BRAC UNIVERSITY
CSE 330: Numerical Methods (LAB)
Lab 1: Introduction to MATLAB

MATLAB

MATLAB is a high-level programming language that has been used extensively to solve complex engineering problems. Also it provides a very nice tool to implement Numerical Methods.

Text Books

- Applied Numerical Methods With MATLAB by Steven C Chapra
- Numerical Methods using MATALB by John H. Mathews

You can collect the pdf version of these books from the lab teacher.

Special Note to Students

Numerical Methods and MATLAB are two extremely important requirements in Engineering and Sciences. For EE students, a lot your future work will directly depend on MATLAB. For example Digital Signal Processing, Image Processing, Telecommunications, Antenna Simulation, Biomedical Signal processing, Control System Design and Solid State Electronic Device simulation require hands on experience and expertise on MATLAB. For CS students, Image Processing and other Mathematical modeling demand a strong background on Numerical Methods.
So students must put special effort on this course.

Students must install MATLAB in their respective home PCs. Throughout the semester several projects and assignments will be given.

Starting MATLAB

Several versions of MATLAB are available. Make sure you install at least version 7 or upwards.

Double clicking on the MATLAB icon in the desktop will open the MATLAB interface.

MATLAB works with three types of windows on your computer screen. These are the
1. Command window,
2. the Figure window and
3. the Editor window.

- The Figure window only pops up whenever you plot something.

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- The Editor window is used for writing and editing MATLAB programs (called M-files) and can be invoked in Windows from the pull-down menu after selecting File | New | M-file. In UNIX, the Editor window pops up when you type in the command window: edit filename ('filename' is the name of the file you want to create).

- The command window is the main window in which you communicate with the MATLAB interpreter. The MATLAB interpreter displays a command >> indicating that it is ready to accept commands from you.

The Command Window
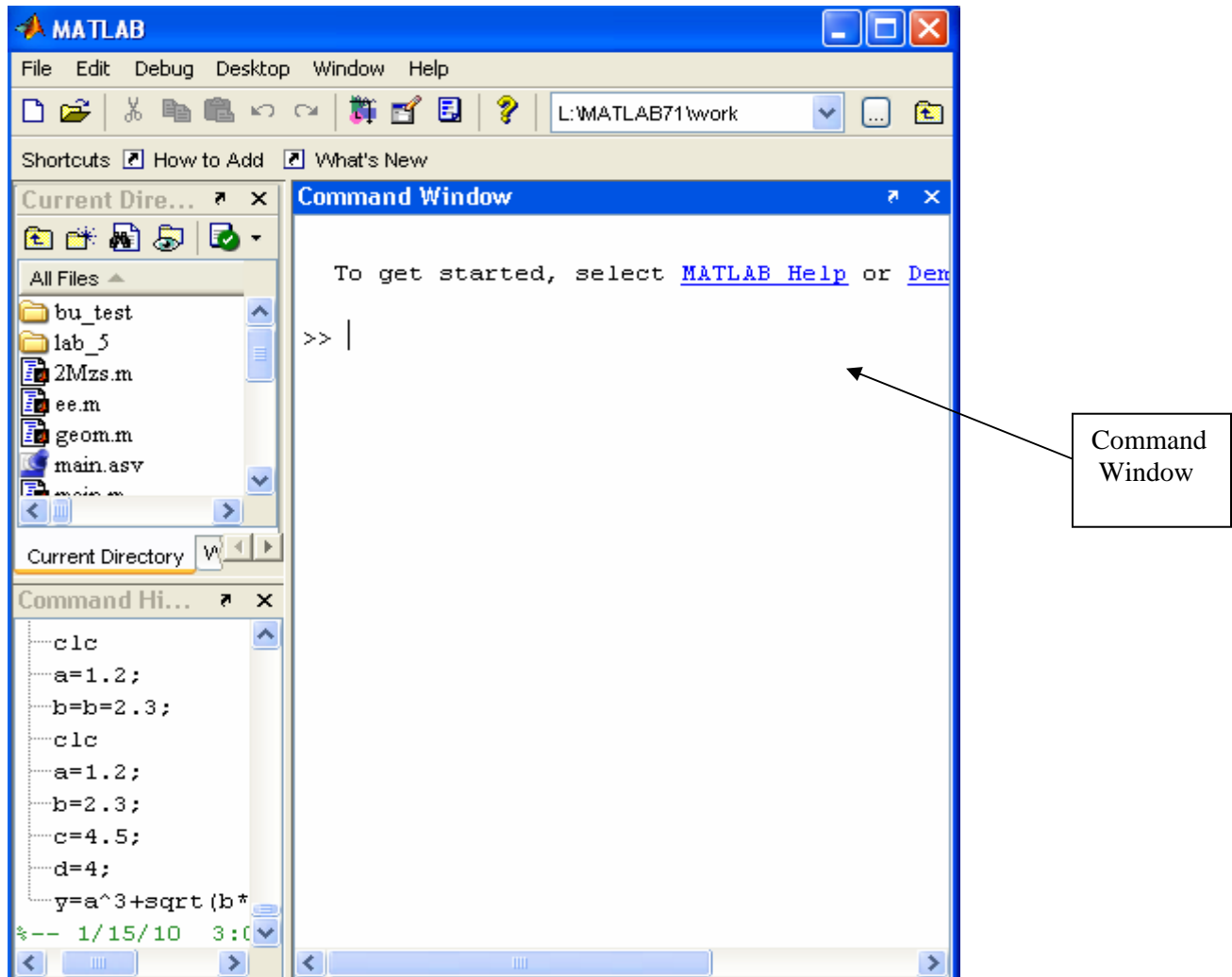
Figure 1: The MATLAB Environment

