Econ 613 Advanced Econometrics
MATLAB Session

1 Introduction

- MATLAB is a powerful computer programming language. It provides a data analysis environment based on a Matrix Programming Language which is ideal for mathematical and statistical applications. Softwares with similar purposes include GAUSS, Splus, R and Ox.

- MATLAB can run in the edit mode (or interactive mode), ie, executing one command at a time, interactively. It also runs in the command mode (or batch mode), ie, running a long MATLAB program with a series of MATLAB commands.

- The MATLAB editor is a very is flexible and power.

- A MATLAB program consists of statements and commands. If a statement ends with a semicolon (;) nothing is printed to the screen. If a statement ends without a semicolon (;) the value of the variable denoted will be printed to the screen. Here is a small example you can type in interactive mode

  x=3;

  x=3

  z=7;

  y=x+z;

  a=[1 2 3]

  a=[1; 2; 3]

- Routines (programs) in MATLAB end with the statement: return;
- Comments start with the sign %.
- Here is a small program that you can save in a file and execute.

2 Matrix Operations

- Summation and substraction of matrices can be done when the two matrices are of the same dimensions. The commands are

  a=[1 2 3; 4 5 6];

  b=[11 12 13;14 15 16];

  c=a+b;

  d=a-b;

- In linear algebra, matrix multiplications and matrix divisions should be done with care. The commands are

  a=[1 2 3; 4 5 6]; % a has 2 rows and 3 columns. Row 1 contains 1

  b=[2 1 0;1 3 1;0 1 4];

  c=a*b; % c will be a 2× 3 matrix

- If X is a T×K matrix, then the element in the i-th row and j-th column is : X(i,j). Scalars don't need indexes. Vectors need only one index.
- X(:, 1:2) refers to all rows, columns 1 through 2 of matrix X.
- One important feature of MATLAB is element-by-element operations are allowed.

  a=[1 2 3];

  b=[2 3 4];

d=a+b; % a is added to the first row and the second row of b

e=a-b; % c is added to the three columns of b respectively

f=a.*b; % Element by element multiplication

g=a./b; % Element by element division

h=a.^2 % Each element is squared

- Inverse a matrix: x=y';
- Inverse a matrix: x=inv(y);

3 MATLAB Commands

- a=zeros(3,5); % a 3×5 matrix of zeros
- b=ones(2,4); % a 2×4 matrix of ones
- c=eye(4); % a 4×4 identity matrix
- d=i:k:j; % generating a sequence starting from i, advancing by k, stoping at j
- a=sum(x); % summation
- a=mean(x); % mean
- a=prod(x); % product
- a=median(x); % median
- a=sdt(x); % standard deviation
- a=max(x); % maximum
- a=min(x); % minimum

- a=exp(x); % exponential function
- a=log(x); % nature log function
- a=sqrt(x); % square root
- a=pi; % 3.1415926...
- a=gamma(x); % gamma function
- a=sin(x), cos(x), tan(x), arcsin(x); %trigonometric functions
- a=size(x); % dimension of matrix x
- a=length(x); % the size of the longest dimension of x
- a=det(x); % determinant of matrix x
- a=diag(x); % extracting the diagonal elements of matrix x
- y =filter(b,a,X); % This command is very useful in time series analysis and implements the following

$$\begin{aligned} y(n) &= b(1) * x(n) + b(2) * x(n-1) + \cdots + b(nb+1) * x(n-nb) \\ &\quad -a(2) * y(n-1) - \cdots - a(na+1) * y(n-na) \end{aligned}$$

- rand('seed',sd); % set the seed of random number generator to sd
- randn('seed',sd); % set the seed of random normal generator to sd
- normpdf(x) % computes the density of a standard normal distribution
- R = normrnd(MU,SIGMA,m,n) % generates normal random numbers with parameters MU and SIGMA, where scalars m and n are the row and column dimensions of R