

Chittagong Independent University (CIU)



School of Science & Engineering (SSE)

Lab Report

Course title : Numerical Methods for Engineering
Course code : CCR250L
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Submitted to	Submitted by
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Problem Statement / Problem description: Implementation of bisection method.

Objectives of the lab: To find the roots of nonlinear equations using Bisection method

Derivation of the method:

The bisection method is an approximation method to find the roots of the given equation by repeatedly dividing the interval. This method will divide the interval until the resulting interval is found, which is extremely small.

Algorithm :

- Start
- Read a, b, e=0.001
Here a and b are initial guesses $[x^2 - 3]$
e is the absolute error i.e. the desired degree of accuracy*
- Compute: $f_1 = f(a)$ and $f_2 = f(b)$
- If $(f_1 * f_2) > 0$, then display initial guesses are wrong and goto (11).
Otherwise continue.
- $c = (a + b) / 2$
- If $([a - b] < e)$, then display c and goto (11).
* Here [] refers to the modulus sign. *
- Else, $f = f(c)$
- If $((f * f_1) > 0)$, then $a = c$ and $f_1 = f$.
- Else, $b = c$ and $f_2 = f$.
- Goto (5).
Now the loop continues with new values.
- Stop

Source code:

```
#include <stdio.h>
#include <stdlib.h>
#include <math.h>
float fun(float a);
char* update;
void main(){
float a,b,e,f1,f2,c,f;

printf("a:");
scanf("%f",&a);
printf("b:");
scanf("%f",&b);
printf("e:");
scanf("%f",&e);

f1=fun(a);
f2=fun(b);

if((f1*f2)>0){
printf("You guess wrong interval.");
return;
}else{
```

```
printf("|%-5sa%4s|%-5sb%4s|%-3sf(a)%3s|%-3sf(b)%3s|%-5sc%4s|%-3sf(c)%  
3s|update|%-1snew(b-a)%1s|\n",,,,,,,);
```

```
    do{  
c=(a+b)/2;  
f=fun(c);  
if(f*f1>0){  
    a=c;  
    update="a=c";  
    f1=f;  
}else{  
    b=c;  
    update="b=c";  
    f2=f;  
}  
}
```

```
printf("|%-10f|%-10f|%-10f|%-10f|%-10f|%-10f|%-6s|%-10f|\n",a,b,f1,f2,c,f,upda  
te,b-a);
```

```
}while(fabs(b-a)>=e);
```

```
}
```

```
//printf("f1=%f",f1);
```

```
}
```

```
float fun(float a){
float k;
k=(a*a)-3;
return k;
}
```

Sample input/ output (Snapshot):

```
"D:\Autumn2022\Numerical Lab\bisection.exe"
a:1
b:2
e:0.0001
```

```
"D:\Autumn2022\Numerical Lab\bisection.exe"
a:1
b:2
e:0.0001
```

a	b	f(a)	f(b)	c	f(c)	update	new(b-a)
1.500000	2.000000	-0.750000	1.000000	1.500000	-0.750000	a=c	0.500000
1.500000	1.750000	-0.750000	0.062500	1.750000	0.062500	b=c	0.250000
1.625000	1.750000	-0.359375	0.062500	1.625000	-0.359375	a=c	0.125000
1.687500	1.750000	-0.152344	0.062500	1.687500	-0.152344	a=c	0.062500
1.718750	1.750000	-0.045898	0.062500	1.718750	-0.045898	a=c	0.031250
1.718750	1.734375	-0.045898	0.008057	1.734375	0.008057	b=c	0.015625
1.726563	1.734375	-0.018982	0.008057	1.726563	-0.018982	a=c	0.007813
1.730469	1.734375	-0.005478	0.008057	1.730469	-0.005478	a=c	0.003906
1.730469	1.732422	-0.005478	0.001286	1.732422	0.001286	b=c	0.001953
1.731445	1.732422	-0.002097	0.001286	1.731445	-0.002097	a=c	0.000977
1.731934	1.732422	-0.000406	0.001286	1.731934	-0.000406	a=c	0.000488
1.731934	1.732178	-0.000406	0.000440	1.732178	0.000440	b=c	0.000244
1.731934	1.732056	-0.000406	0.000017	1.732056	0.000017	b=c	0.000122
1.731995	1.732056	-0.000195	0.000017	1.731995	-0.000195	a=c	0.000061

```
Process returned 86 (0x56)   execution time : 88.519 s
Press any key to continue.
```

Application of the method:

- Scientific programing
- Modeling of airflow over airoplane bodies
- Estimation of ocean current
- Electromagnetics

Discussion:

Using bisection method we can find roots of a function. It is a very effective method.