ASSIGNMENT NO:6 **DATE:27/02/2015**

PROGRAM STATEMENT:Solve the equation x^3-9x+1=0 for the root lying between 2 and 3 ,correct upto 3 significant figures.

THEORY: It is an iterative method and is based on a well known theorem which states that if f(x) be a continuous function in a closed interval [a,b] and f(a)f(b)<0 ,then there exists b at least one real root of the equation f(x)=0,between a and b. If further f '(x) exists and f '(x) maintains same sign in same [a,b] i.e. f(x) is strictly monotonic ,then there is only one real root of f(x)=0 in [a,b].The method of bisection is nothing but a repeated application of the tabulation theorem.

Let the interval [$a_{0,}b_0$] be divide into two equal parts by x_1 ,i.e. X_1 =(a_0+b_0)/2 and f(x_1) is calculated .If f(x_1)=0 ,then x_1 is exact root of f(x_0) =0. preceding in this manner ,we find x_{n+1}=(a_n+b_n)/2 which is the (n+1) th approximate of the root α of f(x)=0 an lies in interval [a_n , b_n] where b_{n-} a_n=(b_0-a_0)/2^n and a_0<=a_n<b_n<=b_0 for all n.

PROGRAM CODE:

```
//C Program to find the Soln of an Equation using Bisection Method
#include <stdio.h>
#include <math.h>
double eq(double x)
{
      return (pow(x,3)-9*x+1);
}
double mod(double x)
{
      if(x<0)
            return -x;
      else
            return x;
}
double error(int a)
{
      return 5*pow(10,-a-1);
}
int main()
{
      int i=0;
      double a,b,x,e,f;
      printf("The equation we are solving is->   x^3-9*x+1=0\n");
      printf("Enter value of a::");
      scanf("%lf",&a);
      printf("Enter value of b::");
      scanf("%lf",&b);
      x=(a+b)/2;
      printf("You need the answer correct upto how many decimal 
places? ::");
      scanf("%lf",&e);
      e=error(e);
      if((eq(a)>0&&eq(b)<0)||(eq(b)>0&&eq(a)<0))//Condition that proves 
that the result lies between a and b
      {
            printf("n\ta(n)\t\t\tb(n)\t\t\tx(n+1)\t\t\tf(x(n+1))\n");
            while((mod(a-b)>e)||(mod(b-x)>e)||(mod(x-a)>e))
            {
                  x=(a+b)/2;
```

```
                f=eq(x);
                printf("%d\t%lf\t\t%lf\t\t%lf\t\t%lf\n",i++,a,b,x,f);
                if(f>0)
                    b=x;
                else if(f<0)
                    a=x;
                else
                    break;
            }
            printf("The root is %lf\n",x);
        }
        else
        {
            printf("The result doesn't lie between a and b. Program
Terminated.\n");
        }
        return 0;
}
```

OUTPUT:

```
The equation we are solving is->x^3-9*x+1=0
Enter value of a::2
Enter value of b::3
You need the answer correct upto how many decimal places? ::3
n     a(n)            b(n)            x(n+1)              f(x(n+1))
0     2.000000        3.000000        2.500000        -5.875000
1     2.500000        3.000000        2.750000        -2.953125
2     2.750000        3.000000        2.875000        -1.111328
3     2.875000        3.000000        2.937500        -0.090088
4     2.937500        3.000000        2.968750        0.446259
5     2.937500        2.968750        2.953125        0.175922
6     2.937500        2.953125        2.945312        0.042378
7     2.937500        2.945312        2.941406        -0.023990
8     2.941406        2.945312        2.943359        0.009160
9     2.941406        2.943359        2.942383        -0.007423
10    2.942383        2.943359        2.942871        0.000867
The root is 2.942871
```