

Matlab Lab 1: Iterates and Cobwebs
Math 112 - Spring, 2010

STARTING UP MATLAB AND SETTING THE PATHS

1. Turn on machine if necessary and log on.
2. Download zipped Matlab file from the Sakai site. Unzip these files into a folder somewhere in your workspace, named something that you'll identify as related to this course. (For example: "TotallyCoolMatlab-Stuff").
3. Start Matlab (under Programs in the Start menu). At the upper left of the command window you'll see three dots in the pull-down menu. Select this, and then select the folder you just made as your Current Directory.
4. Basics (skip if you know this - if you don't, download "Matlab Basics" and work through.):
 - (a) how to declare and manipulate vectors and matrices,
 - (b) plotting a function of one variable, (zooming in, ginput, hold on, line styles, adding a title and labeling axes)
 - (c) plotting a function of two variables
 - (d) writing a function as an M-file and using it
5. Try these routines:
 - (a) `Y=iterates(@fcn, x0, N)`
 - (b) `cobweb(@fcn,x0,N)`

First, set the global variable, `a`, in the Command Window by typing `global a` and then `a=.5`, or whatever value you want it to be. You can use `logistic` as the function, i.e. you type:

```
global a
a = 3.2
```

```
Y=iterate(@logistic,.1,20);
plot(Y)
```

and you should get a graph with 20 iterates of the function $f(x) = 3.2x(1 - x)$ starting at $x_0 = .1$.

Or type:

```
a = 2;
cobweb(@logistic,.2,10)
```

and you should get a cobweb graph with 10 iterates for the function $f(x) = 2x(1 - x)$ starting at $x_0 = .2$

6. Try the built-in routine `fzero`: $z=fzero(@fcn,x0)$, where $x0$ is an initial guess for the zero. You might want to use it to find the fixed point of the equation $f(x) = \frac{1}{2}(x + \frac{5}{x})$, (which should be the equal to $\sqrt{5}$, as we saw last time).

```
z = fzero(' .5 * (x + 5/x) - x ',2)
```

tells Matlab to find the zero of the function $.5(x + \frac{5}{x}) - x$, i.e. the point where $f(x) = x$. It also tells Matlab to use the initial guess, 2.

Try starting at different initial guess: what happens? Why?

Instead of actually typing in the function you can put the name of a Matlab file that returns the value of the function. An example of this can be found in the file: `FindZeroExample` which finds the zero of the function stored in the file `FindZeroFunction`. Check these out and see if you can modify them to answer the following:

7. Use the built-in function `fzero` to find a point of period 2 for the logistic map with $a = 3.2$. Use `iterate` to see if this period 2 orbit is *stable*.
Hint: you first might want to write an M-file that returns $F^2(x) - x$, where F is the logistic map: $F(x) = 3.2x(1 - x)$.