LAB III

1.a Login to default directory and see if the directory **LAB3** exists. [Hint. **ls**]

1.b If the directory **LAB3** exists, then remove it. [Hint. To remove the directory **LAB3**, the following steps are needed (i) Go to that directory (**cd LAB3**); (ii) Remove its content (**rm ***); (iii) Go back to the previous directory (**cd ..**); (iv) Remove the directory (**rmdir LAB3**).]

1.c Create the directory **LAB3** (**mkdir LAB3**) and go to the directory (**cd LAB3**).

2. Write a C program that accepts 4 real numbers from the keyboard and prints out the difference (using 4-decimal places) of the maximum and minimum values of these numbers.

   Test data and expected output:

```
Enter four numbers: -1.5 2 7.5 11.2
Difference is 12.7000
```

3. Write a C program that accepts a real number x from the keyboard and prints out the corresponding value of $\sin(1/x)$ using 4-decimal places.

   Test data and expected output:

```
Enter value of x: 0.5
Value of sin(1/x) is 0.9093

Enter value of x: 0
Value of x must be nonzero: try again
```

4. Write a C program that accepts (from the keyboard) a *positive* integer less than 1000 and prints out the sum of the digits of this number.

   Test data and expected output:

```
Enter a +ve no less than 1000: -4
Entered number is out of range

Enter a +ve no less than 1000: 1234
Entered number is out of range

Enter a +ve no less than 1000: 546
Sum of the digits of 546 is 15
```

5. A decimal number between 0 and 32 exclusive can be expressed in binary system as $x_4x_3x_2x_1x_0$, where x_i's are either zero or one. Write a C program that accepts (from the terminal) a decimal number in the above range and prints out the equivalent binary representation with leading bit 1.

   Test data and expected output:

```
Enter a +ve no less than 32: -5
Entered number is out of range
```

```
Enter a +ve no less than 32: 21
Binary equivalent of decimal number 21  is 10101

Enter a +ve no less than 32: 14
Binary equivalent of decimal number 14  is 1110

Enter a +ve no less than 32: 35
Entered number is out of range
```

6. A positive decimal fraction can be expressed in binary system as $0.x_1x_2x_3x_4\cdots$, where x_i's are either zero or one. Write a C program that accepts (from the keyboard) a positive decimal fraction a $(0 < a < 1)$ and prints out at most first four bits of the equivalent binary representation. If the binary representation continues after four bits, then it appends the binary representation with $\cdots$.

   Test data and expected output:

```
Enter a +ve decimal fraction less than 1: .875
Binary equivalent of 0.875000 is 0.111

Enter a +ve decimal fraction less than 1: -0.1
Entered number is not a +ve decimal fraction less than 1

Enter a +ve decimal fraction less than 1: 1.2
Entered number is not a +ve decimal fraction less than 1

Enter a +ve decimal fraction less than 1: 0.525
Binary equivalent of 0.525000 is 0.1000...
```

7. Write a C program that accepts coordinates of two-dimensional points A and B and prints out (using two decimal places) the distance between A and B. It also prints out the coordinates (using two decimal places) of the midpoint of A and B.

   Test data and expected output:

```
Enter coordinates of points A: -1 3
Enter coordinates of points B: 2 -1
Distance between A and B is 5.00
The coordinates of midpoint  of A and B are (0.50,1.00)
```

8. Compute the roots of the equation $ax^2 + bx + c = 0$ and print using three-decimal places. The roots are real $\dfrac{-b \pm \sqrt{D}}{2a}$ if the discriminant $D = b^2 - 4ac$ is non-negative. If the discriminant is negative, then the roots are complex conjugate $\dfrac{-b}{2a} \pm \dfrac{\sqrt{-D}}{2a}i$. The program proceeds in the following steps.

   (a) It accepts the values of a, b and c from the keyboard.

   (b) No solution if both a and b are zero. The program finishes with appropriate message.

   (c) Linear equation if $a = 0$ but $b \neq 0$ and the root is $-c/b$. The program prints out the root with appropriate message and the program finishes.

   (d) Calculates the discriminant D and determines the corresponding roots.

(e) Prints out the roots with appropriate message and the program finishes.

Test data and expected output:

```
Enter a,b,c: 0 2 3
Linear equation: root=-1.500

Enter a,b,c: 1 3 2
The roots are real: -1.000  and -2.000

Enter a,b,c: 2 6 9
The roots are complex: -1.500+1.500 i and -1.500-1.500 i

Enter a,b,c: 0 0 4
No solution: a & b both zero
```