

# Probability and Random Processes

## ECS 315

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**Continuous Random Variables**



**Office Hours:**

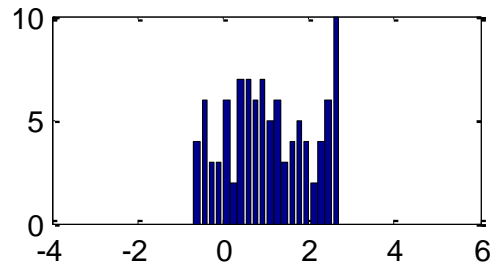
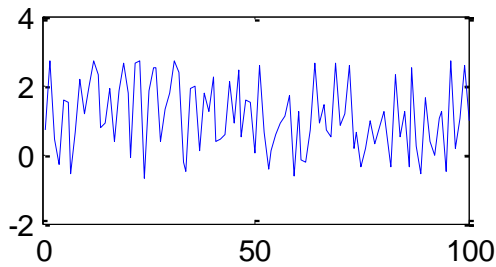
**Rangsit Library:**

**Tuesday 16:20-17:20**

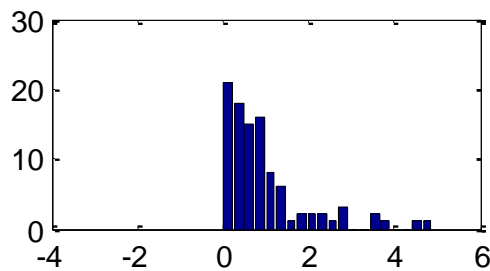
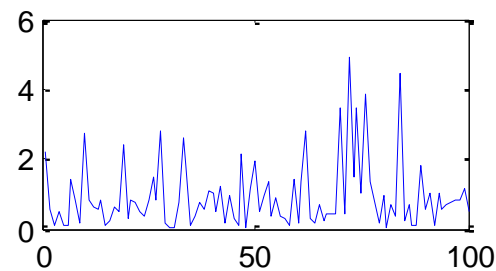
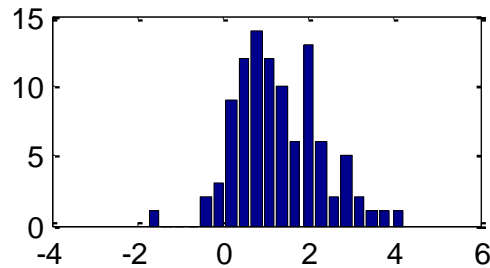
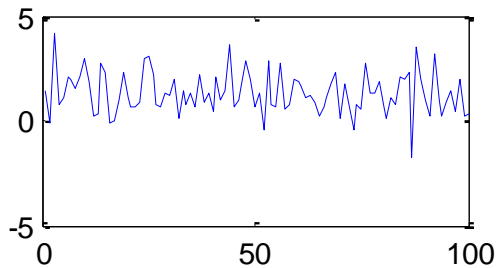
**BKD3601-7:**

