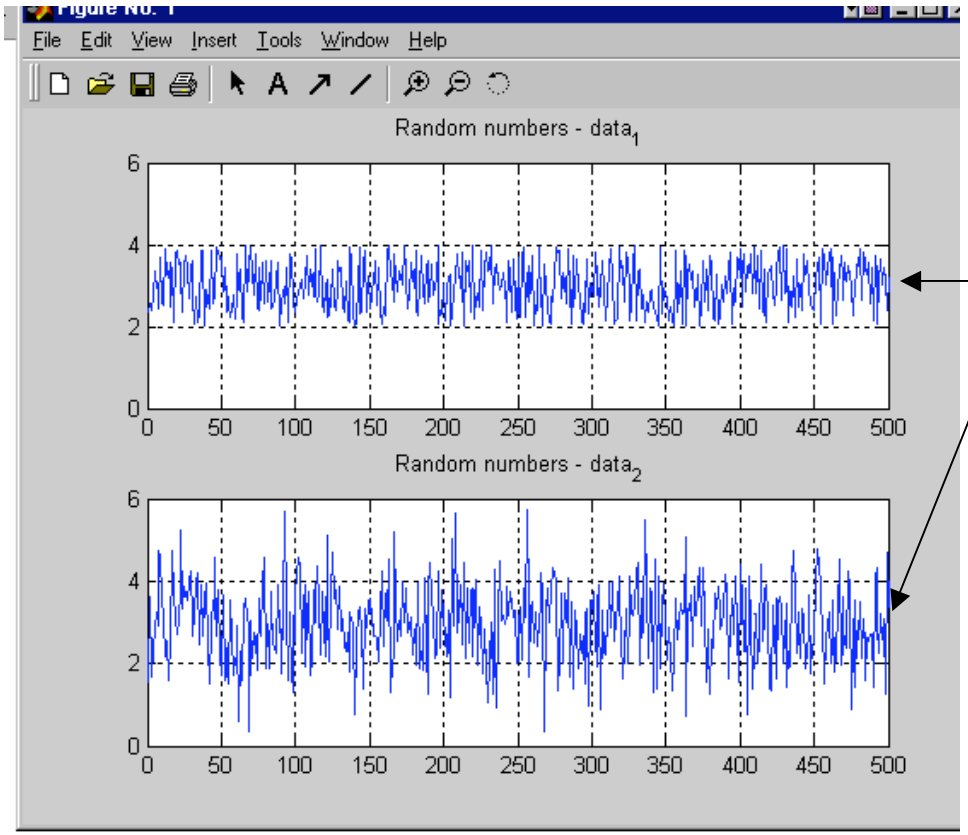
Lecture 13C - Random Numbers

- Section 3.2.2 – Standard Deviation
- Section 3.2.3 – Histograms
- Section 3.3 – Random Numbers

Chapter 3.2.2 – Standard Deviation

std (x) computes standard deviation of the values in a vector x. If x is a matrix, it computes a row vector containing the standard deviation of each column of x.



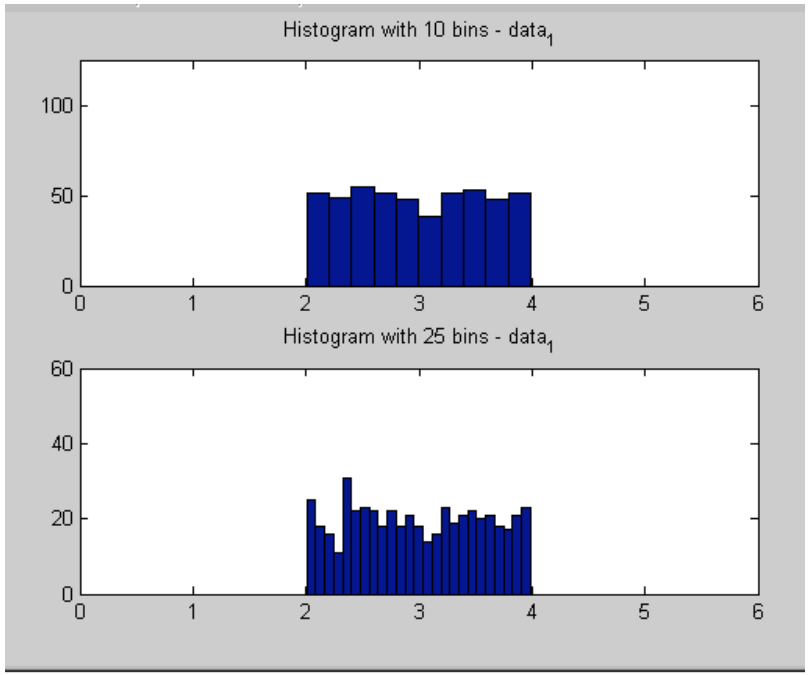
Mean looks like about 3 for both data_1 and data_2

