Name : Deepankar Sharma

Course: BCA

University Roll No: 2092014

Student Id : 20041299

Semester: 3

Date: September 11, 2021

**Practical No:04 Iteration Method**

**Objective:** To find root of the equation using Iteration method.

**2. Algorithm:**

1. Start

2. Define function as f(x)

3. Define convergent form g(x)

4. Input:

a. Initial guess x0

b. Tolerable Error e

c. Maximum Iteration N

5. Initialize iteration counter: step = 1

6. Do

x1 = g(x0)

step = step + 1

If step > N

Print "Not Convergent"

Stop

End If

x0 = x1

While abs f(x1) > e

7. Print root as x1

1. Stop
2. **Code:**

#include <stdio.h>

#include <math.h>

#include <stdlib.h>

#define phi(x) (7 + log10(x)) / (2)

// double differential(float x0)

// {

//     double grad = phi(x0 + 0.0000001 \* x0) - phi(x0);

//     grad /= (0.0000001 \* x0);

    // printf("gradient= %f\n", grad);

    // if (grad < 0)

    // {

    //     grad = grad - 2 \* grad;

    // }

    // printf("|gradient|= %f\n", grad);

    // return grad;

// }

double differential(double x0)

{

    const double delta = 1.0e-10;

    double x1 = x0 - delta;

    double x2 = x0 + delta;

    double y1 = phi(x1);

    double y2 = phi(x2);

    double grad= (y2 - y1) / (x2 - x1);

    printf("gradient= %f\n", grad);

    if (grad < 0)

    {

        grad = grad - 2 \* grad;

    }

    printf("|gradient|= %f\n", grad);

    return grad;

}

int main()

{

    int k = 0;

    double x1, x0;

    double allErr;

    printf("Enter the allowed Error: ");

    scanf(" %lf", &allErr);

    int i1, i2;

    printf("Enter the interval lower limit: ");

    scanf(" %d", &i1);

    printf("Enter the interval upper limit: ");

    scanf(" %d", &i2);

    printf("\nEnter the initial guess x0: ");

    scanf("%lf", &x0);

    {

        if (x0 <= i2 && x0 >= i1)

        {

            double grad = differential(x0);

            if (grad <= 1)

            {

                x1 = x0;

                do

                {

                    k++;

                    x0 = x1;

                    x1 = phi(x0);

                    printf("x after iteration %d is: %lf\n", k, x1);

                } while (fabs(x1 - x0) > allErr);

            }

            else

            {

                printf("|gradient|=%f is not less than 1, Hence cannot apply Iteration Method !!!!\n", grad);

                exit(0);

            }

            printf("\n\nOne root is %lf obtained at %d th iteration \n", x1, k);

        }

        else

        {

            printf("You entered wrong initial guess, needed something between %d and %d !!!", i1, i2);

        }

    }

}

**4. Output:**

Enter the allowed Error: 0.0001

Enter the interval lower limit: 0

Enter the interval upper limit: 1

Enter the initial guess x0: 1

gradient= 0.217146

|gradient|= 0.217146

x after iteration 1 is: 3.500000

x after iteration 2 is: 3.772034

x after iteration 3 is: 3.788288

x after iteration 4 is: 3.789221

x after iteration 5 is: 3.789275