CMPSC 455

Lab 2

Mike DeLeo

Q1A

For the function f(x) = 0 where

and the bounds are (a,b) = (0,1). Find the x(n+1) value that is within 10 decimal places of the xn value. Use the bisection method to approximate the value.

format long;

a = 0;

b = 1;

xn\_1(1) = 0;

i = 2;

while (true)

    fa = a - exp(-a);

    fb = b - exp(-b);

    mid = (a + b) /2;

    fmid(i) = mid - exp(-mid);

    xn\_1(i) = mid;

    if (floor(xn\_1(i)\*10^11) == floor(xn\_1(i-1)\*10^11))

        break;

    end

    if (sign(fa) ~= sign(fmid(i)))

        b = mid;

    elseif(sign(fb) ~= sign(fmid(i)))

        a = mid;

    end

    i = i + 1;

end

sz = size(xn\_1);

sz = sz(2);

out = [xn\_1(sz) xn\_1(sz-1)];

disp (out)

Result:

In 41 iterations

0.567143290410058 0.567143290410968

Q1B

Implement the fixed point iteration of

Where x0 = 1, find the x(n+1) value that is within 10 decimal places of the xn value.

xn\_1(1) = 1;

i = 2;

while (true)

    xn\_1(i) = exp(-xn\_1(i-1));

    if (floor(xn\_1(i)\*10^11) == floor(xn\_1(i-1)\*10^11))

        break;

    end

    i = i+ 1;

end

sz = size(xn\_1);

sz = sz(2);

out = [xn\_1(sz) xn\_1(sz-1)];

disp (out);

Result:

In 51 iterations

0.567143290409964 0.567143290409466

Q1C

Apply Steffenson’s Method to the fixed point iteration . Where X0 = 1, and x(n+1) agrees to xn within 10 decimal places.

xn\_1(1) = 1;

i = 2;

while (true)

    p1 = exp(-xn\_1(i-1));

    p2 = exp(-p1);

    xn\_1(i)=p2-(p2-p1)^2/(p2-2\*p1+xn\_1(i-1));

    if (floor(xn\_1(i)\*10^11) == floor(xn\_1(i-1)\*10^11))

        break;

    end

    i = i+ 1;

end

sz = size(xn\_1);

sz = sz(2);

out = [xn\_1(sz) xn\_1(sz-1)];

disp (out);

Result:

In 6 iterations

0.567143290409784 0.567143290409784

Q1D

Apply newtons method to solve f(x) = 0, where , and x0 = 1. Find the first x(n+1) that agrees with xn to 10 decimal places.

xn\_1(1) = 1;   %initial condition x0

i = 2;

while (true)

    temp = xn\_1(i-1);

    xn\_1(i) = temp - ((temp - exp(-temp))/(1 + exp(-temp)));

    if (floor(xn\_1(i)\*10^11) == floor(xn\_1(i-1)\*10^11))

        break;

    end

    i = i+ 1;

end

tem = ['xn ' 'x(n+1)'];

temp= [xn\_1(i-1) xn\_1(i)];

disp(tem);

disp(temp)

Result:

In 6 iterations

0.567143290409784 0.567143290409784

Q2

Find the alpha and lambda term from the following Asymptotic Error Constant Calculation

The equation above can be simplified to the following two equations where the sequence goes to infinity

Results:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Bisection | Fixed Point | Steffensons | Newton's Method |
| Alpha | 1 | 0.999796342 | Inf | 0 |
| Lambda | 0.5 | 0.564011777 | Nan | 1.11E-16 |