

Math 2250
MATLAB TUTORIAL
Fall 2005

Math Computer Lab

The Mathematics Computer Lab is located in the T. Benny Rushing Mathematics Center (located underneath the plaza connecting JWB and LCB) room 155C. The hours for the labs are:

Monday to Thursday – 8:00 a.m. to 8:00 p.m.

Friday – 8:00 a.m. to 6:00 p.m.

Closed on weekends and university holidays

Students are also welcome to use the computer lab in 205 South Physics. This is a good option for students who need to use the lab on weekends as well as earlier or later than the math lab hours.

More information about the lab can be found at:

<http://www.math.utah.edu/ugrad/lab.html>

Account and Logging on

Almost all students registered in any math class will already have accounts set-up. These are created from university class lists, so students who registered late may not be included yet.

Your login name is of the form c-azbx where azbx are as follows:

a is the first letter of your last name

z is the last letter of your last name

b is the first letter of your first name

x is your middle initial

If someone has the same initial as you, your login may be c-azbx1 or c-azbx2, etc.

Passwords – Your initial password is azbx (as above) followed by the last 4 digits of your student ID number. If you have a login name with a number at the end, the number is NOT in your password.

Your login name and password are all lowercase with no spaces.

Common Desktop Environment

Once logged in, you will see the common desktop environment (CDE) which is the default environment of our unix based system. The first thing to look for is the computer icon towards the bottom of the screen. Click on this icon to open an **xterm window**.

Changing password - On the xterm window, type **passwd** then hit enter. You will then be prompted to enter your initial password followed by your desired new password. Your password should consist of at least 6 characters (upper and lower case letters and digits).

Loggin out – In CDE, there is a logout or exit icon at the bottom of your desktop. You can also logout by right-clicking on your mouse and then choosing the logout option.

MATLAB

MATLAB is a tool for doing numerical computations with matrices and vectors. It can also display information graphically.

To start MATLAB, type **matlab** on your xterm then enter. A MATLAB 7 window will then appear.

Saving your session

The first thing to do when you begin a session is to save the session in case you will need it later. This is done by typing the following on the command window:

```
>> diary filename.txt
```

To turn it off or before you exit type

```
>> diary off
```

When finished, you can edit this file using external text editor and print it out.

Arithmetic operations

You can do the usual arithmetic operations also

```
>> 3+4
```

```
>> 5*(4+7)
```

```
>> (3+4)^2/7
```

You can define a variable as well

```
>> y = 5^3
```

If you put a semi-colon at the end of the command, the answer will be suppressed.

```
>> 3+4;
```

Another nice feature of MATLAB is that you can define how your answer should look like, i.e. in decimal form, fractional form, etc. Type the following to see the difference.

```
>> 2/3
```

```
>> format rat
```

```
>> 2/3
```

```
>> format long
```

```
>> 2/3
```

```
>> format short
```

```
>> 2/3
```

- By using **format rat**, your answer is given as ratio of small integers (fractional form).
- By using **format long**, you will get an answer in a decimal form with 15 digits accuracy.
- The default format is **format short** where the answer is given as a 5-digits decimal.

Scalar Functions

You can also compute the numerical value of usual functions:

sin – sine function (argument in radian)

asin – inverse sine

cos, tan

acos, atan

exp – exponential

log – natural log

abs – absolute value

sqrt – square root

round – round to nearest integer

floor – round to next smallest integers

ceil – round to next largest integer

rem – remainder after division

```
>> pi
```

```
>> sin(pi)
```

```
>> asin(0)
```

```
>> round(3/4)
```

Getting help

You can bring a help window by clicking *Help* button at the very top of the window and selecting *Full Product Family Help*.

If you already know the function call, you can type

```
>> help sin
```

Or if you are looking for a particular command

```
>> lookfor matrix
```

This will bring a list of possible command. The list may be long; to stop the listing, press CTRL-C.

Matrix and Vector

MATLAB is designed to handle matrix/vector computation very well. You will find this useful as you are learning more linear algebra in this course.

To enter the matrix

```
1 2
```

```
3 4
```

and store it in a variable a, do this:

```
>> a = [1 2; 3 4]
```

```
>> b = [1 2; 0 1]
```

You can do matrix multiplication, summation, and so on

```
>> a+b
```

```
>> a*b
```

```
>> b*a
```

A vector is defined in a similar way

```
>> u = [0;1] % this gives you a column vector
```

```
>> v = [0 1] % this gives you a row vector
```

Be careful in being consistent when you are defining vector. For example you cannot add a row vector to a column vector

```
>> u+v
```

```
>> u+v'
```

The apostrophe ' sign can be used to transpose a vector/matrix.

A brief but slightly more detailed tutorial on matrix/vector computations can be found at

<http://www.math.utah.edu/computing/ms/matlab/matlab.html>

Graphing

To make a graph of $\sin(x)$ in the interval $[0, 5]$, we can do the following

```
>> x = [0:0.2:10]; % define a vector with components ranging from 0 to 10 with steps 0.2
```

```
>> y = sin(x);
```

```
>> plot(x,y)
```

Printing

You can print from MATLAB by finding the printer icon or go to *File* at the top of the window and selecting *Print*. Choose the printer name appropriately. The printer names are

lcb115 LCB 115 computer lab

mc155c Math Center

spps 205 South Physics

You can also print a file from xterm window by typing **lpr -P *printername***

M-Files

MATLAB can execute a sequence of statements stored in diskfiles. Such files are called "M-files" because they must have the file type of ".m" as the last part of their filename. Much of your work with MATLAB will be in creating and refining M-files.

M-files can be created using the built-in MATLAB editor as well as local text editor (emacs, nedit, vi). To call the built-in text editor, click *File* followed by *New* then select *M-file*.

There are two types of M-files: script files and function files. They essentially serve the same purpose but sometimes it makes more sense to choose one over the other. For example, you can store huge amount of data in script files but use function file to do a task that's repetitious.

Script files

```
A= [1 2 3 4;
    5 6 7 8;
    9 10 11 12;
    13 14 15 16];
```

Save it as *matrixa.m*

Be careful when naming these files as you cannot use any of the defined MATLAB function name. Choose a name that's somewhat cryptic - *matrixa.m* instead of *matrix.m*

You can run script files directly from the built-in editor by clicking on the Run button (the one with page and arrow icon) or you can call it from the MATLAB command window

```
>> matrixa
```

Function files

```
function y = sincos(x1,x2)
% compute y = sin(x1)^2 + sin(x2)^2
y = sin(x1)^2 + sin(x2)^2;
```

Save the file with name corresponding to the function name. Here, for example, you should save it as *sincos.m*

Now, you can call this from MATLAB by typing

```
>> y = sincos(pi,pi);
```

```
function dum = plotx(a,b)
% plot x^2 on the interval [a,b]
step = (b-a)/10;
x = [a : step : b];
y = x.^2;      % the dot in front of ^ is to square x element by element
plot(x,y)
dum =1;
```

Save the file as *plotx.m* and run it from MATLAB

```
>> z=plotx(-1,1);
```

Now, try to modify this file to plot x^3 instead of x^2 .

REFERENCES

A very detailed and good introduction to MATLAB is the MATLAB primer written by Kermit Sigmon which can be accessed online through several sites such as:

http://www.mines.utah.edu/gg_computer_seminar/matlab/matlab.html

We can also send you a hard pdf copy if you are interested in learning more about MATLAB.