**Thursday 16:00-17:00**

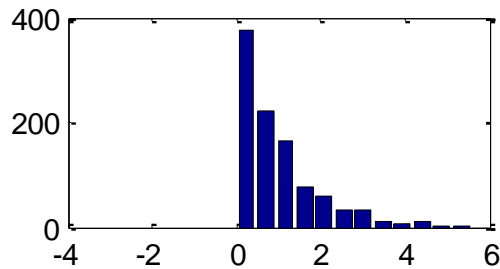
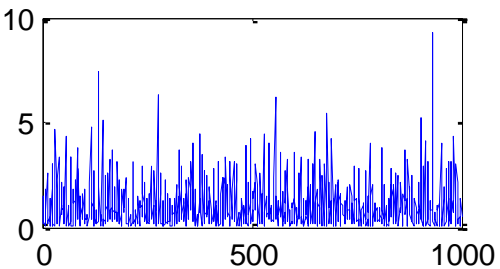
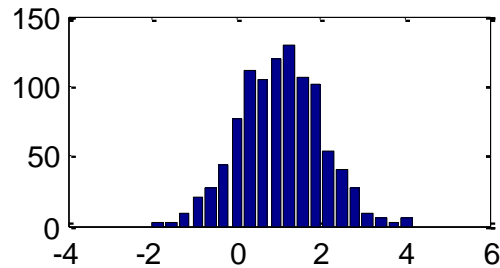
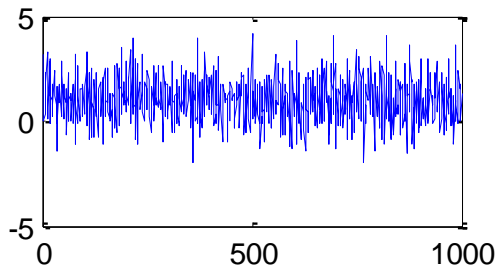
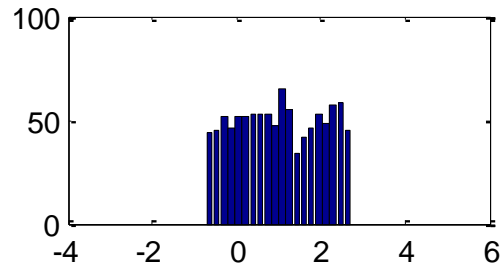
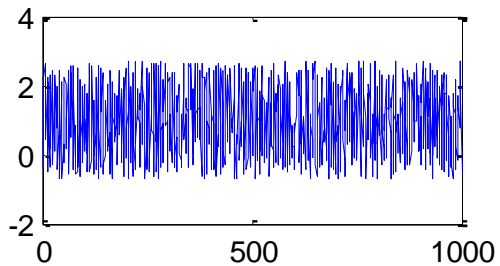
# Three Important Continuous RVs



Mean = 1  
Std = 1  
N = 100

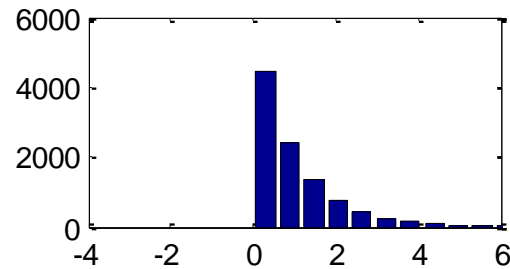
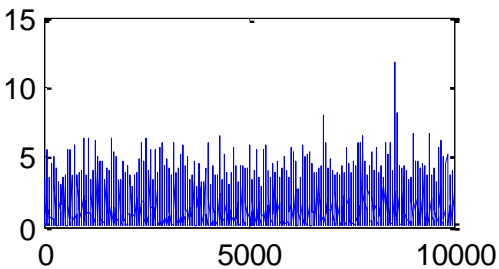
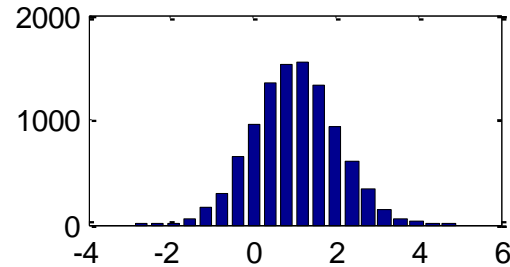
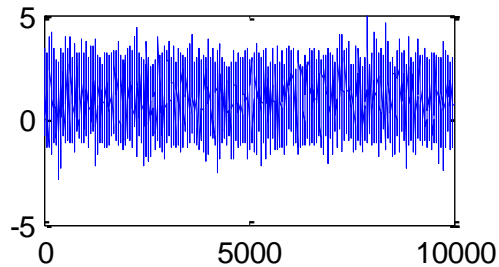
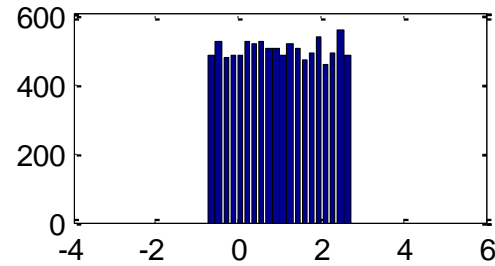
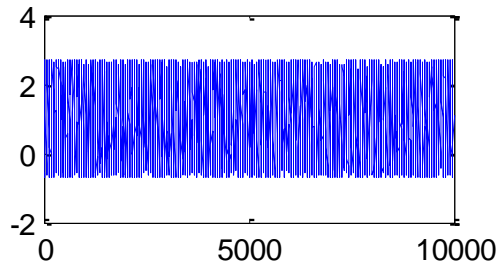


