CS 2 lab 3

Firstly I created the function which calculates the root of given function with given tolerance. I had some issues with implementing number of iterations as pointer, so I implemented it as global variable.

#include <math.h>

#include <stdio.h>

int i\_iter;

double bisec( double xa, double xb, double (\*pf)(double), double eps)

{

int i;

double fa, fb, xc, fc;

fa = pf(xa);

fb = pf(xb);

if ( fa \* fb > 0.0)

{

i\_iter = -1;

return 0;

}

for ( i = 1; i <= 1000; i++ )

{

xc = ( xa + xb ) / 2.;

fc = pf( xc );

if( fa \* fc < 0. )

{

xb = xc;

fb = fc;

}

else

{

xa = xc;

fa = fc;

}

if ( fabs(fc) < eps && fabs(xb-xa) < eps)

break;

}

i\_iter = i;

return xc;

}

double gx(double x){

return(cos(x)-x);

}

Question 1

I created the file to which I wrote the tolerable error and corresponding number of iterations.

FILE \*fp=fopen("bisec\_data.txt","w");

printf("Insert first boundary point: ");

scanf("%lf", &a);

printf("\nInsert second boundary point: ");

scanf("%lf", &b);

printf("\nInsert tolerable error: ");

scanf("%lf", &eps);

double solution = bisec(a, b, gx, eps);

printf("\nSolution is: %lf",solution);

printf("\nNumber of iterations: %d", i\_iter);

int power = -3;

for(int i = 0; i < 18; i++){

eps = pow(2,power);

solution = bisec(a, b, gx, eps);

fprintf(fp,"2^%d\t%d\n", power, i\_iter);

power = power - 1;

}

fclose(fp);

Question 2

Question 3

double secant( double xa, double xb, double (\*pf)(double), double eps)

{

int i;

double fa, fb, xc, fc;

fa = pf(xa);

fb = pf(xb);

if ( fa \* fb > 0.0)

{

i\_iter = -1;

return 0;

}

for ( i = 1; i <= 100000; i++ )

{

xc = xb-fb\*(xb-xa)/(fb-fa);

fc = pf( xc );

if( fa \* fc < 0. )

{

xb = xc;

fb = fc;

}

else

{

xa = xc;

fa = fc;

}

if ( fabs(fc) < eps)

break;

}

i\_iter = i;

return xc;

}

double newton( double xa, double (\*pf)(double), double(\*pff)(double), double eps)

{

int i;

double fa, fpa, xc, fc;

fa = pf(xa);

fpa = pff(xa);

for ( i = 1; i <= 100000; i++ )

{

xc = xa - fa/fpa;

fc = pf( xc );

xa = xc;

if ( fabs(fc) < eps)

break;

}

i\_iter = i;

return xc;

}

Question 4

I created global variable w and modified g function. I created new file in which I saved data.

for(int i = 0; i < 146; i++){

solution = bisec(a, b, gx, eps);

fprintf(f,"%lf\t%lf\n", w, solution);

w += 0.1;

}

Question 5