but deviation looks larger for data_2

Chapter 3.2.3 – Histograms

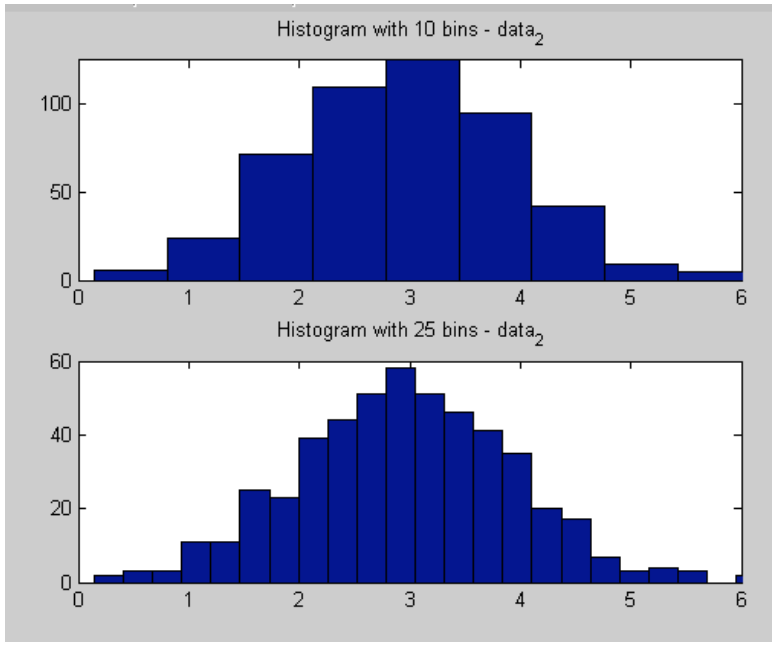
hist (x) generates a special plot called a histogram from the values in a vector x. The default is "10 bins".

hist (x, 25) generates a histogram with "25 bins".



uniform distribution

rand



normal distribution

randn

Chapter 3.3 – Random numbers

rand (m,n) generates random #'s between 0 and 1 – uniformly distributed. Creates m by n matrix.

rand ('seed', x) initiates a random sequence. Initially set to 0, but this is how you change it.

```
% try this
rand('seed', 0)
set1=rand(1,6)
set2=rand(1,6)
rand('seed', 0)    % start sequence over
set3=rand(1,6)
set4=rand(1,6)
rand('seed', 10)   % different seed gives different sequence
set5=rand(1,6)
```

Random numbers - uniform distribution

rand (m, n) generates random #'s between 0 and 1.

What if you want values in a different range?

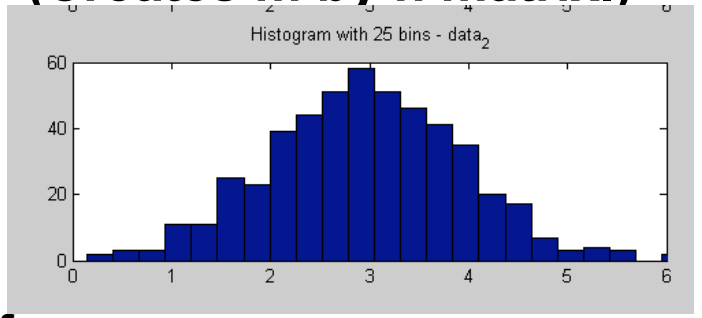
Use: x = (b – a) * random_number + a

where: b= upper bound, a= lower bound

```
% Try generating 100 random #'s between 3 and 10
rand ('seed', 0)       % set seed to 0
% use formula:  x=(10 - 3) * random_number + 3
set1=(7*rand(1,100))+3
% take a look at the histogram of this
hist(set1)
% calculate the mean
mean(set1)
% calculate the standard deviation
std(set1)
% find the max & the min
```

Random numbers - normal distribution

randn (m, n) yields random #'s with mean= 0, std= 1 in a Gaussian or "normal distribution". (Creates m by n matrix.)



Looking at the graph from before…

It looks like there is a peak.

(In this example it was 3.)

68% of values fall within 1 standard deviation of mean.

95% of values fall within 2 standard deviations of mean.

99% of values fall within 3 standard deviations of mean.

To modify Gaussian values with a mean of 0 and standard deviation of 1, use: x = s * random_number + m

where: s= standard deviation, m= mean

```
% Try generating 1000 random #'s with s=2 and m=3
randn ('seed', 0)       % set seed to 0
set2=(2*randn(1,1000))+3;
hist(set2,25)
```

Summarize Random #s

See p. 65-67

rand ('seed', x) initiates a random sequence.

rand (m,n) generates random #'s between 0 and 1 – uniformly distributed. Creates m by n matrix.

To change range, use:

x = (b – a) * random_number + a

where: b= upper bound, a= lower bound

randn (m, n) yields random #'s with mean 0 and std 1 in a Gaussian or "normal distribution".

Use randn ('seed', x) to change the seed for this.

To change range, use:

x = a * random_number + b

where: b= mean, a= standard deviation