

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 exists at least one point  $c$  (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.

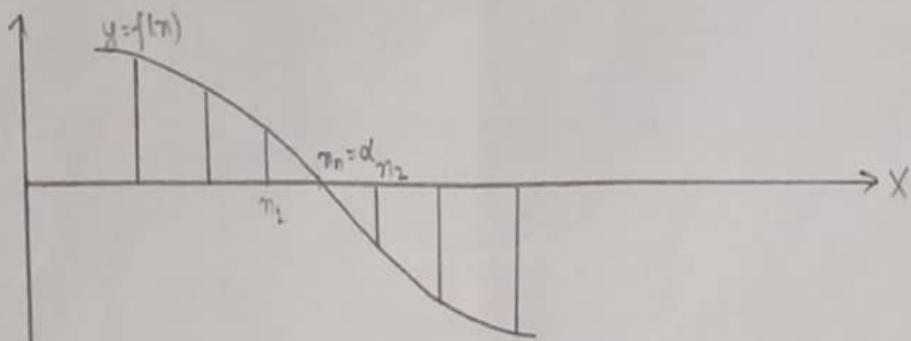


Fig. Graphical representation of bisection method

Then its root by bisection method is given by,  $n_0 = \frac{a+b}{2}$  ----- ①

If  $f(n_0)=0$ , then root of the equation lies at  $x=n_0$ , otherwise root may be either at interval  $[a, n_0]$  or  $[n_0, b]$  satisfying intermediate value property.

Then better next root is calculated by using ① 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,

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

### Algorithm:

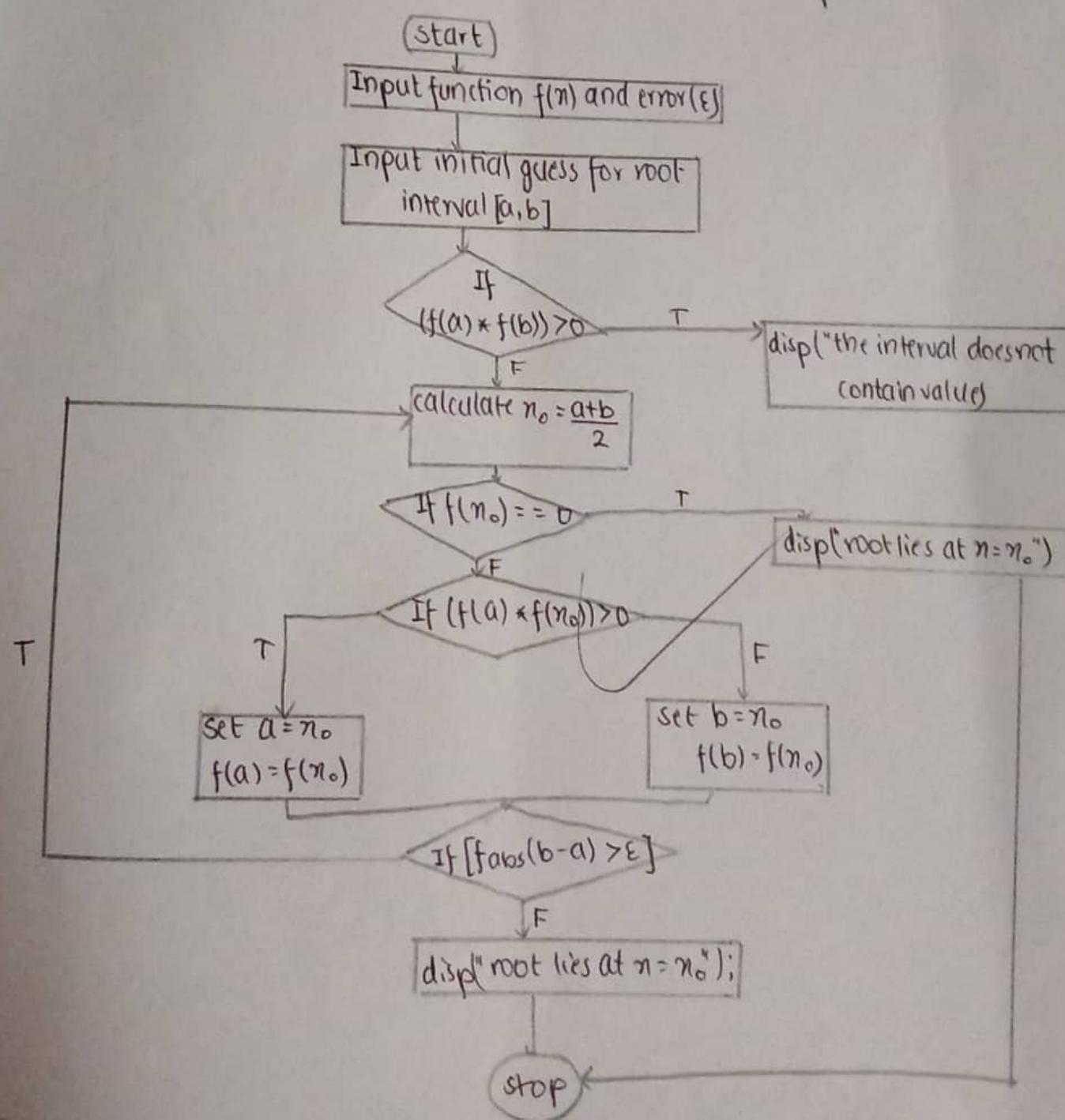
- 1) Input the function  $f(n)$  and error ( $\epsilon$ ).
- 2) Input the initial guess for root interval  $[a, b]$ .
- 3) If  $(f(a) * f(b) > 0)$  then,
 

disp ("the interval does not contain root value")

Goto step 2

end
- 4) calculate root  $n_0 = \frac{a+b}{2}$
- 5) If  $(f(n_0) == 0)$  then, disp ("root lies at n =  $n_0$ ")
- 6) If  $(f(a) * f(n_0) > 0)$   
then set,  $a = n_0$ ;  $f(a) = f(n_0)$ ;
- 7) If  $(f(a) * f(n_0) < 0)$   
else set  $b = n_0$ ;  $f(b) = f(n_0)$ ;
- 8) If  $(|f(b) - f(a)| > \epsilon)$  Goto step 4  
else print ("root lies at n =  $n_0$ ")
- 9) end
- 10) 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
fn 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 labs(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 eqn.

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