**Experiment No.05**

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**Aim :** Study and implementation of the IEEE 754 Floating Point Representation standard.

**Code :**

import java.util.Scanner;

public class IEEE754 {

    static String intToBinary(int n) {

        StringBuilder sb = new StringBuilder();

        while (n > 0) {

            sb.append(n % 2);

            n /= 2;

        }

        return sb.reverse().toString();

    }

    static String fracToBinary(float frac, int limit) {

        StringBuilder sb = new StringBuilder();

        while (frac > 0 && sb.length() < limit) {

            frac \*= 2;

            if (frac >= 1) {

                sb.append("1");

                frac -= 1;

            } else {

                sb.append("0");

            }

        }

        return sb.toString();

    }

    public static void main(String[] args) {

        Scanner sc = new Scanner(System.in);

        System.out.print("Enter the Decimal Number = ");

        float num = sc.nextFloat();

        sc.close();

        int bits = Float.floatToIntBits(num);

        int sign = (bits >>> 31) & 1;

        int exponent = (bits >>> 23) & 0xFF;

        int mantissa = bits & 0x7FFFFF;

        int intPart = (int) num;

        float fracPart = num - intPart;

        String intBinary = intToBinary(intPart);

        String fracBinary = fracToBinary(fracPart, 10);

        String fullBinary = intBinary + "." + fracBinary;

        int shift = intBinary.length() - 1;

        String sciNotation = "1." + intBinary.substring(1) + fracBinary + " \* 2^" + shift;

        int realExp = shift;

        int biasedExp = realExp + 127;

        String biasedExpBinary = String.format("%8s", Integer.toBinaryString(biasedExp)).replace(' ', '0');

        String mantissaStr = (intBinary.substring(1) + fracBinary);

        mantissaStr = String.format("%-23s", mantissaStr).replace(' ', '0');

        String bin32 = String.format("%1s %8s %23s", sign, biasedExpBinary, mantissaStr).replace(" ", "");

        String hex = String.format("%08X", bits);

        System.out.println("Given number in Binary = " + fullBinary);

        System.out.println("Given number in Scientific Notation = " + sciNotation);

        System.out.println("Real Exponent = " + realExp);

        System.out.println("Select the destination floating point format = 32 bit");

        System.out.println("Biased Exponent = " + realExp + " + 127 = " + biasedExp + " = " + biasedExpBinary);

        System.out.println("Actual fractional part = " + intBinary.substring(1) + fracBinary);

        System.out.println("Mantissa of 23 bits = " + mantissaStr);

        System.out.println("Sign bit = " + sign);

        System.out.println("32 bit representation of the given number = " + bin32);

        System.out.println("Hex representation = " + hex);

        sc.close();

    }

}

**Output :**

