MATH 374: Probability and Statistics for Electrical and Computer Engineers

Course Description from Bulletin: This course focuses on the introductory treatment of probability theory including: axioms of probability, discrete and continuous random variables, random vectors, marginal, joint, conditional and cumulative probability distributions, moment generating functions, expectations, and correlations. Also covered are sums of random variables, central limit theorem, sample means, and parameter estimation. Furthermore, random processes and random signals are covered. Examples and applications are drawn from problems of importance to electrical and computer engineers.

Prerequisites: MATH 251

Enrollment: Not applicable for AM majors. Credit only granted for one of MATH 374, MATH 474, and MATH 475.

Textbook: Alberto Leon-Garcia, *Probability, Statistics, and Random Processes for Electrical Engineering,* 3rd ed., Prentice Hall, 2007, ISBN13: 9780131471221.

Software: MATLAB

Objectives:

1. Students will learn basic rules of probability, basic counting techniques, and be able to compute and interpret means and variances.
2. Students will learn basic discrete and continuous probability distributions, including binomial, Poisson, uniform, exponential, normal distributions.
3. Students will learn point and interval estimation for various parameters, including the population mean and variance of random variables.
4. Students will explore hypothesis testing of various parameters.
5. Students will understand the concepts of random processes, correlation functions, linear systems and their response to random signals,
6. Students will understand how these probability and statistics concepts apply to solving electrical and computer engineering problems. MATLAB will be used for computational examples.

Lecture schedule: 3 50 minute or 2 75 minute lectures per week

Course Outline:	**Hours**
1. Probability: deterministic models vs. probability models.	3
2. Random variables, axioms of probability, computing probability with counting, conditional probability, independence.	4
3. Discrete random variables: probability mass function (pmf) and cumulative distribution function (cdf), expectation and moments, Bernoulli and Poisson distributions.	4
4. Continuous random variables: probability density function (pdf) and cdf, expectation and moments, function of random variables, Chebyshev's inequality, exponential, normal distributions.	6

5. Pairs of random variables: joint cdf/pdf and marginal cdf/pdf, conditional probability, expectation, function of pairs of random variables, pairs of normal random variables. 5
6. Vector random variables: functions, expectation, and joint Gaussian random vectors. 4
7. Sums of random variables, sample mean, and central limit theorem. 4
8. Parameter estimation, confidence interval and hypothesis testing. 6
9. Random processes: discrete-time processes, binomial counting and Poisson processes, Gaussian random processes, stationary random processes. 3
10. Response of linear systems to random singles, and optimal linear systems. 3

Grading:

Homework:	20—30%
Quizzes/Tests:	40—50%
Final Exam :	20—30%

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