Statistical Analysis of Data (Part I)

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Estimators for statistical moments

$X_1, \cdots, X_n$ are independent observations of X

- Sample mean

$$\widehat{\mu} = \frac{1}{n} \sum_{i=1}^{n} X_i$$

- Sample skewness

$$\widehat{\gamma_1} = \frac{\frac{1}{n} \sum_{i=1}^{n} (X_i - \widehat{\mu})^3}{\left(\frac{1}{n-1} \sum_{i=1}^{n} (X_i - \widehat{\mu})^2 \right)^{3/2}}$$

- Sample variance

$$\widehat{\sigma^2} = \frac{1}{n-1} \sum_{i=1}^{n} (X_i - \widehat{\mu})^2$$

- Sample kurtosis

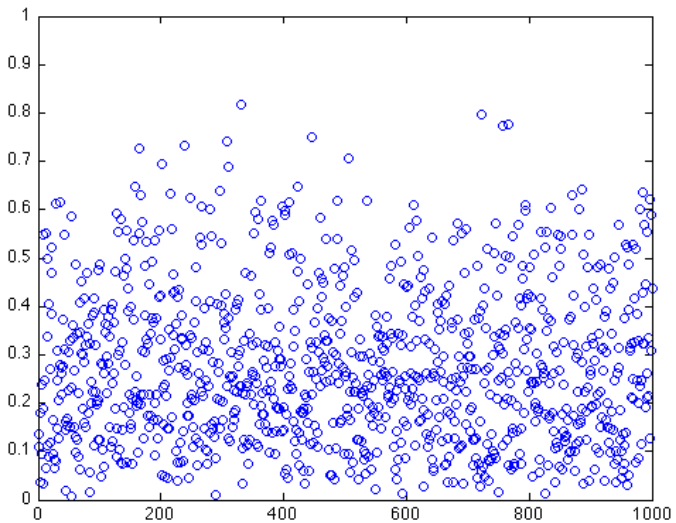
$$\widehat{\beta_2} = \frac{\frac{1}{n} \sum_{i=1}^{n} (X_i - \widehat{\mu})^4}{\left(\frac{1}{n} \sum_{i=1}^{n} (X_i - \widehat{\mu})^2 \right)^2}$$

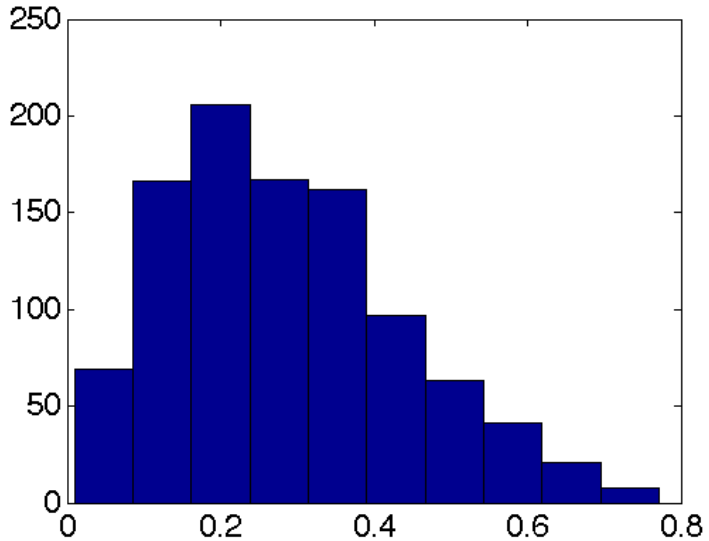
main_data_analysis1.m (1/2)

```
clc; clear all; close all;
a = 2; b=5; Ns = 1000;

X      = betarnd(a,b,Ns,1);
mu     = mean(X)
sigma2 = var(X)
sigma  = std(X)
gamma1 = skewness(X)
beta2  = kurtosis(X)

figure(1)
plot(1:Ns,X,'o')
ylim([0 1]);

figure(2)
hist(X)
xlim([0 1]);
```

Statistical analysis in Matlab/Octave

$$\texttt{mu} = 0.2849$$
$$\texttt{sigma2} = 0.0234$$
$$\texttt{sigma} = 0.1528$$
$$\texttt{gamma1} = 0.5900$$
$$\texttt{beta2} = 2.8555$$





main_data_analysis2.m (2/2)

```
clc; clear all; close all;
a = 2; b=5; Ns = 1000;

rng_stream = RandStream('mt19937ar','Seed',30081984);
RandStream.setGlobalStream(rng_stream); % Matlab 2013

X      = betarnd(a,b,Ns,1);
mu     = mean(X)
sigma2 = var(X)
sigma  = std(X)
gamma1 = skewness(X)
beta2  = kurtosis(X)

figure(1)
plot(1:Ns,X,'o')
ylim([0 1]);
figure(2)
hist(X)
xlim([0 1]);
```

References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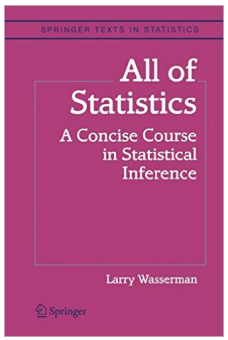

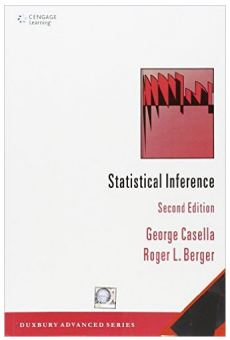

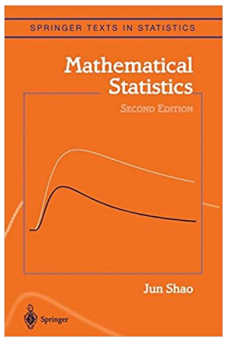

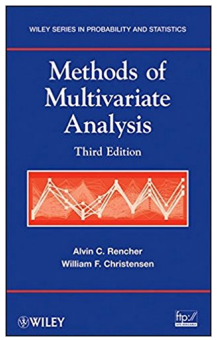

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