

A First Matlab Tutorial

%Make a directory f:\math3543
Find matlab on Novell:
It may be on the desktop. If not,
click or double click:
"More Applications"
"Matlab61"
This puts "Matlab61" on the desktop
and sometimes starts it up as well.

At the matlab prompt, >>, type the
commands exactly as they are here.

```
>> cd f:\math3543
```

Ignore the warning messages, if any.
Running this command is a good idea if you keep
your work for this course in the directory
f:\math3543. Let's make sure we know where
we are.

```
>> pwd
```

```
>> diary on
```

The command "diary on" saves the session to a
file called 'diary'. diary('myfile') can be
used to save the session to myfile. The quotes
are important. You can look at the file with
any text editor, but not until you either run
"diary off" or you exit matlab.
"diary" will be in the directory given by the
pwd command above.

The command "diary on" appends to the current
file "diary" (or "myfile") if it exists. So you
can stop your Matlab session, and then continue
where you left of.

```
>> addpath l:\math3543
```

This tells matlab how to find commands I make
for you. For example,

```
>> hello
```

runs the commands in l:\math3543\hello.m
you will get: hello, 2pi=6.283, and 5

At this point see what the 4 arrow keys do.

Enter some matrices. Rows are separated
by ; or newline. Numbers in a row are
separated by space or ,

```
>> A=[3 -2 0  
      -2 3 1  
      0 1 5]
```

```
>> B=[-2,4,1;0,3,4;-3,2,1]
```

```
>> C=A*B  
>> A+B  
>> B^3  
>> 3*A+A*B  
>> inv(A)  
>> det(A)  
>> eig(A)
```

```
>> [P,D]=eig(A)
```

The columns of P are the eigenvectors of A

```
>> P*D*inv(P) %Note ans is A!
```

```
>> % anything after a % sign is a comment
```

```
>> b=[1,5,-2]
```

Of course to do matrix arithmetic,
the dimensions must agree.

```
>> A+b  
??? Error using ==> +  
Matrix dimensions must agree.
```

```
>> inv(A)*b  
??? Error using ==> *  
Inner matrix dimensions must agree.
```

```
>> size(A), size(b)
```

comma allows two or more commands on a line

```
>> b=b' % We need the transpose of b.  
>> A*b  
>> x=inv(A)*b %Solve Ax=b
```

Use column matrices for vectors.

```
>> u=[1 2 3]'
```

```
>> v=[-1 0 3]' % v=[-1;0;3] is the same thing
>> v'*u        % dot product
>> cross(v,u)
>> w=2*v-4*u   % linear combination
```

```
>> A=rand(10,10)
>> A=rand(10,10);
```

Some stuff is better not seen,
that's what ; does.

```
>> I=eye(6)      % identity matrix.
>> a=ones(8,1)
>> a=zeros(3,8)
>> a=ones(8)

>> x=(-pi:.1:pi)
>> x=linspace(-pi,pi,30)
>> y=sin(x)
>> plot(x,y)
>> help plot     % Use help often!
```

Make a matrix with row 1 being x,
row 2 being y. Then the columns of
P are vectors in 2 dim.

```
>> P=[x;y]

>> P(1,:) % extract row 1 from P. : means all
>> P(2,2:8)% 2:8 means columns 2 to 8.

>> c=cos(pi/6), s=sin(pi/6)
>> R=[c -s; s c]
```

Multiplication by R rotates the x - y coordinates
by pi/6

```
>> Q=R*P
>> xx=Q(1,:), yy=Q(2,:)
>> plot(xx,yy)
>> hold on %lets look at both of them
>> plot(x,y)
```

The file l:\math3543\Mat1 contains a 10x8 matrix
of random numbers. Suck it into the matrix A. Be
sure to enter the following commands exactly as
they are here.

```
>> fid=fopen('l:\math3543\Mat1')%fid is just a
>> A=fscanf(fid,'%f',[8,10]) % name - file i. d.
>> A=A'
```

Some explanation is needed. Matlab deals with
matrices column by column. Computers deal with
files line by line. The file 'l:\math3543\Mat1'
looks like the 10x8 matrix we want. That is, the
rows of the matrix are the lines of the file.
fscanf reads the file, one number at a time,
taking the 8 numbers from line 1, then the 8 from
line 2, etc, putting them into columns of a
matrix. We have told fscanf to make an 8x10
matrix. So the 8 numbers on line 1 are put into
the 8 numbers of column 1, the 8 numbers on line
2 are put into the 8 numbers of column 2, etc.
But we then take the transpose, which gives us
the right matrix. Rather annoying that it is so
twisted. Just look at this example whenever you
need to read in a matrix.

The '%f' in the fscanf statement tells matlab it
is reading decimal numbers. In computer speak,
the 'f' stands for floating point.

The file l:\math3543\v1 contains a line of 10
numbers. Suck it into a column vector b.

```
>> fid=fopen('l:\math3543\v1')
>> b=fscanf(fid,'%f',[10,1])
```

The system of equations $Ax=b$ has 10 equations, 8
unknowns. We can't solve this.

```
>> inv(A)
??? Error using ==> inv
Matrix must be square.
```

```
>> inv(A'*A)*A'*b
```

This is called the least squares solution
to $Ax=b$.

```
>> diary off
>> quit
```

References

<http://www.math.umb.ca/~stockie/matlabtour.pdf>.
<http://www.maths.dundee.ac.uk/~ftp/na-reports/MatlabNotes.pdf>.