# Lab Assignment MA 322

**Name – Anubhav Bajaj**

**Roll no. – 190123007**

**Lab no. – 02**

## Q1

| n | x1 | x2 | f1(x1,x2) | f2(x1,x2) |
|---|---|---|---|---|
| 1 | 1.000000 | 2.000000 | -0.090703 | 0.167706 |
| 2 | 1.079665 | 1.945385 | -0.002695 | 0.017268 |
| 3 | 1.086138 | 1.943714 | -0.000045 | 0.000091 |
| 4 | 1.086187 | 1.943685 | -0.000045 | 0.000091 |

## Q2

### Using Newton method

| n | x | f(x) | p |
|---|---|---|---|
| 1 | 2.000000 | 2.430000 | 1.065711 |
| 2 | 1.608696 | 0.675055 | 1.051845 |
| 3 | 1.376944 | 0.182306 | 1.035299 |
| 4 | 1.246095 | 0.047940 | 1.021342 |
| 5 | 1.175348 | 0.012350 | 1.011889 |
| 6 | 1.138315 | 0.003139 | 1.006301 |
| 7 | 1.119328 | 0.000792 | 1.003247 |
| 8 | 1.109708 | 0.000199 | 1.001649 |
| 9 | 1.104865 | 0.000050 | 1.000831 |
| 10 | 1.102435 | 0.000012 | 1.000417 |
| 11 | 1.101218 | 0.000003 | 1.000209 |
| 12 | 1.100609 | 0.000001 | 1.000105 |
| 13 | 1.100305 | 0.000000 | 1.000052 |
| 14 | 1.100152 | 0.000000 | 1.000026 |
| 15 | 1.100076 | 0.000000 | 0.000000 |
| 16 | 1.100038 | 0.000000 | 0.000000 |

### Using Modified Newton method

| n | x | f(x) | p |
|---|---|---|---|
| 1 | 2.000000 | 2.430000 | 1.795807 |
| 2 | 1.217391 | 0.030557 | 1.978577 |
| 3 | 1.103027 | 0.000019 | 0.000000 |
| 4 | 1.100002 | 0.000000 | 0.000000 |

## Code

## Q1

```
clear all;
f1 = @(x1,x2) sin(x1*x2) + x1 - x2;
f2 = @(x1,x2) x2*cos(x1*x2) + 1;
a = [1;2];

Newton(a,f1,f2);
function Newton(a,f1,f2)
    syms x y;
    F = jacobian([f1(x,y),f2(x,y)],[x y]);
    fprintf('%2s %15s %15s %15s %15s \n', 'n', 'x1', 'x2', 'f1(x1,x2)',
'f2(x1,x2)');
    i = 1;
    a_old = [0;0];
    f = zeros(2,1);
    while(norm(a-a_old,Inf)>10^(-3))
        a_old=a;
        f(1) = f1(a(1),a(2));
        f(2) = f2(a(1),a(2));
        fprintf('%2d %15f %15f %15f %15f \n', i, a(1), a(2), f(1), f(2));
        A = subs(inv(F),{x,y},{a(1),a(2)});
        a = a - A*f;
        i=i+1;
    end
    fprintf('%2d %15f %15f %15f %15f \n', i, a(1), a(2), f(1), f(2));
end
```

## Q2

```
clear all;
clc;
clf;
close all;
f = @(x) (x-1.1)^2 * (x+1);

syms x
F = (x-1.1)^2 * (x+1);

X1 = Newton(f,F,2);
Y1 = modifNewton(f,F,2,2);
convert(X1);
convert(Y1);


function convert(X)
    fprintf('%s %20s %20s %20s\n','n','x','f(x)','p');
    for i = 1:height(X)
        if i<= (height(X) -2)
            X(i,4) = log10(  ( abs(1.1 - X(i+2,2))/abs(1.1 - X(i+1,2)) )  ) /
log10( abs(1.1 - X(i+1,2))/abs(1.1 - X(i,2)) )   ;
        else
            X(i,4) = 0;
        end
```

```
        fprintf('%2d %20f %20f %20f\n', X(i,1)+1, X(i,2), X(i,3), X(i,4));
    end
    fprintf('\n');

end

function  X = Newton(f,F,x)
    F = diff(F);
    i = 0;
    df = matlabFunction(F);
    %fprintf('%s %20s %20s\n','n','x','f(x)');
    while(abs(f(x))>1e-8)
        X(i+1,1)=i;
        X(i+1,2)=x;
        X(i+1,3)=f(x);
        %fprintf('%2d %20f %20f\n',i,x,f(x));
        x = x-(f(x)/df(x));
        i = i+1;
    end
    X(i+1,1)=i;
    X(i+1,2)=x;
    X(i+1,3)=f(x);
    %fprintf('%2d %20f %20f\n',i,x,f(x));
end

function X = modifNewton(f,F,x,p)
    F = diff(F);
    i = 0;
    df = matlabFunction(F);
    %fprintf('%s %20s %20s\n','n','x','f(x)');
    while(abs(f(x))>1e-6)
        X(i+1,1)=i;
        X(i+1,2)=x;
        X(i+1,3)=f(x);
        %fprintf('%2d %20f %20f\n',i,x,f(x));
        x = x-p*(f(x)/df(x));
        i = i+1;
    end
    X(i+1,1)=i;
    X(i+1,2)=x;
    X(i+1,3)=f(x);
    %fprintf('%2d %20f %20f\n',i,x,f(x));
end
```