Non Linear Optimisation I Assignment:

Function 1: Question 2.1

```
function [x,F,J,iter,status] = newton(Fun,x0,maxit,printlevel,tol)

x = x0;
count = 1;
status =0;
fh = str2func(Fun);

for i = 1:maxit

        [F_iter,J_iter] = fh(x);

        if (count < printlevel)
        fprintf('\n');
        fprintf('Iteration %d || Function Value : %f', i,norm(F_iter,'fro'));
        end

        if (i==1)
        F_x0 = F_iter;
        end

        x = x - J_iter\F_iter;

        if((norm(F_iter,'fro')/norm(F_x0,'fro')) < tol)
        status =1;
        break;
        end

        count = count + 1;

end

F = F_iter;
J = J_iter;
iter = i;
end
```

Function 2: Question 2.1
(test function)

```
function [F,J] = eigen_val_compute(x)

syms y

A =[4,2,1;2,3,0;1,0,1];
my_func = @(y) y.^2;

k = ones(size(A,1),1);
my_func = @(y) vertcat(A*y(1:end-1),(y(1:end-1)'.^2)*k) - [y(end)*y(1:end-1);1];

F = my_func(x);

J_1 = @(y) horzcat(vertcat(A -y(end)*eye(size(A)),2*y(1:end-1)'),vertcat(-y(1:end-1),0));
J = J_1(x);

end
```

Function 3: Question 2.2

```
function [F,J] = eigen_val_compute(x)

syms y

A =[4,2,1;2,3,0;1,0,1];

k = ones(size(A,1),1);
my_func = @(y) vertcat(A*y(1:end-1),(y(1:end-1)'.^2)*k) - [y(end)*y(1:end-1);1];

F = my_func(x);

J_1 = @(y) horzcat(vertcat(A -y(end)*eye(size(A)),2*y(1:end-1)'),vertcat(-y(1:end-1),0));
J = J_1(x);

end
```

Output:

Question 2.2

```
Iteration 1 || Function Value : 1.057544
Iteration 2 || Function Value : 3789.240280
Iteration 3 || Function Value : 947.170821
Iteration 4 || Function Value : 236.660090
Iteration 5 || Function Value : 59.062093
Iteration 6 || Function Value : 16.914112
Iteration 7 || Function Value : 22.397877
Iteration 8 || Function Value : 11.713604
Iteration 9 || Function Value : 3.012441
Iteration 10 || Function Value : 0.565416
Iteration 11 || Function Value : 0.051056
Iteration 12 || Function Value : 0.000620


x =

    0.4318
   -0.7331
    0.5255
    1.8218


F =

  1.0e-03 *

    0.0004
   -0.0006
    0.0005
    0.6200


J =

    2.1782  2.0000  1.0000  -0.4320
    2.0000  1.1782       0   0.7333
    1.0000       0  -0.8218  -0.5256
    0.8640  -1.4666  1.0513        0

iter =

     1
```

status =

1

Question 2.1

Iteration 1 || Function Value : 1.000000
Iteration 2 || Function Value : 0.250000
Iteration 3 || Function Value : 0.062500
Iteration 4 || Function Value : 0.015625
Iteration 5 || Function Value : 0.003906
Iteration 6 || Function Value : 0.000977
Iteration 7 || Function Value : 0.000244
Iteration 8 || Function Value : 0.000061
Iteration 9 || Function Value : 0.000015
Iteration 10 || Function Value : 0.000004

x =

3071/1024

F =

1/262144

J =

-1/256

iter =

10

status =

1