CBNST LAB PRACTICAL

Date: September 14, 2021

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Bisection Method

Algorithm:

1. Start

2. Define function f(x)

3. Input
    a. Lower and Upper guesses x0 and x1
    b. tolerable error e

4. If f(x0)*f(x1) > 0
    print "Incorrect initial guesses"
    goto 3
  End If

5. Do
    x2 = (x0+x1)/2

    If f(x0)*f(x2) < 0
        x1 = x2
    Else
        x0 = x2
    End If

  while abs(f(x2) > e

6. Print root as x2

7. Stop

Code:

```c
#include <stdio.h>
#include <math.h>
#include <stdlib.h>

#define phi(x) (pow(2.718282, -1 * x) - sin(x))
```

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```
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);

    // printf("gradient= %f\n", grad);
    return (y2 - y1) / (x2 - x1);
    // return (pow(-2.718282, -1*x)-cos(x));
}

int main()
{
    int k = 0;
    double x1, x0, f0, f1, x2, f2;
    int step = 1, N;
    double allErr;

    printf("Enter the allowed Error: ");
    scanf(" %lf", &allErr);
    printf("Enter the interval lower limit (initial guess 'a'): ");
    scanf(" %lf", &x0);
    printf("Enter the interval upper limit (initial guess 'b'): ");
    scanf(" %lf", &x1);

    f0 = phi(x0);
    f1 = phi(x1);
    if (f0 * f1 > 0.0)
    {
        printf("\n\nIncorrect Initial Guesses !!!!!!\n");
    }

    printf("Enter maximum iteration:  ");
    scanf("%d", &N);
    {
        {
            printf("\nStep\t\ta\t\tb\t\tf(a)\t\tf(b)\t\tc=(a+b)/2\
t\tf(c)\n\n");
```

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```
            do
            {
                x2=(x0+x1)/2;
                f2= phi(x2);

                printf("%d\t\t%f\t%f\t%f\t%f\t%f\t%f\n", step, x0, x1, f0, f1, x2, f2);

                step = step + 1;

                if (step > N)
                {
                    printf("%d iterations Completed !!!!!\n", N);
                    exit(0);
                }

                if (f0 * f2 < 0)
                {
                    x1 = x2;
                    f1 = f2;
                }
                else
                {
                    x0 = x2;
                    f0 = f2;
                }

            } while (fabs(f1) > allErr);

            printf("\nRoot is: %f\n", x1);
        }
    }
}
```

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