Econ 512

Fall 2018

Solution to Homework 1 – Introduction/Review of Matlab Basics

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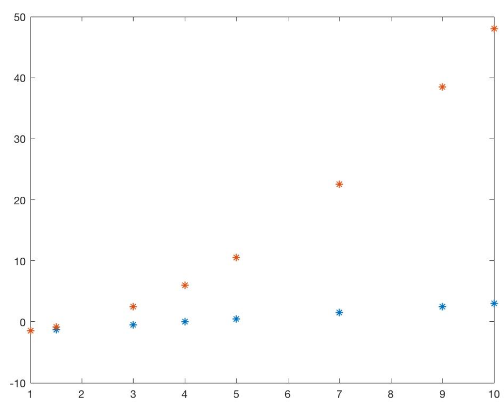
1. The matlab codes are given by:

```
X=[1 1.5 3 4 5 7 9 10];
Y1=-2+0.5*X;
Y2=-2+0.5*X.^2;
figure
plot(X,Y1,'*',X,Y2,'*')
```

The relationships between X and Y1, Y2 are plotted as:



The blue stars are for $Y1$ and the red stars for $Y2$.

2. The matlab codes are given by:

```
step=(20-(-10))/199;
X_2=-10:step:20;
s=sum(X_2)
```

The output which is the sum of the elements of generated vector is 1000.

3. The matlab codes are given by:

```
A=[2, 4, 6;
   1, 7, 5;
   3, 12, 4];
b=[-2; 3; 10];
C=A'*b
D=(A'*A)\b
E=sum(A)
F=A([1,3],1:2)
x=A\b
```

The output are: $C=\begin{bmatrix}29\\133\\43\end{bmatrix}$, $D=\begin{bmatrix}-3.2505\\0.3961\\0.8037\end{bmatrix}$, $E=205$, $F=\begin{bmatrix}2 & 4\\3 & 2\end{bmatrix}$ and the solution to $Ax=b$ is $x=\begin{bmatrix}-0.1622\\1.2432\\-1.1081\end{bmatrix}$.

4. The matlab codes are given by:

```
I=eye(5);
B=kron(I, A)
```

We use kronecker product to generate matrix B.

5. The matlab codes are given by:

```
A5= normrnd(10,5,5,3)
A5(A5<10)=0;
A5(A5>=10)=1;
disp(A5)
```

We use 'normrnd' to generate the matrix A and then convert it a new matrix by the above codes.

6. The matlab codes are given by:

```
M = csvread('datahw1.csv');
save('datahw1.mat','M');
load('datahw1.mat');
x1 =  M(:,3); % export
x2 = M(:,4);   % RD
y = M(:,5);   % prod
x3 = M(:,6); % capital
X=[x1 x2 x3];
% Since the matlab does not have a OLS regression function for multivariate
% regression that returns both the coefficients and their standard errors,
% I use a new function to find it.
[b_hat, se]= ols(y, X, 1)
```

The reported estimates and heteroskedastic standard errors are:
$\hat{\beta}_1$ =0.0817 , $\hat{\beta}_2$ =0.1201, $\hat{\beta}_3$ =0.1399, $\hat{\beta}_4$ =0.0295
$se(\hat{\beta}_1)$ =0.0193, $se(\hat{\beta}_2)$ =0.0061, $se(\hat{\beta}_3)$ =0.0089, $se(\hat{\beta}_4)$ =0.0020.

The function *ols* is given below:

```
function[b_hat, se] = ols(Y, X, hetero)
% Y - dependent variable
% X - regressors (without a constant)
% hetero - 1 if using heteroskedasticity and 0 if using homoskedisticity
    [n, ~] = size(X);

    if numel(Y) ~= n
        error('Incompatible data.')
    end

    % Get estimates
    X1 = [ones(n, 1) X]; XX1 = X1' * X1;
    b_hat = XX1 \ (X1' * Y);
    r_hat = Y - X1 * b_hat;

    % Get asyvar.
    switch hetero
        case 1
            X2 = bsxfun(@times, X1, r_hat);
            avar = XX1 \ (X2' * X2) / XX1;
        otherwise
            avar = (r_hat' * r_hat) * inv(XX1) / n;
```

```
    end

    se = sqrt(diag(avar));

end
```

Output file

```
Econ512_HW1

s =

        1000


C =

    29
   133
    43


D =

   -3.2505
    0.3961
    0.8037


E =

   205


F =

     2     4
     3    12


x =

   -0.1622
    1.2432
   -1.1081


B =

     2     4     6     0     0     0     0     0     0     0     0     0     0
0     0
     1     7     5     0     0     0     0     0     0     0     0     0     0
0     0
     3    12     4     0     0     0     0     0     0     0     0     0     0
0     0
```

```
     0     0     0     2     4     6     0     0     0     0     0     0     0
0     0
     0     0     0     1     7     5     0     0     0     0     0     0     0
0     0
     0     0     0     3    12     4     0     0     0     0     0     0     0
0     0
     0     0     0     0     0     0     2     4     6     0     0     0     0
0     0
     0     0     0     0     0     0     1     7     5     0     0     0     0
0     0
     0     0     0     0     0     0     3    12     4     0     0     0     0
0     0
     0     0     0     0     0     0     0     0     0     2     4     6     0
0     0
     0     0     0     0     0     0     0     0     0     1     7     5     0
0     0
     0     0     0     0     0     0     0     0     0     3    12     4     0
0     0
     0     0     0     0     0     0     0     0     0     0     0     0     2
4     6
     0     0     0     0     0     0     0     0     0     0     0     0     1
7     5
     0     0     0     0     0     0     0     0     0     0     0     0     3
12    4


A5 =

   24.5400    8.6377    8.2308
   14.1261   15.4921    5.8821
   16.8949    8.6106    2.1147
    4.7091   13.5077   12.5399
    7.6569   -0.2591   11.4099

     2     4     6
     1     7     5
     3    12     4


b_hat =

    0.0817
    0.1201
    0.1399
    0.0295


se =

    0.0193
    0.0061
    0.0089
    0.0020
```