

CS 401: Problem Set 3

Essential Knowledge—Please give a brief answer (1-2 sentences) for each

1. Explain the result of the following Matlab statements:

```
» mypi='3.1416';
```

```
» sin(mypi)
```

What would you need to do to compute the value of $\sin(3.1416)$? You are only allowed to work with the variable `mypi` and any Matlab functions.

2. Your data consist of a vector of observations called `obs` made at the times `t`. You want a plot of observations vs. time. How would you have Matlab create this plot so that each observation is plotted as a green diamonds and the squares are connected by black lines?
3. (For those who like scripts...) Create a simple `startup.m` script for your system. You should add at least two directories to your path which are not in the default Matlab path (these directories should contain your data or functions). Your script should also seed the random number generator. Please send me your `startup.m` file (and please keep it brief).
4. For PS4, you will have to develop a Matlab solution to a problem relevant to you. The solution should consist of a function or two that implement a solution to your problem. Suitable problems could include code to simulate a phenomenon, load or manipulate a specific data type, or compute a summary statistic of your data. Please send me a brief description of the problem you're planning to work on. Provide enough detail so that I can give you feedback.

Programming: Working with Find

Your task is to develop a function called “`findallseq`” that searches a vector of numbers and returns the location of any number that is followed by $n - 1$ copies of itself. For example, if the vector is `[1 1 2 2 3 3 3]` and $n=2$, then `findallseq` should return `[1,3,5,6]`. If $n=3$, then it should return `5`. As

with most computational problems, the solution may not be immediately apparent. When you encounter a problem that seems hard, a good strategy is to figure out how to solve a simpler, but related problem. Often, solving the simpler problem will provide insight into the harder one. So, here's a simpler problem...

5. You have a vector of numbers and you want to know whether any adjacent pairs of numbers are the same. Specifically, you want an index to any numbers in the vector that are followed by a copy of themselves. For example, if $x=[1\ 2\ 2\ 3]$ is the vector, then the index should be 2. This sort of problem comes up in a variety of situations; for example, finding duplicate entries in a database, and it is exactly the same as the “findallseq” problem with $n=2$. Write a function called “findduplicate.m” that solves this problem. Hint: look into the “diff” function.
6. Notice, that a sequence of n duplicate numbers (e.g. $[3, 3, 3]$) contains $n-1$ pairs of duplicate numbers (e.g. 2 pairs: the first at position 1, the second at position 2). This suggests that we might be able to implement findallseq by applying the solution developed in findduplicate (or a part of it) several times. Implement findallseq.m. I will accept any solution to the problem.

Bonus (Optional) Write a function called findseq that returns the start of any sequence of identical numbers of length n or greater. If the vector is $[1\ 1\ 2\ 2\ 3\ 3\ 3]$ and $n=2$, then findseq should return $[1,3,5]$ rather than the $[1,3,5, 6]$ that findallseq would return. I will award a cookie to the person submitting the “best” solution to the problem. I will determine “bestness” based on the three E's: efficacy, efficiency, and elegance.