

CS 3320

Module 5 Programming Assignment

Problem Description

Write a function that will find a root of a function using the Regula Falsi method with the following requirements:

- The inputs to the function are: xLower, xUpper, and func:
 - xLower: lower value of the bracket
 - xUpper: upper value of the bracket
 - func: function handle of the routine that calculates the function value of the given function.
- The outputs of the function are root, flag, function value at the root, and number of iterations
 - root: a root of the function in [xLower, xUpper] if one is found.
 - flag: indicating whether a root is found. For example, if [xLower, xUpper] does not bracket a root, the flag should return an error status indicating no root was found.
 - function value at the root: func(root) if a root is found.
 - number of iterations: Number of iterations used to find the root if a root was found.

Program Requirements

Your program will do the followings:

- Validate the given bracket, [xLower, xUpper], contains a root, i.e., $\text{func}(\text{xLower}) * \text{func}(\text{xUpper}) < 0$. If the function has the same sign at xLower and xUpper, set the flag to -1 and return.
- Check if either xLower, xUpper is a root, e.g., if $\text{func}(\text{xLower}) = 0$ then xLower is a root, set flag=0, (number of iterations)=0, and root=xLower and return
- Calculate a new approximated root using the formula of regula falsi in a loop.
- Break out the loop and return the proper values if one of the following conditions is met:
 - The $\text{func}(\text{root}) < (\text{machine epsilon})$
 - The distance between approximated roots in two consecutive iteration is less a ulp apart at the root location
 - The loop reached the maximum number of iterations. Set maxInt to 100000 in your program.

Test Cases

You will use your program to identify a root of the following functions:

Function 1: $y = x^4 - 6x^3 + 12x^2 - 10x + 3$

Function 2: $y = x^3 - 7x^2 + 15x - 9$

(Note that 1 is a root for both functions.)

For each function, you will run the following cases:

1. Use [1.5, 2.5] as the bracket and record the results.
2. Use [0, 1.5] as the bracket record the results.

Submission

You will submit your source code, a table summarized the results from the test cases, and a brief report (100 – 200 words) on the analysis of your results pertains to the Regula Falsi method such as number of iterations and the accuracy of the root.

Sample Table

| Bracket | Function 1 | | | Function 2 | | |
|------------|------------|----------|---------|------------|----------|---------|
| | Root | Function | # Of It | Root | Function | # Of It |
| [1.5, 2.5] | | | | | | |
| [0, 1.5] | | | | | | |