Assignment – 15

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Task 1:

Bit Manipulation Basics:

Create a function that counts the number of set bits (1s) in the binary representation of an integer. Extend this to count the total number of set bits in all integers from 1 to n.

Program:

```
public class BitManuplatioin {

	public static int countSetBIts(int num) {
		int count = 0;
		while (num > 0) {
			count += num & 1;
			num >>= 1;
		}
		return count;
	}

	public static int totalSetBits(int n) {
		int count = 0;
		for (int i = 1; i <= n; i++) {
			count += countSetBIts(i);
		}
		return count;
	}

	public static void main(String[] args) {
		int num=10;
		System.out.println("Count of set bits in binary
                                representation of "+num+" is:
                                 "+countSetBIts(num));
		System.out.println("Total count of set bits in binary
                                 representation of 1 to "+num+" is:
                                 "+totalSetBits(num));
	}

}
```

Output:

```
Count of set bits in binary representation of 10 is: 2
Total count of set bits in binary representation of 1 to 10 is: 17
```

Task 2:

Unique Elements Identification:

Given an array of integers where every element appears twice except for two, write a function that efficiently finds these two non-repeating elements using bitwise XOR operations.

Program:

```
public class UniqueElements {

	public static int findRightMostBit(int num) {
		int position = 0;
		while ((num & 1) == 0) {
			position++;
			num >>= 1;
		}
		return position;
	}

	public static void findNonRepetingElements(int[] arr) {
		int result = 0;
		for (int num : arr) {
			result ^= num;
		}
		int rightMostSetBit = findRightMostBit(result);

		int group1 = 0;
		int group2 = 0;
		for (int num : arr) {
			if (((num >> rightMostSetBit) & 1) == 0) {
				group1 ^= num;
			} else {
				group2 ^= num;
			}
		}
		System.out.println("Non repeating are: " + group1 +
                                    " and " + group2);
	}

	public static void main(String[] args) {
		int[] arr = { 2, 4, 5, 9, 2, 4 };
		findNonRepetingElements(arr);

	}

}
```

Output:

```
Non repeating are: 9 and 5
```