Assignment 2 Paul(Pengshengnan) Cheng V00838497

Question1

a)

(1) Let = 1.56

Condition number = 1.56\*(-cos(1.56))/(1-sin(1.56))= -288.9844

ill-conditioned

(2)Let = 0.51

Condition number = 0.51\*(-cos(0.51))/(1-sin(0.51))= -0.8696

Well-conditioned

b)

(1) pi/2 1.5708 relative error = condition number \* ((X- )/)= -2.0000

(2) relative error = = condition number \* ((X- )/)= 0.0174

We can use Taylor polynomial approximation of order n =1 because when x = pi/2, the function is not calculable.

Question2

a)

ln(x)=0+1\*(x-1) - 1/2!\*(x-1)2 + 2/3!\*(x-1)3 – 6/4!\*(x-1)4 + (24/a5)/5!\*(x-1)5 (remainder)a(x,1)

b)

ln(1.5) = 1\*(1.5-1) – 1/2!\*(1.5-1)2 + 2/3!\*(1.5-1)3 – 6/4!\*(1.5-1)4 =0.401041

|Et| = |0.405465108108164 – 0.401041| = 0.00442400

c)

R4= (24/a5)/5!\*(x-1)5 a(x,1)

Upper bound

|R4|=(x-1)5/5a5= (1.5-1)5/5\*0.55=1/5=0.200

Question 3

a)

function [ root ] = Newton( f, fp, x0, s, imax )

%UNTITLED Summary of this function goes here

% Detailed explanation goes here

i=1;

fprintf ( ' iteration approximation \n')

while i <= imax

root = x0-feval(f,x0)/feval(fp,x0);

fprintf ( ' %6.0f %18.8f \n', i, root )

if (abs(1-x0/root)<s)

return;

end

i = i + 1;

x0 = root;

end

fprintf ( ' failed to converge in %g iterations\n', imax )

end

b)

function y = fQ3(x)

y = 1/sqrt(x)+2\*log10(0.0000015/(3.7\*0.005)+2.51/(13743\*sqrt(x)));

end

function y = fqQ3(x)

y = -1/2\*x^(-3/2)\*(1+2\*log10(2.51/13741));

end

c)

>> Newton('fQ3','fpQ3',0.008,1e-08,20)

iteration approximation

1 0.00671087

2 0.00553364

3 0.00448478

4 0.00357317

5 0.00280003

6 0.00215974

7 0.00164139

8 0.00123056

9 0.00091126

10 0.00066745

11 0.00048419

12 0.00034834

13 0.00024883

14 0.00017668

15 0.00012481

16 0.00008781

17 0.00006156

18 0.00004304

19 0.00003002

20 0.00002090

failed to converge in 20 iterations

ans =

2.0899e-05

d)

>> Newton('fQ3','fpQ3',0.08,1e-08,20)

iteration approximation

1 0.09915670

2 0.12985429

3 0.18312078

4 0.28600255

5 0.51641048

6 1.15330564

7 3.55097863

8 17.95013161

9 195.86288769

10 6951.50702391

11 1465073.09593974

12 4480704788.02159120

13 757817577352238.75000000

14 52709872546568762000000.00000000

15 30576157238699772000000000000000000.00000000

16 13508878903552999000000000000000000000000000000000000.00000000

17 3967107022979102100000000000000000000000000000000000000000000000000000000000000.00000000

18 19964380075648976000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000.00000000

19 7127360039873332300000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000.00000000

20 1520330473834389400000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000.00000000

failed to converge in 20 iterations

ans =

1.5203e+267

e)

Because when f’(x) is close to 0, the next approximation will be way far from the current x, and then make problems. That is why when x0=0.08, the approximation is not even near the zero point.