

## TITLE : TO CALCULATE ROOT OF GIVEN EQUATION USING BISECTION METHOD

### THEORY :

This method depends on intermediate value property of an equation which states that if a function,  $y=f(x)$  is continuous between interval  $[a, b]$  such that its functional value is opposite in direction at the end points, then there must exist at least one point (at which  $f(c) = 0$ ).

Consider a function  $y=f(x)$ , which is continuous between  $[a, b]$  such that their functional value at end point  $f(a)$  and  $f(b)$  has opposite sign satisfying intermediate value property as shown in figure.

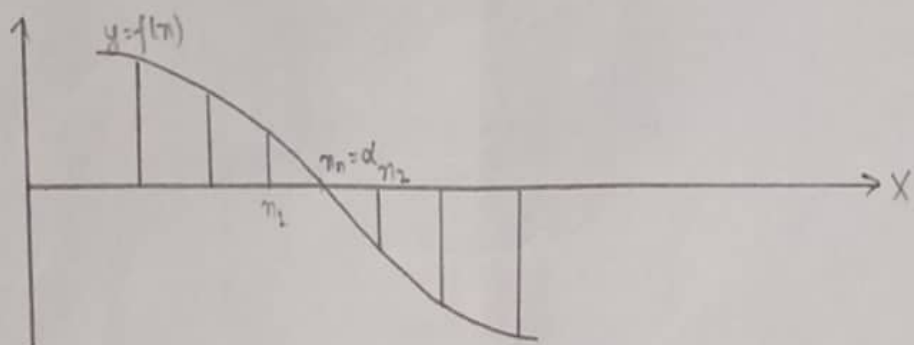


Fig. Graphical representation of bisection method

Then its root by bisection method is given by,  $x_0 = \frac{a+b}{2}$  ----- (i)

If  $f(x_0) = 0$ , then root of the equation lies at  $x = x_0$ , otherwise root may be either at interval  $[a, x_0]$  or  $[x_0, b]$  satisfying intermediate value property. Then better next root is calculated by using (i) for corresponding interval.

This process is repeated until we get the value of root correct upto desired accuracy i.e.  $|b-a| < \epsilon$ . Hence, the method is called bisection method.

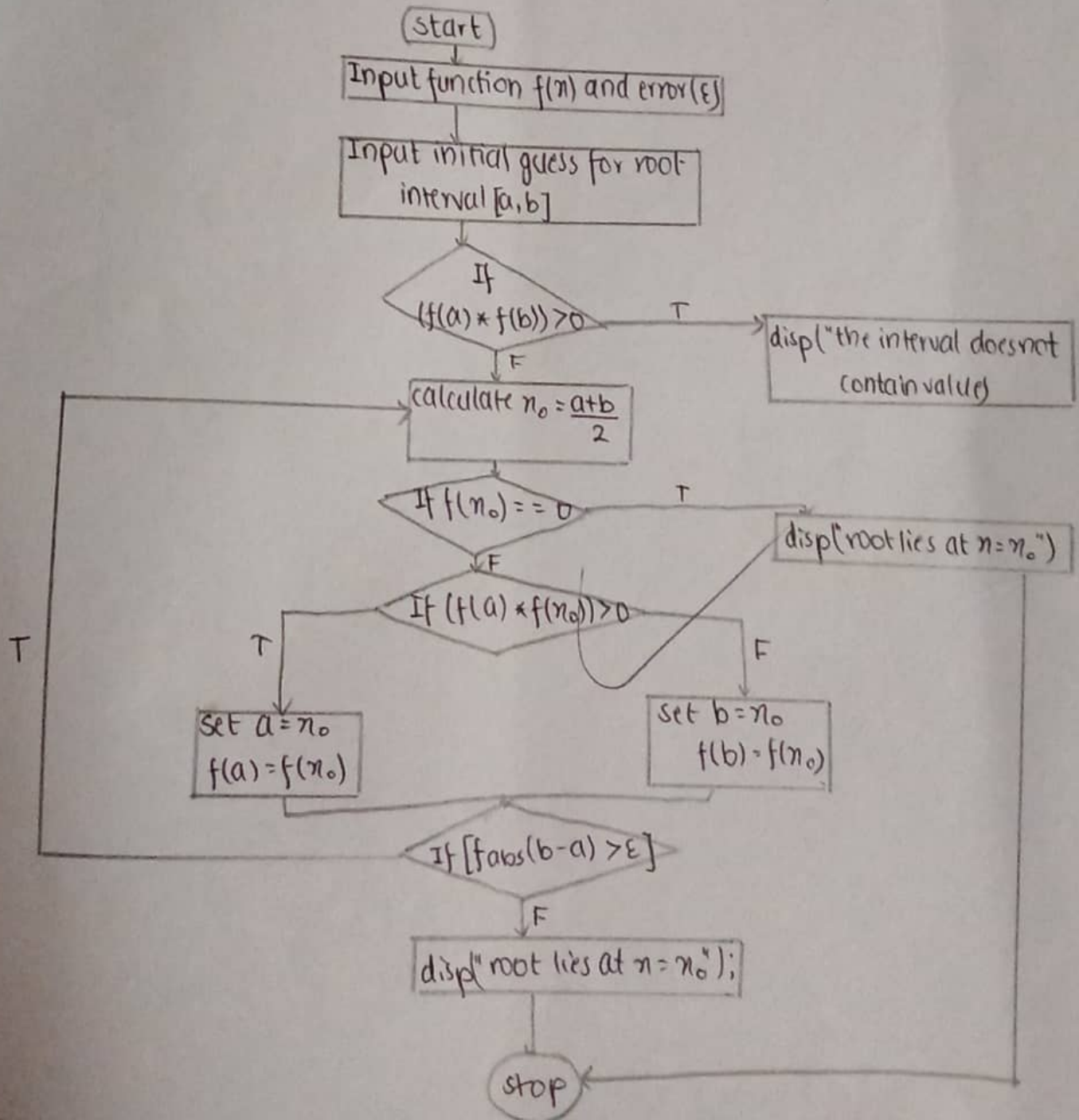
The convergence of bisection method is given by,

