IS5306: NUMERICAL METHODS

TAKE HOME ASSIGNMENT 1

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PROBLEM

Find the roots of the Nonlinear Equation $\sin(x) + x^2 - 1 = 0$ with an error less than 0.0001. Newton - Raphson method was used to solve this problem using MATLAB Software.

MATLAB CODE

```
clc
clear

n = 0; % Iteration counter
x = 0.5; % Initial guess, can be adjusted based on the problem
error = 1; % Initial error
tol = 0.0001; % Tolerance

% Function and its derivative
f = @(x) sin(x) + x^2 - 1;
f_deri = @(x) cos(x) + 2*x;

while error > tol
    f1 = f(x);
    f2 = f_deri(x);
    x_n = x - (f1 / f2);
    error = abs(x_n - x);
    x = x_n;
    fprintf('\nn = %i', n)
    fprintf('\nx_%i = %f', n, x)
    fprintf('\nfx = %f', f1)
    fprintf('\nf-derivative = %f', f2)
    n = n + 1;
end

fprintf('\nx_%i =%f',n-1,x)
```

SIMULATION USING MATLAB

```
clc
clear

n = 0; % Iteration counter
x = 0.5; % Initial guess, can be adjusted based on the problem
error = 1; % Initial error
tol = 0.0001; % Tolerance

% Function and its derivative
f = @(x) sin(x) + x^2 - 1;
f_deri = @(x) cos(x) + 2*x;

while error > tol
    f1 = f(x);
    f2 = f_deri(x);
    x_n = x - (f1 / f2);
    error = abs(x_n - x);
    x = x_n;
    fprintf('\nn = %i', n)
    fprintf('\nx_%i = %f', n, x)
    fprintf('\nfx = %f', f1)
    fprintf('\nf-derivative = %f', f2)
    n = n + 1;
end

fprintf('\nx_%i =%f',n-1,x)
```

Figure 1: MATLAB simulation

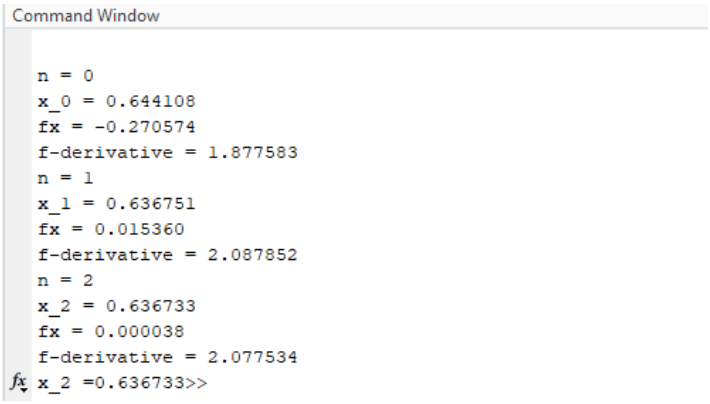

Figure 2: MATLAB program output

SOLUTION

According to the MATLAB simulation,

The root of the Nonlinear Equation $\sin(x) + x^2 - 1 = 0$ = 0 is 0.636733

Accuracy = 1.8 × 10-5

Number of iterations = 03