• View the MATLAB introduction by typing
>> intro

at the MATLAB prompt. This short introduction will demonstrate some basic MATLAB commands.

• Explore MATLAB's help capability by trying the following:

```
>> help
>> help plot
>> help ops
>> help arith
```
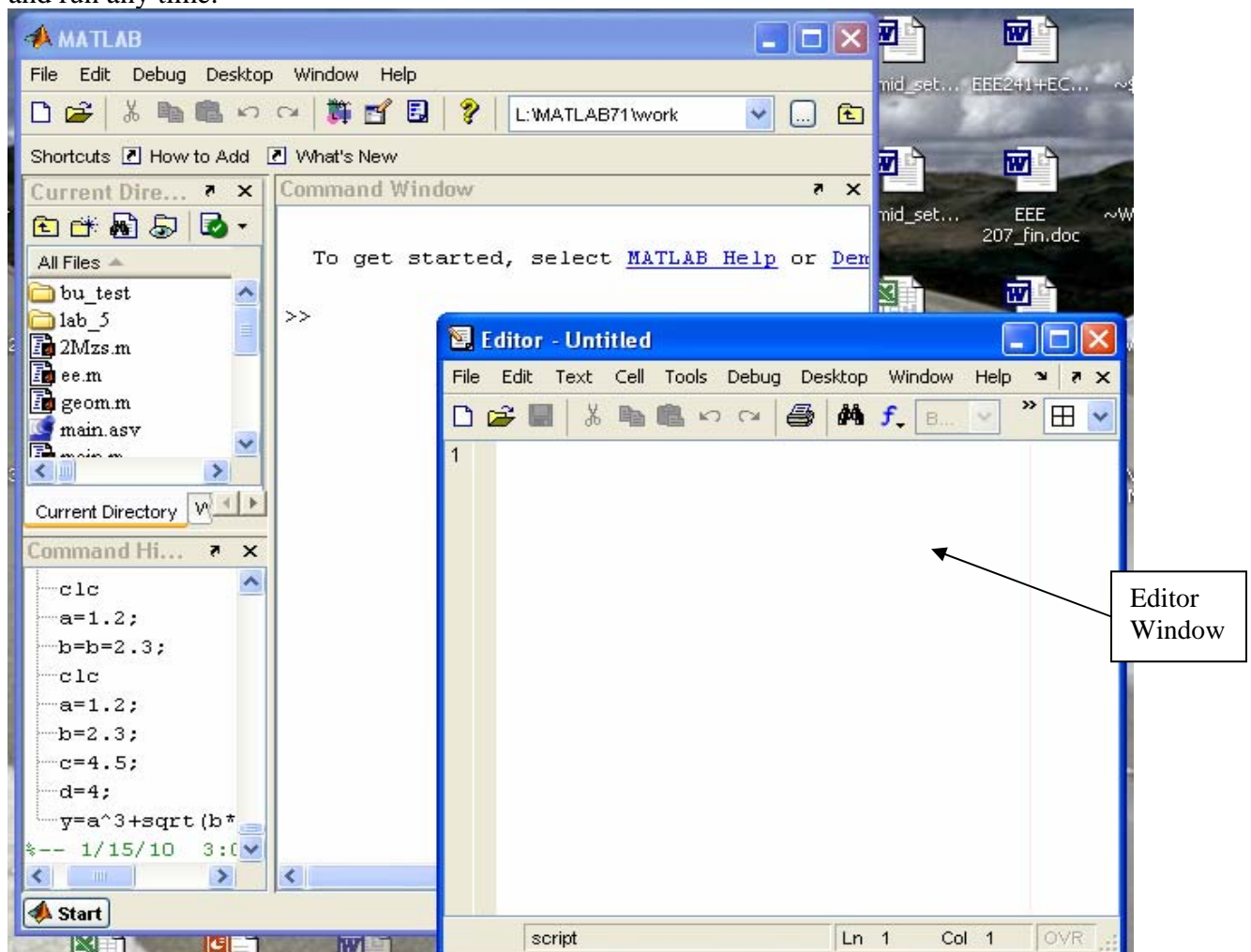
• Type demo and explore some of the demos of MATLAB commands.

