Exercise: The Basics of Matlab

Working in the command window

August 19, 2013

Introduction

This part of the laboratory assignment is about how to work with commands directly in Matlab’s command window. It can be likened to the use of Matlab as a very advanced desk-calculator, with commands for both the calculations and graphics.

What to do

Getting started and seeking help

1. Start Matlab by double clicking on the Matlab icon.

2. When the Matlab window comes up, you should start by moving to the right folder/directory. In the top widow, there is a box:

   Click the button and find your way to your directory. When you come to the right directory, click on it so the directory name will appear in the box for Current Directory.

3. On the top of Matlab window are menus. Click on Help menu and then select option Matlab Help. When the help window comes up, you see various tabs. Click Index. In the search box at the top of the index window, you can write what you want to know more about. Try typing exponential and see what happens. Click the box to the left, then the explanatory text to the right. If everything worked as it should, you will receive information on what the $e^x$ function looks like in Matlab and how to call it.
Command Window

The Matlab window consists of various other windows, including Command Window, Work Space Command History

4 Now calculate $e^{2 \sqrt{3}} \sin 0.8$ on the command window by writing
   \[ \text{exp}(2) \times \text{sqrt}(3) \times \sin(0.8) \]
   Note that you have to write the multiplication sign \(*\).

5 The result of the calculation above is automatically stored in the variable \texttt{ans}
   Calculate now the square root of 2, $\sqrt{2}$. Note that you will get the result in the variable \texttt{ans}. Also, note that the earlier result in \texttt{ans} will disappear (be over-written).

6 Assignment
   If you want to save the result so that you can come back to use it in the Matlab session, then you have to save it in your own variable.
   This you can achieve through ‘assignment.’ In Matlab the equal sign ‘\=' is the assignment operator. For you to calculate $e^{2 \sqrt{3}} \sin 0.8$ and save the result in variable \texttt{z}, write \texttt{z = exp(2)*sqrt(3)*sin(0.8)}. Then \texttt{z} is assigned the value that is calculated.

7 The equal sign ‘\=' in Matlab does not denote equality but assignment. For equality, to check whether two values are equal, you use instead ‘\=='. Write the following in the command window (note that you do not need to type the >>–sign, it is Matlab command prompt):

   >> a = 1
   >> b = 3
   >> c = a
   >> a == b
   >> a == c

   The first first three lines are assignment statements, i.e. variables \texttt{a}, \texttt{b}, and \texttt{c} are assigned values.
   But what about lines 4 and 5? Can you guess the result.

Workspace and Command History

8 Look at the window, Workspace. There you will find the variables that you have worked with up-till now in the Matlab-session. In the command window, give the command \texttt{clear z}. What happens?
In the command window, give the command `clear` or `clear all`. What happens?

9 Look at the window *Command History*. There you will see the command you have given.
You can repeat a command by double clicking on the command in the command history. Use the method to repeat the calculation where \(z\) is assigned a value. Note that \(z\) will appear again in the *Workspace*.
You can also use the mouse to click on the command in the command history and drag it to the command window. Use the method to calculate \(z\) again.
The command can also be recalled if you let the cursor stand in the command window and you scroll back-wards with the 'arrow up or down' key on the keyboard. Try the method for you to be able to recall the command that you used in calculating the square root of 2.

**Presentation of results on the screen**

10 If you do not want to see the result of a computation immediately, you can use the semicolon.
Assign the value \(z + 5\) to the variable \(y\) and end the line with a semicolon:
\[
y = z + 5;
\]

11 If you want to see the value of \(y\), you can simply type \(y\) on the *Command Window* and press the 'ENTER' key.

12 If you have not given another instruction to Matlab it will display the result with 4 decimals.
Give the command `format long`. Write \(y\) on the command window again and press the 'ENTER' key. What happens? Give the command `help format` to get more information about how Matlab can present the result of your calculation.
You can try to do different kinds of format. *Note that the different alternatives of presenting your results do not affect the accuracy of your results, irrespective of how it is presented on the screen.*

**Vectors and matrices**

13 Matrices and vectors are surrounded by square brackets. Write the matrix
\[
A = \begin{pmatrix} 2 & -1 \\ -4 & 8 \end{pmatrix},
\]
by writing in the command window \(A = \begin{bmatrix} 2 & -1 \\ -4 & 8 \end{bmatrix}\).
Note or observe that the lines are demarcated with semicolon. The semicolon within the brackets implies also a change of rows in the matrix. Another alternative is to click on 'Enter' after every row or line. Attempt to create $A$ using this method. (First do `clear A`, to delete the earlier version of $A$.)

14. Vectors can be understood as a special type or case of matrices. A column vector is a matrix with one column and a row vector has just one row. Therefore, you can now apply what you learnt in the previous step, to create a row vector $u$ and column vector $v$:

$$u = \begin{bmatrix} 3 \\ -1 \end{bmatrix}$$
$$v = \begin{bmatrix} 1 \\ 0.5 \end{bmatrix}$$

Now attempt some of the elementary operations with matrices and vectors:

a. Give the command $A(1, 2)$. What happens?

b. Give the command $2*u$. What happens?

c. Give the command $u + v$. What happens and why?

d. Give the command $u*v$, the scalar product between $u$ and $v$.

e. Give the command $A*v$, matrix vector-product between $A$ and $v$.

f. Give the command $A*u$. What happens and why?

 g. Give the command $B = \text{inv}(A)$, $B$ is set to the inverse of $A$. Check if the inverse is correct by using Matlab to calculate the product $B*A$. (What would be the result of the operation if $B$ is the inverse of $A$?)

h. Give the command $B = A'$, $B$ is the transpose of $A$. Attempt also to give the command $u'$ and $v'$ respectively. What happens?

i. Give the command $A (1, :)$. What happens? Also give the command $A (:, 2)$.

j. Give the command $A = [A; u]$. What happens? This can be used to for example successively build up a table that can be stored in a matrix and one can add additional table rows as required.

k. Give the command $\sin(v)$. What happens?
l. Give the command \( \mathbf{v}^2 \) (the operator \(^\_\) represents 'raise to power'). This is not applicable because for an operation to multiply a vector by itself cannot be defined mathematically.

m. Give the command \( \mathbf{v} \cdot^2 \). Observe the dot before the raise to power operator. It implies that the operators after this shall be applicable on every single element in the vector. The result of the operation shall also be that every element in it is squared.