**Part I:**

1. **Least Squares Method:**
2. **.m file(Function Script):**

%Least Squares Method 'or Linear Least Squares Regression' is used to fit

%a dependent variable 'y for example' equal to some functions of the

%independent variables'x & u & v for example'.

%the functions are : y1=a0+a1\*x1+a2\*u1+a3\*v1

% y2=a0+a1\*x2+a2\*u2+a3\*v2

% y3=a0+a1\*x3+a2\*u2+a3\*v3

% .......................

% yn=a0+a1\*xn+a2\*un+a3\*vn

%in matrix form :

%X = [1,x1,u1,v1 ; 1,x2,u2,v2 ; ..... ; 1,xn,un,vn]

%a = [a0 ; a1 ; a2 ; a3]

%Y = [y1 ; y2 ; ..... ; yn]

%This Function fits y equal to a function of x only to obtain a line

%equation that has two constants (a0 & a1) in the 'a' matrix that can be

%evaluated by the equation : a = inv(X'\*X)\*X'\*Y

%File created by Ahmed M. Hemdan and it's allowable to be edited

function [a0,a1]=No\_2\_Least\_Squares\_Method(x,y)

X = [ones(length(x),1) x]; %first column treated as all ones since x\_1=1

Y = y; %column vector for proper dimension during multiplication

a = inv(X'\*X)\*X'\*Y; % Least Squares Estimator - equivalent code X\y

plot ( x , y , '\*'); % original data

a0=a(1);%intersection of the line

a1=a(2);%slope of the line

hold on;

plot( x , a0+a1\*x , 'r-' ); %Fitted line

legend('Data',['y=' num2str(a0) '+' num2str(a1) 'x'])

xlabel('X values');

ylabel('Y values');

end

1. **Function Test(Command Window Entries):**

>> x=(-5:.1:5)';

>> y=5.3+1.2\*x+randn(size(x));%line points in addition to some randomizations

>> [a0,a1]=No\_2\_Least\_Squares\_Method(x,y)%a0 & a1 must approximately equals 5.3 & 1.2

a0 =

5.2232

a1 =

1.1878

1. **Plotting:**

