Lab 4

LAB 6: Solution of algebraic and transcendental equation by Regula-Falsi and Newton-Raphson method

6.1 Objectives:

Use python

1. to solve algebraic and transcendental equation by Regula-Falsi method.
2. to solve algebraic and transcendental equation by Newton-Raphson method.

6.2 Regula-Falsi method to solve a transcendental equation

Obtain a root of the equation $x^3 - 2x - 5 = 0$ between 2 and 3 by regula-falsi method. Perform 5 iterations.

```
# Regula Falsi method
from sympy import *
x=Symbol('x')
g =input('Enter the function  ')  #%x^3-2*x-5;     %function
f=lambdify(x,g)
a=float(input('Enter a valus :')) #2
b=float(input('Enter b valus :')) # 3
N=int(input('Enter number of iterations :')) #5

for i in range(1,N+1):
    c=(a*f(b)-b*f(a))/(f(b)-f(a))
    if((f(a)*f(c)<0)):
        b=c
    else:
        a=c
    print('itration %d  \t  the root %0.3f \t function value %0.3f \n'%
                                          (i,c,f(c)));
```

```
Enter the function  x**3-2*x-5
Enter a valus :2
Enter b valus :3
Enter number of iterations :5
itration 1        the root 2.059        function value -0.391

itration 2        the root 2.081        function value -0.147

itration 3        the root 2.090        function value -0.055

itration 4        the root 2.093        function value -0.020

itration 5        the root 2.094        function value -0.007
```

Using tolerance value we can write the same program as follows:
Obtain a root of the equation $x^3 - 2x - 5 = 0$ between 2 and 3 by regula-falsi method. Correct to 3 decimal places.

6.3 Newton-Raphson method to solve a transcendental equation

Find a root of the equation $3x = \cos x + 1$, near 1, by Newton Raphson method. Perform 5 iterations

```
from sympy import *
x=Symbol('x')
g =input('Enter the function ')  #%3x-cos(x)-1;     %function
f=lambdify(x,g)
dg = diff(g);
```

```
df=lambdify(x,dg)
x0= float(input('Enter the intial approximation  ')); # x0=1
n= int(input('Enter the number of iterations  '));    #n=5;
for i in range(1,n+1):
    x1 =(x0 - (f(x0)/df(x0)))
    print('itration %d  \t  the root %0.3f \t function value %0.3f \n'%
                                     (i, x1,f(x1))); #print all
                                     iteration value

    x0 = x1
```

```
Enter the function  3*x-cos(x)-1
Enter the intial approximation  1
Enter the number of iterations  5
itration 1        the root 0.620        function value 0.046

itration 2        the root 0.607        function value 0.000

itration 3        the root 0.607        function value 0.000

itration 4        the root 0.607        function value 0.000

itration 5        the root 0.607        function value 0.000
```

6.4 Exercise:

1. Find a root of the equation $3x = \cos x + 1$, between 0 and 1, by Regula-falsi method. Perform 5 iterations.

   Ans: 0.607

2. Find a root of the equation $xe^x = 2$, between 0 and 1, by Regula-falsi method. Correct to 3 decimal places.

   Ans: 0.853

3. Obtain a real positive root of $x^4 - x = 0$, near 1, by Newton-Raphson method. Perform 4 iterations.

   Ans: 1.856

4. Obtain a real positive root of $x^4 + x^3 - 7x^2 - x + 5 = 0$, near 3, by Newton-Raphson method. Perform 7 iterations.

   Ans: 2.061