Assignment 2: Bisection Method

Sunday, October 15, 2023 11:53 AM

Exercise 1: Bisection Method

$a = 0 \quad b = 1$

$f(x) = x^3 + 3x - 1 \qquad \epsilon = 0.000001$

#1 $f(a) = -1$ $\quad -3 < 0$

$f(b) = 3$

$c = \frac{a+b}{2} = \frac{0+1}{2} = 0.5$

$f(0.5) = 0.625$ error = 1

$b = 0.5$

#2 $c = \frac{a+b}{2} = 0.25$

$f(0.25) = -0.234375$

$a = 0.25$

#3: $c = \frac{0.25+0.5}{2} = 0.375$

$f(c) = 0.177734375$

$b = 0.375$

#4: $c = \frac{0.25+0.375}{2} = 0.3125$

$f(c) = -0.031982412$

$a = 0.3125$

#5: $c = \frac{0.3125+0.375}{2} = 0.34375$

$f(c) = -0.031482421875$

$b = 0.34375$

#6: $c = \frac{0.3125+0.34375}{2} = 0.328125$

$f(c) = 0.019702911376953125$

$b = 0.328125$

#7: $c = \frac{a+b}{2} = 0.3203125$

$f(c) = -0.006198406$

$a = 0.3203125$

#8: $c = \frac{a+b}{2} = 0.32421875$

$f(c) = 0.006737411$

$b = 0.32421875$

#9: $c = \frac{a+b}{2} = 0.322265625$

$f(c) = 0.000265814$

$b = 0.322265625$

#10: $c = \frac{a+b}{2} = 0.3212890625$

$f(c) = -0.000496721$

$a = 0.3212890625$

#11 $c = \frac{a+b}{2} = 0.321777344375$

$f(c) = -0.000350493$

$a = 0.321777344$

#12 $c = \frac{a+b}{2} = 0.3220021$

$f(c) = -0.000164815$

$a = 0.322021484$

#13 $c = \frac{a+b}{2} = 0.322143555$

$f(c) = -0.000054156$

$a = 0.322143554$

#14 $c = \frac{a+b}{2} = 0.322204159$

$f(c) = 0.000006369$

$b = 0.322204$

#15 $c = \frac{a+b}{2} = 0.32217407$

$f(c) = -0.000003736$

$a = 0.32217$

#16 $c = \frac{a+b}{2} = 0.322189453$

$f(c) = 0.000001316$

$b = 0.322189453$

#17 $c = \frac{a+b}{2} = 0.3221817$

$f(c) = 0.000001209$ error = 0.000000762939 < 0.000001

(2) $x^3 - 2\sin x \qquad a = 0.5 \quad b = 2 \quad \text{maxiter} = 10$

f(c)=0.0000120

(2) $x^3 - 2\sin x$ a = 0.5 b = 2 maxIter = 10
ε = 0.0001

1. $c = \frac{a+b}{2} = 1.25$
   f(1.25) = 0.055156576
   b = 1.25

2. $c = \frac{a+b}{2} = 0.875$
   f(0.875) = -0.866165
   a = 0.875

3. $c = \frac{a+b}{2} = 1.0625$
   f(1.0625) = -0.5476869
   a = 1.0625

4. $c = \frac{a+b}{2} = 1.15625$
   f(1.15625) = -0.2841791
   a = 1.15625

5. c = 1.203125
   f(c) = -0.12479861695
   a = 1.203125

6. c = 1.22656625
   f(c) = -0.03735548
   a = 1.22656625

7. c = 1.23828
   f(c) = 0.008298
   b = 1.23828

8. c = 1.232421875
   f(c) = -0.0147102
   a = 1.232421875

9. c = 1.2353515625
   f(c) = -0.003266
   a = 1.2353515625

10. c = 1.23681640 Root not found in 10 iterations
    f(c) = 0.00248601
    b = 1.23681640

(3) $x + 10 - x\cosh\left(\frac{50}{x}\right)$ a = 120 b = 130 maxIteration: 10
ε = 0.0001

f(a) · f(b) < 0 ✓
-0.56824 · 0.26549

1. $c = \frac{a+b}{2} = 125$
   f(c) = -0.13404647
   a = 125

2. $c = \frac{a+b}{2} = 127.5$
   f(c) = 0.06497896
   b = 127.5

3. $c = \frac{a+b}{2} = 126.25$
   f(c) = -0.03108061414086
   a = 126.25

4. $c = \frac{a+b}{2} = 126.875$
   f(c) = 0.01961288
   b = 126.875

5. $c = \frac{a+b}{2} = 126.5625$
   f(c) = -0.00566491387
   a = 126.5625

6. $c = \frac{a+b}{2} = 126.71875$
   f(c) = 0.00698780355
   b = 126.71875

7. $c = \frac{a+b}{2} = 126.640625$
   f(c) = 0.00066338
   b = 126.640625

8. $c = \frac{a+b}{2} = 126.6015625$
   f(c) = -0.00250186
   a = 126.6015625

9. $c = \frac{a+b}{2} = 126.62109375$
   f(c) = -0.00091898
   a = 126.62109375

10. $c = \frac{a+b}{2} = 126.63085937$ Root not found in 10 iterations
    f(c) = -0.00012773
    a = 126.6308593