# Three Important Continuous RVs



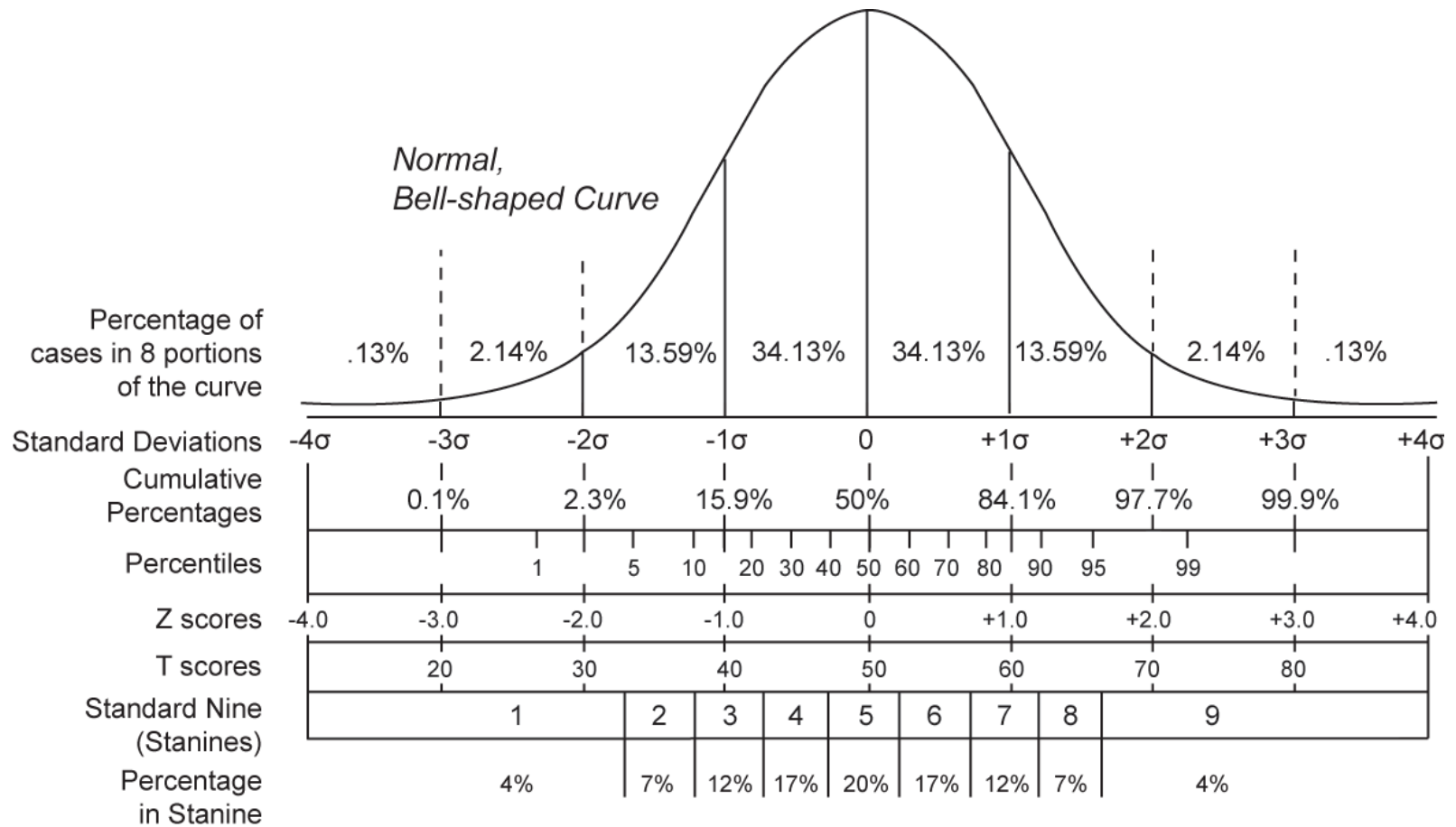
Mean = 1  
Std = 1  
N = 1000

# Three Important Continuous RVs



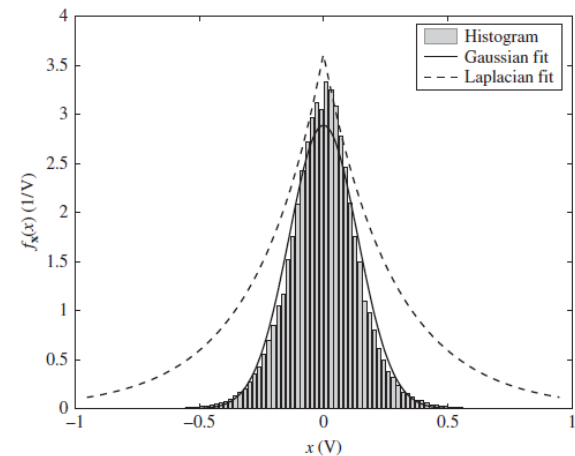
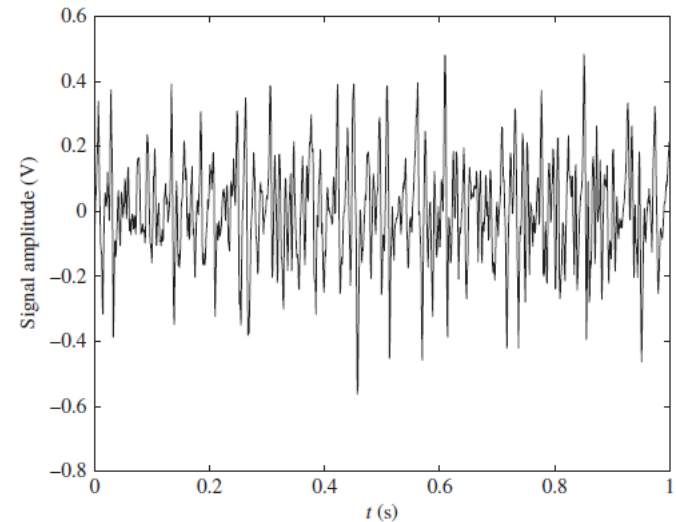
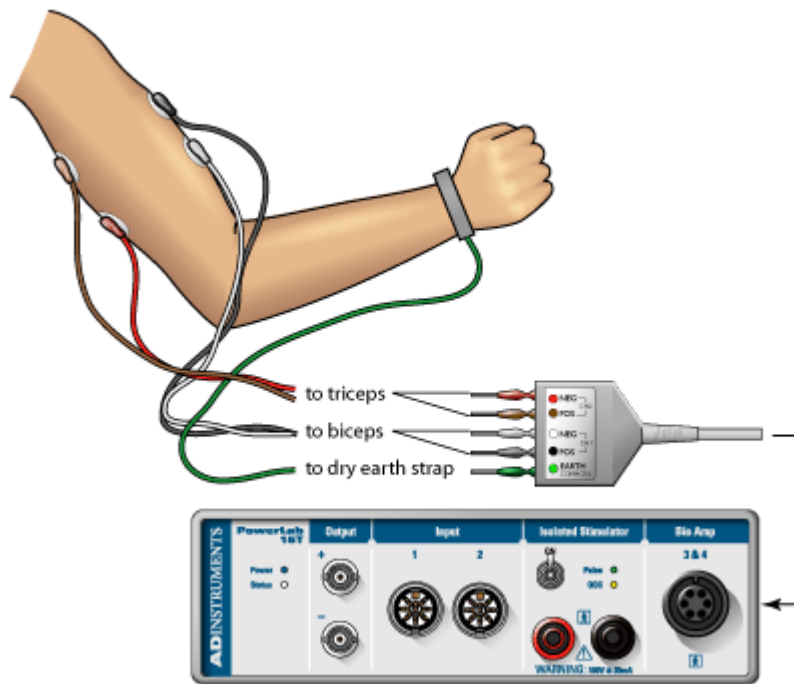
Mean = 1  
Std = 1  
N = 10000

# Gaussian Random Variable



# Example: Muscle Activity

- Look at electrical activity of skeletal muscle by recording a human electromyogram (EMG).