$$N \geq \frac{\log_{10} \left( \frac{|b-a|}{\epsilon} \right)}{\log_{10} 2} \text{ ----- (ii)}$$

### Algorithm:

- 1) Input the function  $f(x)$  and error ( $\epsilon$ ).
- 2) Input the initial guess for root interval  $[a, b]$ .
- 3) If  $(f(a) \times f(b) > 0)$  then,  
    disp("the interval doesnot contain root value")  
    Goto step 2  
    end
- 4) calculate root  $x_0 = \frac{a+b}{2}$
- 5) If  $(f(x_0) == 0)$  then, disp("root lies at  $x = x_0$ ")  
    Goto step 8  
    end
- 6) If  $(f(a) \times f(x_0) > 0)$   
    then set,  $a = x_0$ ;  $f(a) = f(x_0)$ ;  
    else set  $b = x_0$ ;  $f(b) = f(x_0)$ ;  
    end
- 7) If  $(\text{fabs}(b-a) > \epsilon)$  Goto step 4  
    else print ("root lies at  $x = x_0$ ");  
    end
- 8) stop

### Flow Chart:



code :

```
close all;  
clear variables;  
clc;
```

%Function declaration section

```
funct = input('Enter the function f(n) = ');  
f = inline(funct);  
disp(f);  
E = 0.0005;
```

%User Input Section

```
a = input('Enter the starting point of root interval a = ');  
b = input('Enter the end point of root interval b = ');  
fa = f(a);  
fb = f(b);
```

end

```
%out = [a, fa, b, fb];
```

```
%disp(out);
```

```
n = (a+b)/2
```

```
f fn = f(n);
```

```
disp(' _____ ');
```

```
disp('a    f(a)    b    f(b)    n=(a+b)/2    f(n) ');
```

```
disp(' _____ ');
```

```
out = [a, fa, b, fb, n, fn];
```

```
disp(out);
```

```
while (abs(b-a) > E)
```

```
    if (fa * fn > 0)
```

```
        a = n;
```

```
        fa = fn;
```

```
    else
```

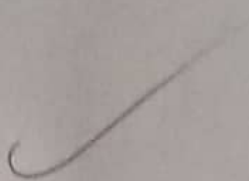
```
        b = n;
```

```
        fb = fn;
```

```
    end
```

conclusion

The Bisection Method was successfully implemented to find the root of given eq<sup>n</sup>.



~~3/05~~