Econ 512 HW 1

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1. Given the following vector of values $X = [1, 1.5, 3, 4, 5, 7, 9, 10]$ construct the values of the functions

$$Y1 = -2 + .5X$$

and

$$Y2 = -2 + .5X^2$$

and plot $Y1$and $Y2$ against X in a single graph.

Program

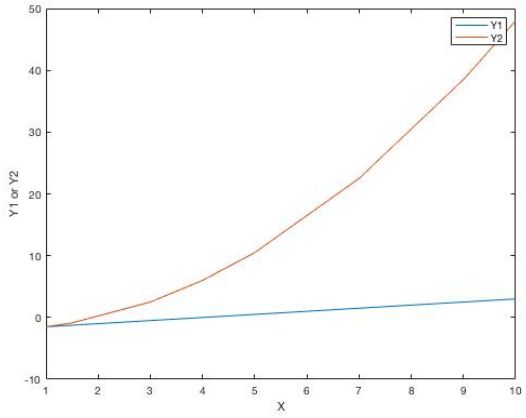
First construct function Y1 and Y2:

```
function [Y] = f1(X)
    Y = [];
    for i = 1:length(X)
        Y(i) = -2 + 0.5 * X(i);
    end
end

function [Y] = f2(X)
    Y = [];
    for i = 1:length(X)
        Y(i) = -2 + 0.5 * X(i)^2;
    end
end
```

Then, plot Y1 and Y2 against X:

```
X = [1, 1.5, 3, 4, 5, 7, 9, 10];
Y1 = f1(X);
Y2 = f2(X);

plot(X, Y1, X, Y2)
legend('Y1', 'Y2')
xlabel('X')
ylabel('Y1 or Y2')
```

The graph we get:



2. Create a 200x1 vector X containing evenly-spaced numbers between [-10, 20] and calculate the sum of the elements of the vector.

Program

```
% Generate a evenly spaced 200 * 1 vector

X = (linspace(-10, 20, 200))';

% Calculate the sum of the elements

S = sum(X);
```

The sum we get is 1000.

3. Given a matrix $A=\begin{bmatrix}2 & 4 & 6\\ 1 & 7 & 5\\ 3 & 12 & 4\end{bmatrix}$ and vector $b=\begin{bmatrix}-2\\ 3\\ 10\end{bmatrix}$. Calculate $C = A'b$, $D = (A'A)^{-1}b$, $E = \sum_i \sum_j [a_{ij}b_i]$, and F = matrix A with the 2nd row and 3rd column deleted. Solve the system of linear equations $Ax = b$ for the vector x.

Program

```
A = [2, 4, 6; 1, 7, 5; 3, 12, 4];

b = [-2; 3; 10];

% Calculate C
C = A' * b;

% Calculate D
D = inv(A' * A) * b;

% Calculate E
[m,n] = size(A);
E = 0;
for i = 1:m
    for j = 1:n
        E = E + A(i,j) * b(j);
    end
end

% Calculate F
F = A([1,3],[1:2]);

% Solve Ax = b
x = A\b;
```

The result we get:

```
C =

    29
   133
    43


D =

   -3.2505
    0.3961
    0.8037


E =

   207


F =

     2     4
     3    12


x =

   -0.1622
    1.2432
   -1.1081
```

4. Using the matrix A in problem 3, create a 15x15 block diagonal matrix $B = \begin{bmatrix} A & 0 & 0 & 0 & 0 \\ 0 & A & 0 & 0 & 0 \\ 0 & 0 & A & 0 & 0 \\ 0 & 0 & 0 & A & 0 \\ 0 & 0 & 0 & 0 & A \end{bmatrix}$ where 0 is a 3x3 matrix of zeros.

Program

```
A = [2, 4, 6; 1, 7, 5; 3, 12, 4];

B = blkdiag(A,A,A,A,A);
```

5. Create a 5x3 matrix of random draws from a normal distribution with mean= 10 and standard deviation=5. Call it A. Convert A to a matrix of zeros and ones where the element of the new matrix is 0 if $a_{ij} < 10$ and 1 if $a_{ij} \geq 10$.

Program

```
% Create A
A = normrnd(10, 5, 5, 3);

% Convert A to A_new
A_new = zeros(size(A));
[m,n] = size(A);
for i = 1:m
    for j = 1:n
        if A(i,j) < 10
            A_new(i,j) = 0;
        else
            A_new(i,j) = 1;
        end
    end
end
```

6. In the github repository `Homework1` for the class, you will find the file `datahw1.csv` that is a comma-delimited spreadsheet file that you will use to answer this question. The dataset constrains 4392 firm/year observations for Taiwanese manufacturing firms. The columns of the data matrix are (in order): (1) firm id, (2) year, (3) dummy variable equal to one if the firm is an exporter (Export), (4) dummy variable equal to one if the firm conducts R&D (RD), (5) productivity index (prod), (6) capital stock (cap). Construct the OLS estimator for the regression equation:

$$prod_{it} = \beta_0 + \beta_1 Export_{it} + \beta_2 RD_{it} + \beta_3 cap_{it} + \varepsilon_{it}$$

Report the point estimates and standard errors.

Program

```
A = csvread('datahw1.csv');
Export = A(:,3);
RD = A(:,4);
cap = A(:,6);
prod = A(:,5);
X = [zeros(size(A,1),1) + 1, Export, RD, cap];

% Compute OLS estimator
beta = inv(X' * X) * (X' * prod);

% Compute point estimates
prod_est = X * beta;

% Compute standard errors
stand_er = prod - prod_est;
```