scanner input = new Scanner(System.in);
        // get the number from a user
        System.out.print("Enter an integer: ");
        short value = (short) input.nextInt();
        System.out.print("Your number in binary: ");
        short mask = 1;
        short bit = 0;
        String output = "";
        // continue dividing by 2 and recording the remainder as long as the value is > 0
        while (value > 0 ) {
            // get the remainder
            bit = (short) (value % 2) ;
            // divide by 2
            value = (short) (value / 2);
            // save the last bit to an output string
            output = bit+ output;
        }
        // print the result
        System.out.println(output);
        input.close();
    }
}
```

DecimalToHex.java

```java
public class DecimalToHex {
    public static void main(String[] args) {
        Scanner input = new Scanner(System.in);
        // get the number from a user
        System.out.print("Enter an integer: ");
        int value = input.nextInt();
        System.out.print("Your number in hex: ");
        int remainder = 0;
        char hex;
        String output = "";
        // continue dividing by 16 and recording the remainder as long as the value is > 0
        while (value > 0 ) {
            // get the remainder
            remainder = value % 16 ;
            switch (remainder) {
                case 10: hex='A'; break;
                case 11: hex='B'; break;
                case 12: hex='C'; break;
                case 13: hex='D'; break;
                case 14: hex='E'; break;
                case 15: hex='F'; break;
                default: hex = (char)(remainder + '0');
            }
            // divide by 2
            value = ( value / 16);
            // save the last bit to an output string
            output = hex + output;
        }
        // print the result
        System.out.println(output);
        input.close();
    }
}
```
Questions:

1. Describe in your own words what the program `DecimalToBinary` does and how it achieves it.

2. Describe in your own words what the program `DecimalToHex` does and how it achieves it.

3. In what way are the two programs similar?

4. Why do we use `short` to represent bits when converting to binary, but `char` to represent hex symbols when converting to hexadecimal?

5. What does the line 25: `default: hex = (char)(remainder + '0');` do when converting to hexadecimal?

6. What would happen if we swapped the order of `addition` on line 23 of `DecimalToBinary.java` or on line 30 of `DecimalToHex.java`?

Write your own code: Can you think of an algorithm to convert decimal numbers to octal (base 8) representation? How about converting decimal numbers to a representation that uses base 5? Write programs for both.