CS 100M: Lecture 11
March 1

Lab this Week
Project 3 is available on website

Prelim 1
Mean = 75.8, standard deviation = 18.8.
Will be returned at end of lecture.
Unclaimed papers will be available for pick up during consulting hours at Carpenter by Wednesday afternoon.
Last day to submit regrade requests to consultants at Carpenter is Tuesday, March 8, at 7pm.

Setting Up Vectors

- Linspace
- Zeros
- Ones
- Rand
- Colon notation
- Augmentation
- Functions of Vectors

linspace

>> x = linspace(-1,1,5)

x =
-1.0000    -0.5000     0     0.5000    1.0000

linspace

a = 1.234; b = 5.567; n = 4;
x = linspace(a,b,n)

% Same thing:
h = (b-a)/(n-1);
x = zeros(1,n);
for k=1:n
    x(k) = a + (k-1)*h;
end
x = x

zeros

>> n = 3;
>> x = zeros(1,n)
x =
0     0     0

>> y = zeros(n,1)
y =
 0     0     0
ones

```matlab
>> n = 3;
>> x = ones(1,n)
x =
     1     1     1
>> y = ones(n,1)
y =
     1     1     1
```

rand

```matlab
>> n = 3;
>> x = rand(1,n)
x =
    0.9501    0.2311    0.6068
>> y = rand(n,1)
y =
    0.4860
    0.8913
    0.7621
```

Colon Notation

```matlab
>> a = 1:5
a =
     1     2     3     4     5
>> b = 1:2:5
b =
     1     3     5
>> c = 1:3:5
c =
     1     4
```

Augmentation

```matlab
>> x = 1:3
x =
     1     2     3
>> y = 10:13
y =
    10    11    12    13
>> z = [x y]
z =
     1     2     3    10    11    12    13
```

Colon Notation

```matlab
>> a = 5:-1:1
a =
    5     4     3     2     1
>> b = 5:-2:-4
b =
    5     3     1    -1    -3
>> c = 10:20:90
   c =
   10    30    50    70    90
```

Sin of a Vector is a Vector

```matlab
>> x = linspace(0,pi/2,4)
x =
    0    0.5236    1.0472    1.5708
>> y = sin(x)
y =
    0    0.5000    0.8660    1.0000
```
**Sin of a Vector is a Vector**

```matlab
a = 0; b = 6*pi; n = 100;
x = linspace(a,b,n);
y = sin(x)
% is the same as
y = zeros(1,n);
for k=1:n
    y(k) = sin(x(k));
end
```

**Ditto for the Other Functions**

```matlab
a = 0; b = 6*pi; n = 100;
x = linspace(a,b,n);
y = cos(x)
% is the same as
y = zeros(1,n);
for k=1:n
    y(k) = cos(x(k));
end
```

**Plotting the Sine Function**

```matlab
for n = 10:10:100
    x = linspace(0,4*pi,n);
y = sin(x);
    plot(x,y)
    title(sprintf('n = %d',n))
    pause
end
```

**n = 10**

![Graph for n = 10](image)

**n = 20**

![Graph for n = 20](image)

**n = 30**

![Graph for n = 30](image)
In its most simple form:

\[ \text{plot}(\text{"x" vector},\text{"y" vector}) \]

"Connect the dots"

To display a continuous function nicely it usually takes 2-4 hundred dots.

Some examples for:

\[
\begin{align*}
x_1 &= \text{linspace}(0,6\pi,200); \\
y_1 &= \sin(x_1); \\
x_2 &= \text{linspace}(0,6\pi,13); \\
y_2 &= \sin(x_2); \\
\end{align*}
\]

\[ \text{plot}(x_1,y_1,x_2,y_2,'or') \]

\[ \text{plot}(x_1,y_1,:',x_2,y_2,'*k') \]

\[ \text{Plot}(x_1,y_1,x_2,y_2,'or',x_2,y_2,'*k') \]

axis off
figure
x = linspace(0,2*pi,200);
y = sin(x); z = cos(x);

figure
plot(x,y)
figure
plot(x,z)

Plots sine in one window and cosine in another window.

hold
x = linspace(0,2*pi,200);
y = sin(x); z = cos(x);

plot(x,y)
hold on
plot(x,z)
hold off
figure
plot(x,y)

Plots sine and cosine in one window and sine (by itself) in another window.

pause, close
x = linspace(0,2*pi,200);
y = sin(x); z = cos(x);

plot(x,y)
hold on
plot(x,z)
hold off
figure
plot(x,y)
pause(2)
close all

Plots sine and cosine in one window and sine (by itself) in another window. Let's you look things over for 2 seconds then closes all figure windows.

Combining Vectors
x = linspace(0,2*pi,200);
y = sin(x); z = cos(x);

w = 3*y + 4*z;
plot(x,w)

Plots the function f(t) = 3sin(t) + 4cos(t)

Adding and Scaling Vectors
>> a = [10 20 30];
>> b = [1 2 3];

>> c = a+b
  c =
       11       22       33

>> d = 7*a
  d =
       70      140      210

x = linspace(0,2*pi,200);
y = sin(x); z = cos(x);

w = 3*y + 4*z;
% Same as
w = zeros(1,200)
for k=1:200
  w(k) = 3*y(k) + 4*z(k);
end
% Same as
w = zeros(1,200)
for k=1:200
  w(k) = 3*sin(x(k)) + 4*cos(x(k));
end