

MA204: Assignment 1

Md Shabbir Jamal

Department of Computer Science and Engineering
BIT, Mesra, Ranchi
btech10026.20@bitmesra.ac.in

Question 1 : Find a simple root of $f(x) = 0$ using bisection method. Read the end points of the interval (a, b) in which the root lies, maximum number of iterations n and error tolerance ϵ .

1. $f(x) = x^3 + 4x^2 - 10$

taking $a = 1$; as $f(1) < 0$,
 $b = 2$; as $f(2) > 0$

```
#include<iostream>
#include<iomanip>
#include<math.h>
using namespace std;

typedef long double ldb;
ldb eps = 0.0000001;

ldb f(ldb x)
{
    return pow(x,3) + 4*pow(x,2) - 10;
}

int main()
{
    ldb st = 0;
    ldb lt = 0;
    cout<<"Enter a : ";
    cin>>st;
    cout<<"Enter b : ";
    cin>>lt;
    ldb value = f((st + lt)/2);
    int iteration = 0;

    while(abs(value) > eps)
    {
        iteration++;
        if(value*f(st) < 0)
        {
            lt = (st + lt)/2;
        }
        if(value*f(lt) < 0)
        {

```

```

        st = (st + lt)/2;
    }
    value = f((st + lt)/2);
}
cout<<"Root of the Equation (x^3 + 4x^2 - 10) : { x = ";
cout<<fixed<<setprecision(3)<<(st + lt)/2<<" }"<<endl;
cout<<"Root found in "<<iteration<<" iterations"<<endl;
cout<<"Error % : "<<(abs(1.365 - (round(((st+lt)/2)*1000.0)/1000.0))/1.365)*100<<endl;
return 0;
}

```

Output

```

Enter a : 1
Enter b : 2
Root of the Equation (x^3 + 4x^2 - 10) : { x = 1.365 }
Root found in 25 iterations
Error % : 0.000

```

2. $f(x) = \cos x - xe^x$

taking $a = 0$; as $f(0) > 0$,

$b = \pi/2$; as $f(\pi/2) < 0$

```

#include<iostream>
#include<iomanip>
#include<math.h>
using namespace std;

typedef long double ldb;
ldb eps = 0.000000000001;
#define pi 3.14159265358979323846

ldb f(ldb x)
{
    return cos(x) - x*exp(x);
}

int main()
{
    ldb st = 0;
    ldb lt = 0;
    cout<<"Enter a : ";
    cin>>st;
    cout<<"Enter b : ";
    cin>>lt;
    lt = ldb(lt)/2;
    int iteration = 0;
    ldb value = f((st + lt)/2);
    while(abs(value) > eps)
    {
        iteration++;
        if(value*f(st) < 0)

```

```

    {
        lt = (st + lt)/2;
    }
    if(value*f(lt) < 0)
    {
        st = (st + lt)/2;
    }
    value = f((st + lt)/2);
}
cout<<"Root of the Equation (cos(x) - xe^x) : { x = ";
cout<<fixed<<setprecision(3)<<(st + lt)/2<<" }"<<endl;
cout<<"Root found in "<<iteration<<" iterations"<<endl;
cout<<"Error % : "<<(abs(0.518 - (round(((st+lt)/2)*1000.0)/1000.0))/0.518)*100<<endl;
return 0;
}

```

Output

```

Enter a : 0
Enter b : 3.14159265358979323846
Root of the Equation (cos(x) - xe^x) : { x = 0.518 }
Root found in 37 iterations
Error % : 0.000

```