Problem Set 1
Advanced Macroeconomics II
WISE, Xiamen University

March 1, 2015

The due date for this assignment is Monday, March 16. It needs to be delivered by 8 am before the lecture starts.

(Reference: This exercise has used part of the Matlab Tutorial of Prof. Eva Carceles-Poveda.)

Instruction: You can refer to the Matlab "help" function to get useful information and examples on the topics or functions that you are interested in. For getting started, some online resources are also useful. For example, this 9 page tutorial is a good introduction at http://www.math.siu.edu/matlab/tutorial1.pdf.

Suggestion for "writing" your homework: after making matlab exercises of the following questions, type the question number in a word file, copy and paste the answer that you obtained from Matlab behind the question. Try to better arrange your text and make a nice layout. Please hand in the printed version. Plagiarism is strictly forbidden. Once found, the score will be zero for all those who copied or to provide the copy. If Plagiarism is found multiple times (twice or more) this semester, the course score will be zero.

1. Determine the size of the following vectors and matrices. Enter them in Matlab and use the "whos" statement to check your results.

$$\begin{aligned} d &= [4, 1, 0, 1, -3] \\ h &= [-2\ 4;\ 6\ 3;\ 9\ 8;\ \text{-1}\ 5] \\ e &= [1\ 1;\ 2\ 3] \\ q &= [2\ 1\ 6\ ] \\ p &= [q;\ zeros(2,3);\ q] \\ p &= [q\ zeros(1,3)] \end{aligned}$$

2. Define a 4×5 matrix, $X = randn(4,5)$, then determine the content and size of the following matrices and check your results for content and size using Matlab.

$$\begin{aligned} u &= X(1:2,:) \\ v &= X(3,:) \\ w &= [X(2,:)\ X(1,:)] \\ a &= [0:-0.2:\ -1] \\ b &= [2:5;6:9] \end{aligned}$$

3. Create a diagonal matrix of dimension 3×3, where the diagonal elements are all equal to 1.

4. Define the matrix created in question 3 as A, do the following exercise on A independently (not sequentially).

   1) Add 1 to each element;

   2) Add 0.5 to just the odd elements of;

   3) Compute the square root of each element;

   4) Compute the square of each element;

   5) Find the sum of all elements;

   6) Find the mean of the elements

5. Let $A = \begin{bmatrix} 1 & 3 & 4 & 7 \end{bmatrix}'$, and $B = \begin{bmatrix} 3 & 2 & 1 & 7 \end{bmatrix}'$.

   1) Add the sum of the elements in A to B;

   2) Raise each element of A to the power specified by the corresponding element in B;

   3) Devide each element in A by the corresponding element in B and call it "C";

   4) Add up the elements in C.

6. Create a vector x with the following elements ...

   1) 1, 2, 6, 9, 13...

   2) 10, 8, 6, 4, 2, 0, -2, -4, -6, ...

   3) 1, 1/2, 1/3, 1/4, 1/5, 1/6...

   4) 0, 1/2, 2/3, 3/4, 4/5, 5/6

7. Define matrices A, B and C, where $A = pascal(4), B = magic(4)$, and $C = fix(10 * rand(4, 2))$. Do the following exercises:

   1) $X = B'$;

   2) $X = A * B$;

   3) $Y = B * A$ (Are X and Y equal?);

   4) $X = A * C$;

   5) $Y = C * A$; (Any problem?)

   6) Now enter the following into Matlab (then is D equal $A * B$?):

$$
\begin{aligned}
&D = zeros(4,4);\\
&for\ i = 1:4\\
&\qquad for\ j = 1:4\\
&\qquad\qquad D(i,j) = A(i,:) * B(:,j);\\
&\qquad end\\
&end
\end{aligned}
$$

8. Kronecker product. Define $X = [2\ 5; 3\ 4]$, and $I = eye(2)$, calculate:

   1) $A = kron(X, I)$;

   2) $B = kron(I, X)$.

Describe what the "kron()" function does.

9. Plot the functions x, x^2, e^x and e^{x^2} over the interval $0 < x < 2.9$. Put a title to each function and add some text inside the graphs.

10. Given x = [1 2 3 4 5 6 7 8 9], explain what the following commands "mean" by summarizing the net result of the command.

    1) x(4)

    2) x(2:7)

    3) x(1:end)

    4) x(1:end-1)

    5) x(6:-2:1)

    6) x(6:-1:2)

    7) sum(x)

11. Using the following loop:

```
if n>1
    m = n+2;
else
    m = n-3;
end
```

to find out:
1) n = 8, m = ?
2) n = 1, m = ?
3) n = - 2, m = ?

12. Using the following loop:

```
if z < 5
    w = 3*z;
elseif  z < 10
    w = 9 - z;
elseif  z < 60
   w = sqrt(z);
else
   w = z;
end
```

to find out:
1) z = 1, w = ?
2) z = 8, w = ?
3) z = 50, w = ?
4) z = 99, w = ?

13. Using the following loop:

```
T = 20;  z=1:1:T; w=zeros(1,T);
for j = 1:T
    w(j)= 3*z(j)+randn;
end
```

to find out:
1) mean of z,
2) mean of w.

14. Generate a time series $y_t = a + by_{t-1} + v_t$, $v_t \sim N(0, \sigma^2)$, and plot it. Assume $a = 0.2$, $b = 0.95$, and $\sigma^2 = 0.01$.

    1) Generate a vector V with size (100×1) of normal random variable with variance $\sigma^2 = 0.01$.

    2) Assume $y_0 = \bar{y} = \frac{a}{1-b}$, then v_t has been generated in the vector V, taking $v_t = V(t)$.

    3) Generate the series of y_t, by as many possible ways as you can think of.

    4) Plot the series y_t in a nice graph.

---

15. **Bonus question:** Find macroeconomic variables for China's economy and make preliminary treatment.

    1) Find the longest possible data for China's real GDP, real consumption and real investment, either annual or quarterly. Put them in a text file or excel file, and name it as "yci_cn". Write a description for your data with source, construction method, frequency, etc.
    2) Plot the raw data against the timeline in a graph with a 3×1 matrix layout, using the matlab command "subplot(3,1,i)", i = 1, 2, 3. Please provide title to your graph with matlab command.
    3) Take natural log of the raw data, and plot the logged data on a graph with a 3×1 matrix layout.
    4) Take first difference ($\Delta y_t = y_t - y_{t-1}$) of the logged data, and plot the differenced data on a graph with a 3×1 matrix layout. Please also plot the differenced data of all three series on one graph, and provides legends and line patterns to distinguish them.