

Session 5: Basic Commands in Matlab

Doing Economics with the Computer

1 Matrices

The name “Matlab” is short for “Matrix Laboratory”, indicating that it refers to a *numerical* application, which allows you to create matrices and offers you a great deal of computational procedures. In Matlab, each variable is a matrix that contains m rows and n columns. Accordingly, by $m > 1 \cap n = 1$ the variable is actually defined as a column vector, and for $m = n = 1$ the variable is a scalar. Given that almost any numerical problem you will encounter as a part of your studies can be expressed in matrix form, Matlab will in almost any case allow you to solve it. This exercise has the purpose to get you familiar with creating, changing and manipulating matrices.

- (a) Create a 2×3 matrix A :

$$A = \begin{pmatrix} 1 & 3 & 2 \\ 5 & 0 & 2 \end{pmatrix}$$

- (b) Create a 4×2 matrix V consisting of zeros, a 3×1 vector W consisting of ones, and a 3×3 identity matrix I . Save your workspace under an

adequate name, clear the workspace and command history, then reload the workspace. Create a vector $Z = [1, 2, \dots, 100]'$.

- (c) Create a column vector R_0 with 10 normally distributed random variables, and a row vector R_{10} with 10 normally distributed variables with an expected mean of 10. Further create a column vector U with 10 uniformly distributed random variables.
- (d) Change the element $(1, 2)$ of matrix A to 8.
- (e) Create a vector B that contains only the second row of A .
- (f) Create a 2×3 matrix C

$$C = \begin{pmatrix} 4 & 1 & 2 \\ 1 & 3 & 3 \end{pmatrix}$$

Extract those elements of C that are equal or less than 2 in a vector D .

2 Basic Manipulations

- (a) Clear your workspace and create:

$$E = \begin{pmatrix} 4 & 1 \\ 1 & 3 \end{pmatrix}$$

and

$$F = \begin{pmatrix} 1 & 1 \\ 2 & 3 \end{pmatrix}$$

Try out addition and subtraction of these matrices. Addition and subtraction of matrices is straightforward. You just have to make sure that the dimension of the two matrices you want to add or subtract match.

- (b) Type in the commands `G=E*F` and `H=E.*F`. What is the difference?
- (c) Compute $K = E^{-1}F$. Try out the different ways to do this.

3 Basic Plotting and Statistics

- (a) Clear your workspace. Generate a vector of uniformly distributed random variables between 0 and 100 and assign them to a vector `x`. Draw 100 numbers. The command for a uniform random variable between 0 and 1 is `rand`, so you just have to multiply it by 100.
- (b) Plot `x` in a graph.
- (c) Create a vector `x1` consisting only of the first 50 observations and another vector `x2` consisting only of the last 50 observations. Create a

subplot where you plot `x1` and `x2`. Consult the Matlab guide for details on how you would add axis-labels, legends, titles, and change line styles and colors.

- (d) Compute the mean and standard deviation of `x`, `x1` and `x2`. Repeat task (b) and include the mean in your plot.

4 Working with Data

Often, you will have stored your data in file formats other than Matlab. Most commonly, these will be *xls*(*x*) or *txt* files.

- (a) First clear your workspace. Then, load the data from the ascii-file `testdata1.txt` to your workspace. What command do you have to use? Re-name the uploaded data-vector `x`.
- (b) Now, load the data from the Excel-file `testdata2.xls`. The command is `xlsread`. Use the `help` command to find out what you have to specify exactly. Re-name the data-vector to `y`.
- (c) Type `who` in the command window to check that only the two variables `x` and `y` are in the workspace.
- (d) The data are artificially generated random numbers. Can you guess what the underlying distributions were for `x` and `y`? Make a histogram to try to find out. What is the mean and standard deviation of `x` and `y`?
- (e) Compute the correlation coefficient.

5 M-files

M-files: In this session we worked solely in the command window of Matlab. We did this because the main aim was to get you familiar with the basic manipulation of the program. When programming (and for the assignment), you will rarely work directly in the command window however. Matlab allows you to place all your commands in text file which is then saved with the extension `.m`. This has the advantage that you write all your desired commands and execute them only once at the end. If you made a mistake, you just have to edit the text file and run it again.

Write an M-file that carries out at once both questions 2(a) and 2(b) of today's session.

6 Preparation for the next Matlab sessions

Read chapter 3 of the Matlab-Guide and try it out directly in Matlab. For example, carry out the following simple tasks:

- Create a vector g with values ranging from 0 to 10 with increments of 0.1 and use a for-loop to increase each value by 0.05.
- Create a scalar $A = 2$. Create a while-loop that increases A by one as long as $A < 10$.
- If-loop: Draw a random number from e.g. a uniform distribution between 0 and 2. If this random number is smaller than 0.9, return the statement 'This number is smaller than 0.9', else return 'This number is greater than (or equal to) 0.9'.