Matlab Introduction

The following are a few things to get you going in Matlab. One general thing you will quickly notice is that Matlab often requires you to think about what you are doing in terms of matrices and vectors. The suggestions below are not intended to fully describe everything to know about Matlab (not even close). It does, however, point out a few things that you will be running into later on.

1. Row vectors are defined as:

   `r1=[1 2 3 4]`

   `r2=[-10:1:10]` is a handy way to quickly generate a list of numbers in row vector form. Try `r2=[-10:1:10];` instead if you want to avoid the output from appearing.

2. Column vectors can be defined in different ways as well:

   `c1=[1;2;3;4]`

   `c2=[-10:1:10]'` generates a column vector (note the prime).

3. Define a three dimensional row vector `x=[1 2 1]` and then define a matrix `A=[1 2 3; 4 5 6; 7 8 9]`.

4. The conjugate transpose of a matrix A is obtained by the command `A'`. If the matrix A is real, then this is just the transpose. If the matrix is complex but the non-conjugate transpose is desired, then the appropriate command is `A.'` which uses "dot-prime".

5. Understand the very important difference between the usual matrix multiplication and component-wise multiplication (as well as division and powers)

   `A*A` is "regular" matrix multiplication. Do this with Matlab and make sure that this is what you expected.

   `A.*A` is component-wise multiplication (the usual operator '*' has a '.' in front '.*'). Do this with Matlab and make sure that you see what's going on. If you do one when you meant to do the other you will not get the answer you expect.

   Note that `A*x` is not a well-defined operation but `x*A` is and so is `A*x'` where `x'` changes the row vector x into a column vector.

6. Define a row vector `t=[0:0.1:5.0];` and use this to plot some function of t, say sin(t), by using the command `plot(t,sin(t))`. Note that the values of t must be already defined

before the plot command is used. If you want a new plot try `plot(t,cos(t))`. If you would like more than one plot to appear in the same figure you can enter the command `hold on` at the matlab prompt and the same figure will be used until you enter the command `hold off`. Alternatively, the command `plot(t,sin(t),'r',t,cos(t),'g')` will plot $\sin t$ with a red line and $\cos t$ with a green line on the same graph. Also try `comet(t,cos(t))`.

7. Vector p-norms are computed in Matlab using the command `norm(v,p)`. That is, to compute the 1–norm of the vector v=[1 2 3], type `norm(v,1)`. The 2–norm is `norm(v,2)` or just `norm(v)`. The ∞–norm is `norm(v,inf)`.

8. Induced Matrix Norms: There are three induced matrix norms available on Matlab, the 1–norm, 2–norm and ∞–norm. These are calculated using the commands `norm(A,1)` (this is the largest column sum of A), `norm(A,2)` or just `norm(A)` (this is the largest singular value of A), and `norm(A,inf)` (this is the largest row sum of A).

9. General Matrix Norms: The Frobenius norm of a matrix A is calculated using `norm(A,'fro')`.