## Matlab Fundamentals:

working with data

## Outline

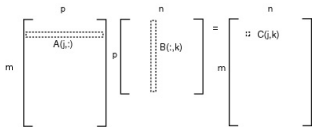
- Errata & Homework I.
- Matrix Multiplication
- ND-arrays
- Loading, saving, and plotting data

## Matlab History

- Matlab stands for "Matrix Laboratory"
- Developed by from LAPACK--a series of routines for numerical linear algebra
- Consequences
  - * is funny, / is even funnier
  - Matlab does linear algebra really well
  - Default type is double array

## Matrix Multiplication C=A*B

- A is m-by-p and B is p-by-n then C is m-by-n:
  - C(i,j)= a(i,1)*b(1,j)+a(i,2)*b(2,j)+ … + a(i,p)*b(p,j)




- Another view:
  - C(i,j)=a(i,:)*b(:,j);
    - 1-by-p p-by-1 answer is 1-by-1

## Matrix Multiplication

- We'll defer matrix division for a while
- matrix multiplication can be useful-- even to those who hate LA
  - ones(3,1)*[1:5]

## ND arrays

- Until V5, Matlab arrays could only be 2D
- Now has unlimited dimensions:
  - A=ones(2,3,2)
  - A is a 3D array of ones, with 2 rows, 3 columns, and 2 layers
  - A(:,:,1) is a 2-by-3 matrix

## Working with Data

- Data is central to applied scientific computing

| | Data → | Program → | Output |
|---|---|---|---|
| Currents | SSH | Geostropic eq. | U,V,plot |
| Weather | T,V,M | Finite diff. | T,V,M in future |
| Bioinfomatics | ATCGCGTA… | Search for genes | Location of genes |
| Electronics | Signal | FFT | Plot of spectrum |

## Getting Data into Matlab

- Options
  - Cut & paste, or enter by hand
  - Read from a file

## File Types

| File Type | Efficiency (info/byte) | Matlab Factor | Intangibles |
|---|---|---|---|
| ASCII | Low | Good | Easy to edit and view, universal. |
| Binary | High | Not so good | Can't view, need to know how it was created |
| Proprietary (e.g. Excel) | ?? | Impossible-to-good | Some formats supported, some not |
| .mat | High | Best | Careful when loading to avoid variable-name collisions |

## Loading Simple Text Files

- "load fname.txt" will create an array fname with the data
  - Each line of fname.txt must have same number of columns
  - Matlab will ignore lines starting with %-- useful for headers

## Omahacorn.txt

- Table of values in Excel
  - Make the file suitable for Matlab (e.g. a matrix)
  - save as text
  - Load into Matlab
  - Rearrange the data with Matlab array operations
  - Save data to a .mat file
  - Create a plot of corn prices vs. time

## Summary

- Matrix mult: "Inner matrix dimensions must agree"
- Load ASCII or .mat files with load
- Save data to ASCII or .mat with save
- Create simple plots with plot
- Get help with help

## Other help options

- helpwin--help info catagorized and available through GUI
- Launch Pad or through Help menu
  - More tutorial-like