

Math 342  
**Probability and Statistics II**  
Course Objectives  
2002 - 2003  
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**Length of Course:**

One semester

**Prerequisite:**

Math 341 (Probability & Statistics I) with a grade of “C” or better or consent of instructor.

**Text (required):**

*A First Course in Probability*, Ross (6<sup>th</sup> Edition). Prentice - Hall.

**Texts (supplemental):**

The instructor may suggest supplemental reading from a number of sources; including, but not limited to:

*Mathematical Statistics*, Rice (any edition). Wadsworth & Brooks - Cole.

*Mathematical Statistics*, Freund (any edition). Prentice - Hall.

*Schaum Outline Series: Probability, Random Variables, & Random Processes*, Hsu (any edition). McGraw - Hill.

*Probability and Random Variables*, Stirzaker, Cambridge Press.

*Probability Models*, Haigh, Springer-Verlag.

**Course Objective:**

This course is designed to provide the student with a continued intense foundation in fundamental concepts of stochastic mathematics used in advanced mathematics that was begun in Math 355. This course focuses on the theory of applied mathematics in the form of mathematical statistics. As such, we consider the form and way that the theory creates the applications. So, there we shall be discussing and proving certain results and then we shall consider how they are applied to econometrics, edometrics, technometrics, decision science, etc. After completing the course the student should be able to work basic problems and proofs in probability and mathematical statistics with special attention to joint probability mass or density functions, properties of expectation, limit theorems, estimation (point and interval), hypothesis testing, and regression.

A student should have mastered and demonstrated the following skills after completing Math 35:

- the student is able to think logically
- the student is able to reason and recognise patterns and be able to make conjectures
- the student is able to use mathematical symbols
- the student is able to prove conjectures based on the axioms of probability.
- the student is able to work with *a posteriori* and *a priori* probability.
- the student is able to work with probability mass, density, and distribution functions.
- the student is able to compute moments for a random variable directly or through a moment generating function.
- the student is able to prove properties of a random variable.
- the student is able to compute point estimates, confidence intervals, and make inferences based on said.
- the student is able to compute covariance, correlation, and work basic problems in linear regression.

Some of the random variables considered in Math 356 (as were considered in Math 355) are the:

Uniform, Bernoulli, Binomial, Multinomial, Gaussian (Normal), Geometric, Hypergeometric, