

01204312

Probability Theory and Random Processes

Department of Computer Engineering, Faculty of Engineering,
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Course Summary

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Course Summary

- **Lecture #1 Introduction to Probability and Set Theory**
 - Intro to probability
 - Experiment \rightarrow procedure and observation
 - Probability definition
- **Lecture #2 Conditional Probability and Independent**
 - Axiom
 - Conditional probability
 - Law of Total Probability
 - Independent Event (independent & disjoint)
 - Sequential Experiments
 - Counting method

Course Summary

- **Lecture #3** *Discrete Random Variable*
 - *Random variable*
 - *Probability mass function*
 - *Useful discrete random variable*

Course Summary

- *Lecture #4 Discrete Random Variable (Part II)*
 - Cumulative Distribution Function (CDF)
 - Expected Value
 - Derived Random Variable
 - Variance & Standard Deviation

Discrete RV Summary

<p><u>Uniform</u> Equiprobable outcomes</p>	$\begin{cases} 1/(j-k+1) & x = k, k+1, k+2, \dots, j \\ 0 & \textit{Otherwise} \end{cases}$	$E[X] = \frac{(j+k)}{2}$
<p><u>Bernoulli</u> Pass/Fail</p>	$\begin{cases} 1-p & x = 0 \\ p & x = 1 \\ 0 & \textit{Otherwise} \end{cases}$	$E[X] = p$
<p><u>Geometric</u> # tests until fail</p>	$\begin{cases} p(1-p)^{x-1} & x = 1, 2, 3, \dots \\ 0 & \textit{Otherwise} \end{cases}$	$E[X] = 1/p$

Discrete RV Summary

<p><u>Binomial</u></p> <p># fails in n tests</p>	$\begin{cases} \binom{n}{x} p^x (1-p)^{n-x} & x=1,2,\dots,n \\ 0 & \textit{Otherwise} \end{cases}$	$E[X] = np$
<p><u>Pascal</u></p> <p># tests until k fails</p>	$\begin{cases} \binom{x-1}{k-1} p^k (1-p)^{x-k} & x = k, k+1, \dots \\ 0 & \textit{Otherwise} \end{cases}$	$E[X] = k/p$
<p><u>Poisson</u></p> <p>occurrence in a period</p>	$\begin{cases} \frac{(\lambda T)^x e^{-(\lambda T)}}{x!} & x = 0, 1, 2, \dots \\ 0 & \textit{Otherwise} \end{cases}$	$\begin{aligned} E[X] &= \alpha \\ \alpha &= \lambda T \end{aligned}$

Course Summary

- *Lecture #5 Multiple Discrete Random Variable*
 - Joint PMF
 - Marginal PMF
 - Covariance
- *Lecture #6 Multiple Discrete Random Variable II*
 - Correlation Coefficient
 - Conditional Joint PMF by an Event

Course Summary

- *Lecture #6-2*
Continuous Random Variable
 - Probability Density Function (PDF)
- *Lecture #7*
Continuous Random Variable
 - *Useful continuous random variable*
 - Uniform
 - Exponential
 - Gaussian

Course Summary

- *Lecture #8*

Continuous Random Variable Part II

- Gaussian Random Variable

- Standard Normal CDF

- Standard Normal Complementary CDF

- Mixed Random Variable

- Delta Function : $\delta(x)$

- Unit Step Function

Course Summary

- *Lecture #9 – 1 Mixed Random Variable*
 - Derived Random Variable
 - Conditioning a continuous RV
- *Lecture #9 – 2 Multiple Random Variables*
 - Joint CDF
 - Marginal PDF
 - Functions of 2 RVs

Course Summary

- *Lecture #10*
Multiple Random Variables – II
 - Expected Value
 - Conditioning Joint PDF by Event
 - Jointly Gaussian Random Variable

Course Summary

- *Lecture #11 Stochastic Process – I*
 - Stochastic Process
 - Counting Process
 - Poisson Process
 - Brownian Motion Process
 - Autocovariance and Autocorrelation
- *Lecture #12 Stochastic Process – II*
 - Random Sequence
 - Stationary Process
 - Wide-sense Stationary Process

Course Summary

- *Lecture #13 Law of large number & Central limit theorem*
 - Law of Large Numbers
 - Weak law
 - Strong law
 - Central Limit Theorem