Visualization with Matlab and R

Survey of methods, cont’d
Plots with Matlab and/or R
Dot Plots

- Dot plots are very easy to make in both Matlab and R

Usage:

\[
\text{plot}(x,y,\text{spec}...) \\
\text{where}
\]

- \(x\) is a vector of \(x\) values
- \(y\) is a vector of \(y\) values
- \(\text{spec}\) is a set of arguments specifying options
Plot in R

- Example

\[
y = c(1,4,5,7,2,3,7,7)
\]
\[
x = 1:length(y)
\]
\[
> \text{plot}(x, y)
\]

- Note R figures out the size of the bounding box from the data

1D dot plot, data in y
Plot in R (cont’d)

- Options can specify
  - glyph (plot character, or pch)
  - color
  - axis labels
  - main label
  - many more: type `help(par)` for more information

- `plot()` is a “high-level” function
  - initializes a new graphic object in the current graphic window

- “low-level” functions add information to the current graphic
  - `points()` is a function that adds dot plot glyphs to the current graphic
Plots in R (cont’d)

- A simple method for complex displays:
  - do an initial plot to set bounds, labels, etc
  - do additional low-level commands to add data

```r
plot(c(0,10), c(0,10),
     xlab="length",
     ylab="width",
     main="Leaf Size",
     pch=" ")
points(leafl, leafw,
       pch=8, col="blue")
```

2D plot, leaf length vs width
Line Graphs

- The same function can be used to make line graphs
- The third argument to `plot()` specifies how points are displayed
  - “p” points (default)
  - “l” lines (connects points with line segments)
  - “b” both lines and points
  - “n” no plot (just display labels, etc)
  - “h” histogram (connect each point to x-axis)
Line Graphs (cont’d)

- Example: plotting a function

```r
> x = 1:100
> u = 50
> t = .1
> h = 1
> phi = h * exp(-(x-u)**2/2*t**2)
> plot(x,phi,"l")
```
Images

- An image is a representation of a 2D array
  - Map each element of the array to a color index
  - Typically the index is in the range 0..255
Matlab image Function

- Output of laplace program is text
- Loaded into Matlab

\[
T = \begin{bmatrix}
100 & 100 & \ldots \\
0 & 49.96 & \ldots \\
0 & 31.15 & \ldots \\
\ldots \\
.. & 0 & 0
\end{bmatrix};
\]

```
image(T);
```

R also has an image function -- stay tuned...
Contour Plots

- A contour plot has the same basic shape as an image
  - 2D array
  - elements are numbers, e.g. temperatures

- The plot consists of a set of lines connecting elements with the same value
  - if elements are temperatures, lines are isotherms

- Parameters to the contour plotting function specify the number of lines, the spacing between underlying values, etc
  - e.g. 8 lines, corresponding to $T = 10$, $T = 20$, ...
contour Function in Matlab

- Matlab has a function to produce contours

```
contour(T);
```

R also has a `contour` function -- stay tuned...
Other Functions for 2D Data

- Some other Matlab (and R?) functions
  - `mesh(T)`
  - draws a 3D plot
  - height of point above \((x,y)\) is \(z = T(x,y)\)
  - lines connect \(z(i,j)\) to \(z(i-1,j), z(i+1,j)\), etc
  - options for hidden surface removal

- Surfaces
  - `surf(T)` is the same as `mesh(T)`, except a solid “plane” is drawn
  - hidden surfaces are not drawn