Handle Graphics and 1D Primitives

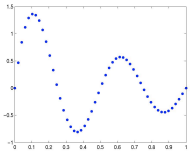
Some Handel graphics

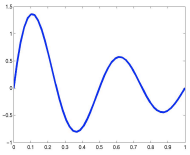
Outline

- Announcements
  - Homework I on web, due Wed. 5PM by e-mail
- Plotting f(x)
- Dissecting plot
- Getting a handle on things
- Example: colortime.m

Plotting f(x)

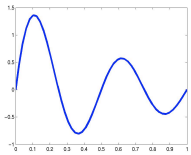
- Simplest plot is an (x,y) pair
  - boring:
- Simplest interesting plot is f(x) for several x
  - plot as points points or lines:





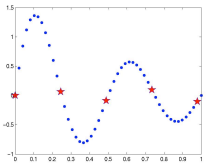
Plotting f(x)

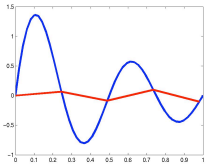
- Philosophical details:
  - is plot of f(x) 1D or 2D?
  - Math: f takes one variable, so 1D
  - but, the curve is a 2D object
  - I will take a "data-oriented" view and call this 1D



Plotting f(x)

- Points vs. lines?
  - most of the time, we will have vectors x and y where y is f evaluated (or observed) for every x
  - plotting with dots represents EXACTLY the info we have
  - plotting with lines implies we know something about f(x) between x_j and x_{j+1}





Plotting f(x) in Matlab

- Let x be a length n vector (1D array)
  - x=(0:49)/49;
  - x=linspace(0,1,50);
- Construct y=f(x)
  - y=sin(2*pi*x*2)./(2*x+0.5);
  - could also load x or y from a file

Plotting f(x) in Matlab

- Standard call: plot(x,y,options)
  - options control color, marker, and line style
    - 'ro:' plots in red (r) with circles at points (o) and a dotted line (:)
  - plot(x,y) uses default color (usually, blue)
  - plot(y) is plot(1:length(y),y)
  - plot(X,Y) (X and Y are matrices) plots one line per column in X and Y

Output of plot

- "PLOT returns a column vector of handles to line objects, one handle per line"
- Huh?
  - handles?
  - line objects?

Getting a handle on things

- h=plot(x,y) will return a handle to the line--h
- Handles are just floating point numbers, but they function as pointers to Matlab graphics objects
- We can use them to get info about objects and to change the objects' properties

Getting a handle on things

- Get properties with "get"
  - get(h)--lists all of the properties of h and their values
  - get(h,property)--returns the value of the property
    - types vary with property (some are texts, some are arrays)
- Change properties with "set"
  - set(h)--lists all of the properties and their default values
  - set(h,property,value, property, value,…)--changes the values of the properties
- set is "vectorized" so you can change properties of lots of objects simultaneously

Handle Properties--ALL objects

- The last 18 properties from get(h) are properties that all objects have
- Most important:
  - Parent--handle to parent object
  - Children--handles to child objects
  - Type--tells what it is (e.g. line)
  - Visible--(on/off) can hide objects
- A few other general properties are used for GUI's

Handle Properties--line objects

- xdata, ydata, zdata specify the points
- color describes color of the line segments
  - specify with a "colordef"
    - a special character ('r', 'g', 'b', 'k', etc.)
    - RGB vector (1-by-3 with numbers between 0 and 1)
- linestyle--controls how line segments look
  - '-'=solid, ':'=dotted, '--'=dashed, 'none'=no lines
- linewidth--thickness of line (a double)

Handle Properties--line objects

- marker--marker type
  - 'o'=circles, 'x'=x's, '+'=crosses, 'p'=pentagrams, 's'=squares, '^'=triangles
- markerfacecolor--color of the inside of the marker
- markeredgecolor--color of the outside of the marker
- markersize--size of marker

Example--Representing time with color

- We have a function y=f(x,t) sampled at discrete times
- We want to plot y for each t as a different color
  - the colors should correspond to t and vary continuously
- We will implement this as a Matlab function "colortime.m"

Development of colortime

- 1) Identify inputs and outputs to function

	variable	size	description
Inputs:	x	m-by-1	row labels
	t	1-by-n	column labels
	Y	m-by-n	data matrix s. t. Y(j,k)=f(x(j),t(k))
Outputs:	h	n-by-1	handles to lines representing Y(x,t(k))

Development of colortime

- 2) Top-down design using *pseudocode*
  - Like outlining a manuscript
  - First, identify key steps, describe in English
  - Then, figure out how to implement each step in code
    - Steps may be complex enough to warrant further top-down refinement (recursion)

Development of colortime

- 1) Check that inputs are OK
- 2) Plot the lines with the appropriate colors

Development of colortime

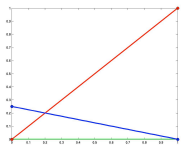
- 1) Check that inputs are OK
- 2) Plot the lines with the appropriate colors
  - Plot the lines
  - Change the colors

Development of colortime

- 1) Check that inputs are OK
- 2) Plot the lines with the appropriate colors
  - Plot the lines
    - h=plot(x,Y);%matlab plots a line for each column in Y
  - Change the colors
    - for j=1:n
      - set(h,'color', RGB(j,:));
    - end

Development of colortime

- 1) Check that inputs are OK
- 2) Plot the lines with the appropriate colors
  - Plot the lines
    - h=plot(x,Y);%matlab plots a line for each column in Y
  - Pick the colors
    - RGB=interp1([tmin;tm
  - Change the colors
    - for j=1:n
      - set(h,'color', RGB(j,:
    - End



Development of colortime

- 1) Check that inputs are OK
- 2) Plot the lines with the appropriate colors
  - Plot the lines
    - h=plot(x,Y);%matlab plots a line for each column in Y
  - Pick the colors
    - RGB=interp1([tmin;tmax],[rgb1;rgb2],t);
  - Change the colors
    - for j=1:n
      - set(h,'color', RGB(j,:));
    - end