EM314 -ASSIGNMENT 02

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**E/15/202**

**SEMESTER 4**

**QUESTION 1**

According to the convergence theorem of bisection method

**QUESTION 2**

**(a**) If g is a contraction in the [ln1.1 , ln3] range then for

p, q ∈[ln1.1 , ln3] and p ≠ q

Since is the largest value that can have , to be a contraction this value should be smaller than

Therefore g is a contraction in the closed interval.

**(b)** Choose p such that

Since p ∈ G

-ln(q) ∈ G

Therefore

The greatest value q can have, when p is in G is and the smallest value q can have is when p is in G

But ln(1.1) = 0.0953 and ln(3) = 1.0986

Therefore

**(c)**

Since the 0 ≤ L < 1

When k is large

Therefore

Therefore is the fixed point

**QUESTION 3**

**(a)**  ⎯⎯⎯⎯ (1)

⎯⎯⎯⎯⎯ (2)

(1) – (2) ⇒

[Using taylor series for ]

is between and

Since and is between and we have

Therefore we can write

This tell us that near to the root , the errors will decrease by a constant factor

And also this tell what happens when

Then errors will increase as we approach to the root rather than decreasing the size.

In this question and , then

Therefore if we use fixed point iteration, it will diverge instead of converge as the error

get increased by a factor of 2.

**(b)** (i) (fixed point)

**(ii)**  At fixed point

Therefore let’s take

**QUESTION 4**

**(a)** function[zero,res,niter] = newton(f,df,x0,tol,nmax)

niter = 0;

x = x0 - f(x0)/df(x0);

e = abs(x -0.8284);

while abs(x - x0) >= tol && niter <= nmax

ne = e;

x0 = x;

x = x0 - f(x0)/df(x0);

res = abs(x - x0)

e = abs(x - 0.8284);

q = e/ne.^2

niter = niter + 1;

end

zero = x

niter

if niter > nmax

fprintf('Newtons method stop without convergence');

end

**(b)** Yes

The answer is 0.8284

**(c)**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| 1 | 23.5980 | 22.7696 | 0.0098 |
| 2 | 10.9553 | 10.1269 | 0.0195 |
| 3 | 4.7864 | 3.9580 | 0.0386 |
| 4 | 1.9826 | 1.1542 | 0.0737 |
| 5 | 0.9957 | 0.1673 | 0.1256 |
| 6 | 0.8331 | 0.0047 | 0.1678 |
| 7 | 0.8284 | 3.0971e-05 | 1.4047 |
| 8 | 0.8284 | 2.7125e-05 | 2.8278e+04 |

Yes.

From the last column we can see that the increase is getting higher and higher.

**(d)**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| 1 | 23.5980 | 22.7696 | 0.0098 |
| 2 | 10.9553 | 10.1269 | 0.0195 |
| 3 | 4.7864 | 3.9580 | 0.0386 |
| 4 | 1.9826 | 1.1542 | 0.0737 |
| 5 | 0.9957 | 0.1673 | 0.1256 |
| 6 | 0.8331 | 0.0047 | 0.1678 |
| 7 | 0.8284 | 3.0971e-05 | 1.4047 |
| 8 | 0.8284 | 2.7125e-05 | 2.8278e+04 |
| 9 | 0.8284 | 2.7125e-05 | 3.6867e+04 |

This shows the quadratic convergence. We can see that near the real solution, the increase of is very high.

**QUESTION 5**

f(x) = 0.8\*sin(x) - x + 3

df(x) = 0.8\*cos(x) – 1

The answer is

And number of iterations

**Solution**

newton(@f,@df,100,10.^-8,40)

res =

789.6413

res =

351.8600

res =

135.7533

res =

424.8231

res =

211.7088

res =

423.6056

res =

164.1453

res =

83.2772

res =

111.8004

res =

46.7327

res =

17.6963

res =

0.6260

res =

0.0265

res =

1.5076e-05

res =

3.9759e-12

zero =

3.0629

**QUESTION 6**

t = (3.5.\*10.^7 + 0.401.\*(1000./x).^2).\*(x - 1000.\*42.7.\*10.^-6) - 1.3806503.\*(10.^-23).\*1000.\*300;

bisection(@f,-1,2,10.^-12,20)

The answer is