• You can use the command window as a calculator, or you can use it to call other MATLAB programs (M-files).

The Editor Window

Go to **File→ New→ M File**
In the editor window you can write any code and save it as a M File. The M file can be saved and run any time.

Editor Window

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Example

Suppose you want to evaluate the expression y $= a^3 + \sqrt{bd} - 4c$, where $a = 1.2$, $b = 2.3$, $c = 4.5$ and $d = 4$. This can be done in two ways:

[1]. In Command Window
[2]. By Creating separate M file.

In the Command window, type as shown in the figure :

Command Window

```
>> a=1.2;
>> b=2.3;
>> c=4.5;
>> d=4;
>> y=a^3+sqrt(b*d)-4*c

y =

   -13.2388

>> |
```

Figure 3: Writing code in command window

Note the semicolon after each variable assignment. If you omit the semicolon, then MATLAB echoes back on the screen the variable value.

There are four different arithmetic operators:

+ addition
- subtraction
* multiplication
/ division (for matrices it also means inversion)

Creating M Files

Note that in the preceding example the code was written in the command window and its volatile meaning after the code is executed if you write "clc" in the command window it will disappear. Codes can be written, executed and permanently saved in the M Files.

➢ Open a M File and write the required code as demonstrated in Figure 4.

- After writing the code save the file with a name with file extension .m The M File name **must not begin with a number** [M File with name "2.m" or "4File.m" will be erroneous]
- Now Run the file from Editor Window by pressing **"F5"** or from **DEBUG → RUN**
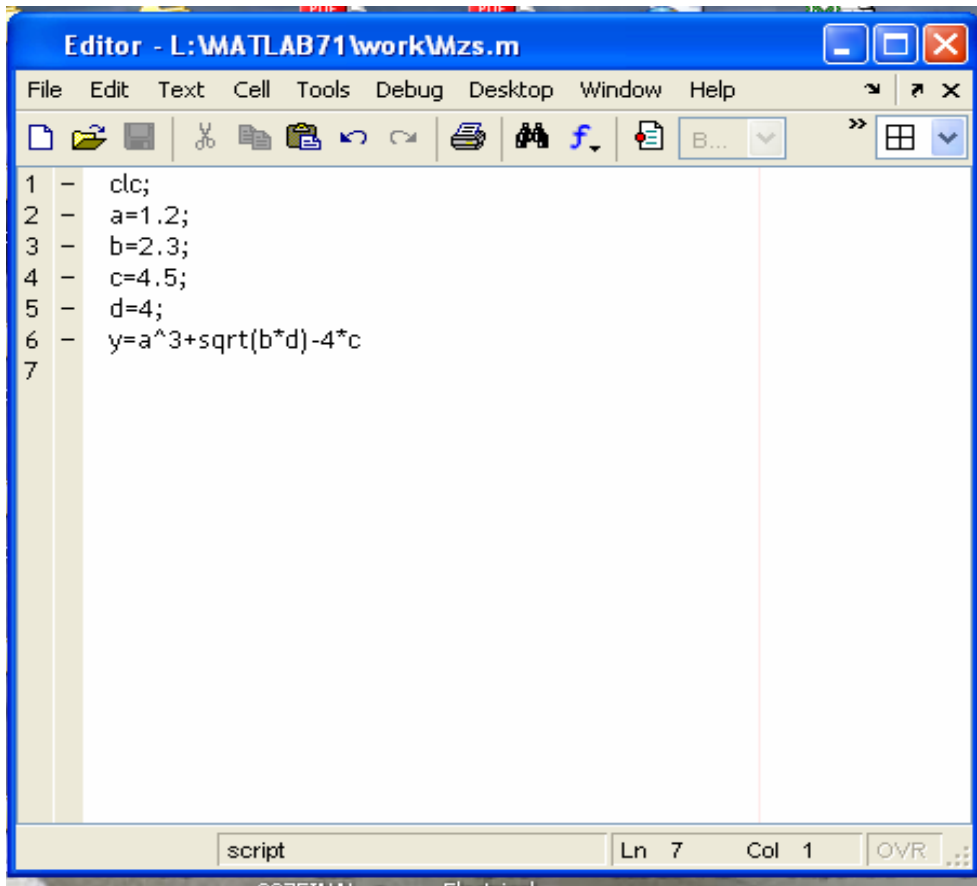
Figure 4: Writing and saving M Files in Matlab Editor.

