CSE2202: Numerical Methods Lab
Online: 2 Section: A1
Time: 40 Minutes Total: 10

Set A

Problem Statement: Determine the real root x_{root} of the equation: $f(x) = x^2 - x - 1$ using Newton Raphson Method. Employ initial guess of $x_0 = 1$ and iterate until $f(x_{root}) < 0.00000001$.

Tasks That You Need to Complete:

1. Firstly, check whether your given $f(x)$ is ill condition system or not by checking the condition number. If condition number is large then your system is ill condition and print the $f(x)$ is numerically unstable and stop. Else print the $f(x)$ is numerically stable and continue with step 2 to 7. [Consider the upper limit of condition number is 1 for this problem.]
2. Write a program using Newton Raphson method to locate the approximate root of the function $f(x) = x^2 - x - 1$ with initial guess $x_0 = 1$.
3. Iterate until iterate until $f(x_{root}) < 0.00000001$ and use Horner's method to find value of $f(x_{root})$.
4. If after n iterations $f(x_{root})$ return 0 then print Root found using Newton Raphson method is exact root.
5. Use Horner's method to evaluate the functions.
6. Use appropriate math function for your code.
7. Follow the following output format for your code.

Sample Input/output:

```
ENTER THE TOTAL NO. OF POWER: 2
 x^0::
 x^1::
 x^2::
 THE POLYNOMIAL IS :::
 INTIAL X1---->
 Calculate the Condition number:
 If condition number is large
             Then print f(x) is numerically unstable and stop
 Else
             Print f(x)is numerically stable

             After n iteration the Root is:
 Value Return by Horner's Method is:
 If Horner's Method return 0 then print
    Root Found Using Newton Raphson Method is Exact Root
 Else
      Root Found Using Newton Raphson Method is Not Exact Root
```

Set B

Problem Statement: Determine the real root x_{root} of the equation: $f(x)$ = = x² − x − 1 using Secant Method. Employ initial guess of $x_0 = 1\, and\, x_1 = 2$ and iterate until $f(x_{root})$ < 0.00000001.

Tasks That You Need to Complete:

1. Firstly, check whether your given $f(x)$ is ill condition system or not by checking the condition number. If condition number is large then your system is ill condition and print the $f(x)$ is numerically unstable and stop. Else print the $f(x)$ is numerically stable and continue with step 2 to 7. [Consider the upper limit of condition number is 1 for this problem.]
2. Write a program using Secant Method method to locate the approximate root of the function $f(x)$ = x² − x − 1 with initial guess $x_0 = 1\, and x_1 = 2$.
3. Iterate until iterate until$f(x_{root})$ < 0.00000001 and use Horner's method to find value of $f(x_{root})$.
4. If after n iterations $f(x_{root})$ return 0 then print Root found using Secant method is exact root.
5. Use Horner's method to evaluate the functions.
6. Use appropriate math function for your code.
7. Follow the following output format for your code.

Sample Input/output:

```
ENTER THE TOTAL NO. OF POWER: 2
 x^0::
 x^1::
 x^2::
 THE POLYNOMIAL IS :::
 INTIAL X0---->
        X1---->

 Calculate the Condition number:
 If condition number is large
             Then print f(x) is numerically unstable and stop
 Else
             Print f(x)is numerically stable

              After n iteration the Root is:
 Value Return by Horner's Method is:
 If Horner's Method return 0 then print
    Root Found Using Secant Method Method is Exact Root
 Else
      Root Found Using Newton Secant Method Method is Not Exact Root
```

Set C

Problem Statement: Determine the real root x_{root} of the equation: $f(x) = x^2 - x - 1$ using Fixed Point Iteration Method. Employ initial guess of $x_0 = 1$ and iterate until $f(x_{root}) < 0.00000001$.

Tasks That You Need to Complete:

1. Firstly, check whether your given $f(x)$ is ill condition system or not by checking the condition number. If condition number is large then your system is ill condition and print the $f(x)$ is numerically unstable and stop. Else print the $f(x)$ is numerically stable and continue with step 2 to 7. [Consider the upper limit of condition number is 1 for this problem.]
2. Write a program using Fixed Point Iteration method to locate the approximate root of the function $f(x) = x^2 - x - 1$ with initial guess $x_0 = 1$.
3. Find function $g(x)$ by rewritting $f(x)$ into $x = g(x)$ form.
4. Check whether derivative of $g(x)$ which denoted as $g'(x) < 1$ or not

5. Iterate until iterate until $f(x_{root}) < 0.00000001$ and use Horner's method to find value of $f(x_{root})$.
6. If after n iterations $f(x_{root})$ return 0 then print Root found using Fixed point iterations method is exact root.
7. Use Horner's method to evaluate the functions.
8. Use appropriate math function for your code.
9. Follow the following output format for your code.

Sample Input/output:

```
ENTER THE TOTAL NO. OF POWER: 2
x^0::
x^1::
x^2::
THE POLYNOMIAL IS :::
INTIAL X1---->
Calculate the Condition number:
If condition number is large
   Then print f(x) is numerically unstable and stop
Else
   Print f(x)is numerically stable
   If g'(x) is less than 1 then
     Print System will converge and after n iteration the Root is:
   Value Return by Horner's Method is:
     If Horner's Method return 0 then print
         Root Found Using Fixed Point Iterations Method is Exact Root
     Else
         Root Found Using Fixed Point Iterations Method is Not Exact Root
```

Note:

The **condition number** of a function measures the sensitivity of a function *f(x)* that is how sensitive that function is to small changes in the input. . On the other hand, the stability of an algorithm measures how well that algorithm computes the value of a function from exact input. If the condition number is large then the system is ill-condition. Ill condition system is numerically unstable.

Condition number = $\frac{xf(x)}{f'(x)}$