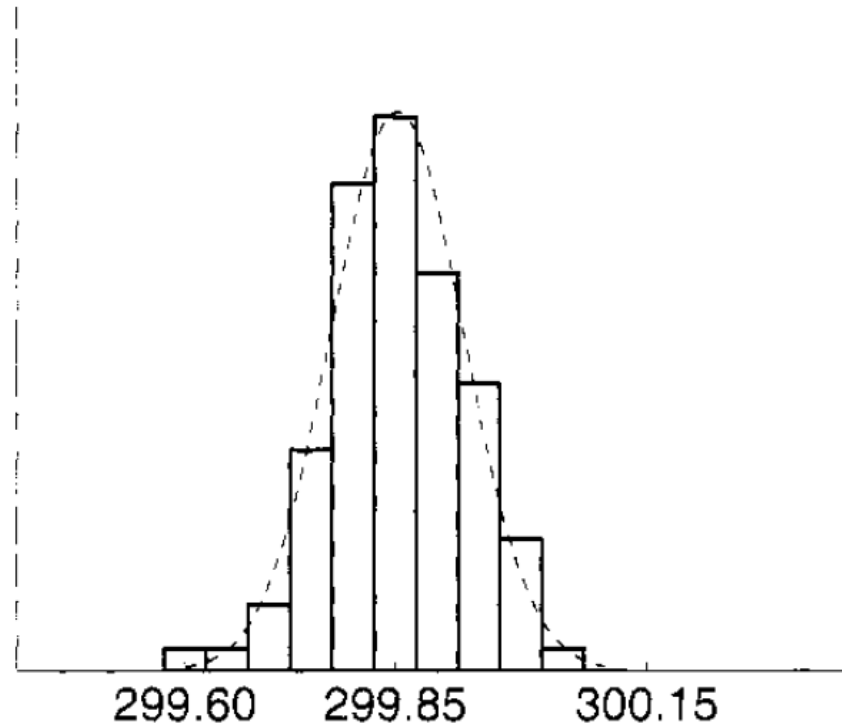
# Application: Gaussain pdf



[<http://www.truecar.com/index.html>]

# Ex. Measuring the speed of light

- 100 measurements of the speed of light ( $\times 1,000$  km/second), conducted by Albert Abraham Michelson in 1879.





# From the News

## Higgs boson-like particle discovery claimed at LHC

COMMENTS (1665)

By Paul Rincon

Science editor, BBC News website, Geneva

4 July 2012



Particle physics has an accepted definition for a **discovery**: a “five-sigma” (or five standard-deviation) level of certainty

The number of sigmas measures how unlikely it is to get a certain experimental result as a matter of chance rather than due to a real effect

They claimed that by combining two data sets, they had attained a confidence level just at the "five-sigma" point - about a **one-in-3.5 million chance** that the signal they see would appear if there were no Higgs particle.

However, a full combination of the CMS data brings that number just back to **4.9 sigma** - a one-in-two million chance.

$$\frac{1}{1-\Phi(5)} \approx 3.5 \times 10^6$$

$$\frac{1}{1-\Phi(4.9)} \approx 2 \times 10^6$$

# Six Sigma

- If you manufacture something that has a normal distribution and get an observation outside six  $\sigma$  of  $\mu$ , you have either seen something extremely unlikely or there is something wrong with your manufacturing process. You'd better look it over.
- This approach is an example of **statistical quality control**, which has been used extensively and saved companies a lot of money in the last couple of decades.
- The term **Six Sigma**, a registered trademark of **Motorola**, has evolved to denote a methodology to monitor, control, and improve products and processes.
- There are Six Sigma societies, institutes, and conferences.
- Whatever Six Sigma has grown into, it all started with considerations regarding the normal distribution.