Learning MATLAB From Help menu

You can get acquainted with almost all the MATLAB features by exploring the Help menu. MATLAB has built in functions that can perform almost all mathematical operations.

- In the MATLAB environment press "F1" or go   Help→Matlab help
- Then select "index" as shown in the figure. Then in the search box write "sqrt" and click on the name. In the write window you will get all you need to know about the sqrt function. See Figure 5.
- Now Study the following functions: "min", "max", "mean", "abs", "sin", "cos", "log10", "log", "imag", "real", "angle", "exp", "linspace", "floor", "ceil", "round", "length" etc.
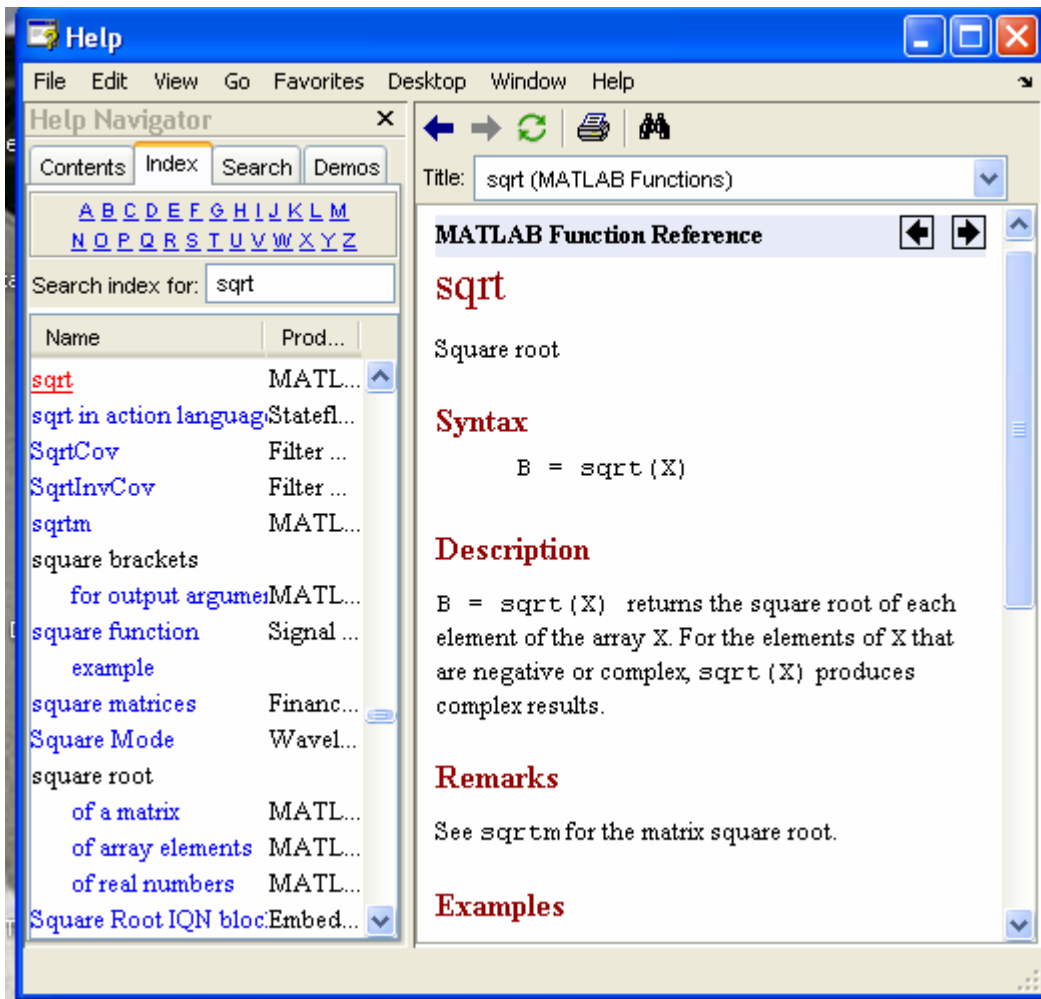
Figure 5: Exploring MATLAB help menu

Lab Task

Write a M file to find the roots of the quadratic equation $Y=5x^2-3x+12$.

Home Task

- Collect MATLAB Software and install in your home PC. [Version 7 or upward]
- Learn basic MATLAB functions by exploring the help menu.

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