Lecture 13C - Random Numbers

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- Section 3.3 – Random Numbers
Chapter 3.2.2 – Standard Deviation

\texttt{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 \( x \).

\begin{itemize}
  \item Mean looks like about 3 for both data\textsubscript{1} and data\textsubscript{2}.
  \item But deviation looks larger for data\textsubscript{2}.
\end{itemize}
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

normal distribution

rand

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: $x = (b - a) \times \text{random\_number} + a$

where: $b =$ upper bound, $a =$ lower bound

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% Try generating 100 random #'s between 3 and 10
rand ('seed', 0)  % set seed to 0
% use formula: $x=(10 - 3) \times \text{random\_number} + 3$
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

\texttt{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: \texttt{x = s * random\_number + m}
where: \texttt{s= standard deviation, m= mean}

% Try generating 1000 random #'s with s=2 and m=3
\texttt{randn (‘seed’, 0)} % set seed to 0
\texttt{set2=(2*randn(1,1000))+3;}
\texttt{hist(set2,25)
Summarize Random #s

**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:

\[ x = (b - a) \times \text{random_number} + a \]

where:  \( b = \text{upper bound}, \ a = \text{lower bound} \)

**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:

\[ x = a \times \text{random_number} + b \]

where:  \( b = \text{mean}, \ a = \text{standard deviation} \)