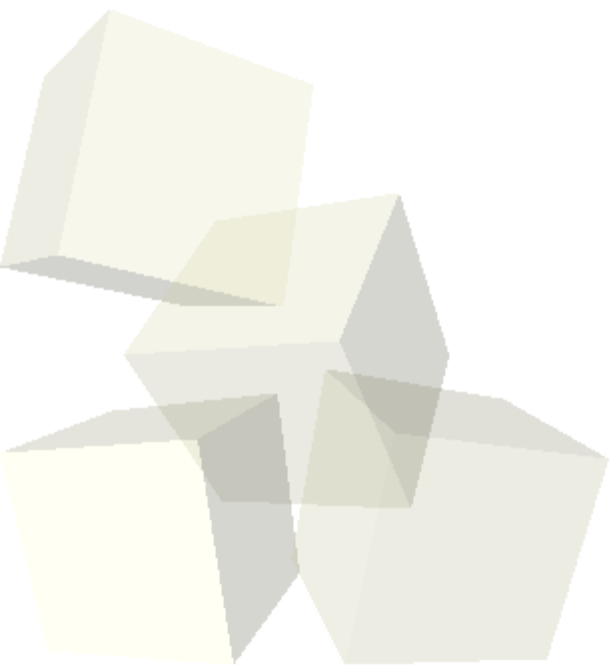




Structures, Strings, and Systems

2/8/2008





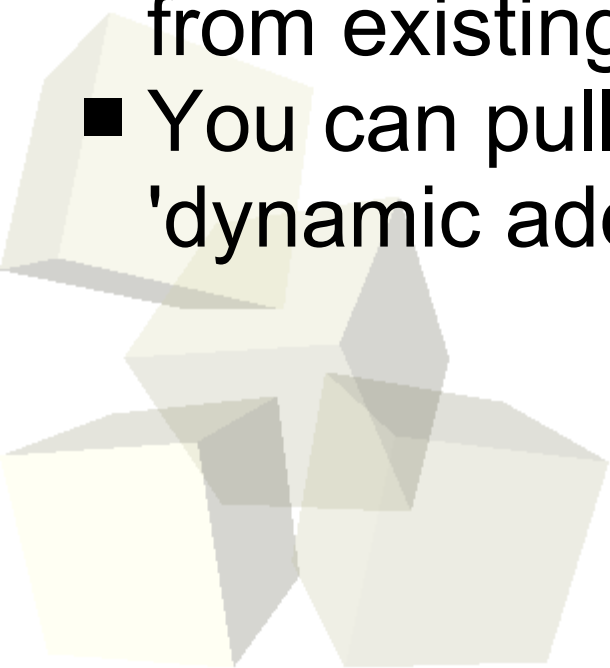
Opening Discussion

- What did we talk about last class?
- Do you have any questions about the reading?
- Do you have any questions about the assignment?





- You can use the dot notation to put fields into a variable to make a structure. Unlike normal imperative languages, the format of the structure isn't predefined.
- Matlab deals with arrays of structures just like numeric arrays.
- The struct function can build arrays of structures from existing cell arrays.
- You can pull out all the values of certain field with 'dynamic addressing'.

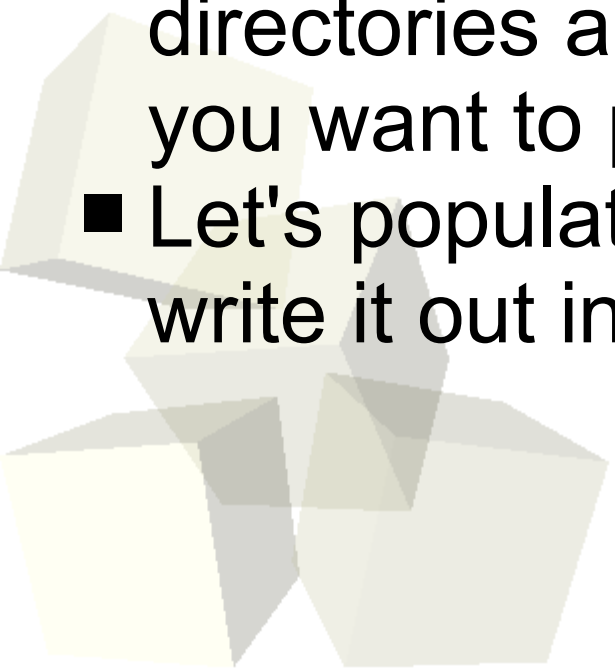




- Like most other languages, Matlab does give you the ability to use strings, though that isn't a real strength.
- A Matlab string is simply a row array of characters.
- A downside of this is that an array with multiple strings must have all the strings be the same length. The `char` function can help with that.
- You can also convert from numbers to strings and back with `str2num` and `num2str`.
- Matlab also has `fprintf` and `sprintf` functions that work much like the C functions.
- Similarly, `sscanf` will pull numbers out of strings.
- `eval` and `evalc` let you process a string like it were a Matlab function.



- Save and load commands let you access native files that store Matlab variables.
- Doing `help fileformats` will also show you all the other formats the Matlab supports normally.
- You can do low level I/O with C-like functions. `fopen`, `fclose`, `fread`, `fwrite`, `fscanf`, `fprintf`, etc.
- In addition, Matlab will also let you play with directories and even has built in support for ftp if you want to pull things across a network in Matlab.
- Let's populate an array with a bunch of values, write it out in a text file, then read it back in.





- Now we get into the things that Matlab was really developed for and where it really stands out.
- 2-D arrays are basically matrices and can be used for doing all types of math.
- Before we get into this we should talk about systems of linear equations and how they can be solved.
- Matlab actually has routines that will try to solve systems of equations that aren't “well behaved”. That is, it will approximate both over-determined and under-determined systems.



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- 2-D arrays are basically matrices and can be used for doing all types of math.
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- A set of linear equations is typically expressed as $Ax=y$, where A is an n by n matrix and x and y are n by 1 matrices. You are given A and y and want to solve for x .
- If the equations are “well behaved” there is a single solution $x=A^{-1}y$. Use \backslash instead of $\text{inv}()$.

- If A isn't square there isn't a single solution. When A has more rows than columns there is no exact solution (overdetermined). When A has more columns than rows there are an infinite number of solutions (underdetermined).
- Matlab actually has routines that will try to solve systems of equations that aren't "well behaved". That is, it will approximate both over-determined and under-determined systems.
- In the overdetermined case, $A \setminus y$ will give you the least squares solution. This is can be viewed as an optimal fit.



Sparse Matrices

- Matlab also has that ability to store sparse matrices.
- We aren't really going to take advantage of this in this class, but if you have a large matrix that has mostly zeros in it, this can be significant.





Closing Comments

- Assignment #3 is due on Monday and quiz #2 is on Wednesday.

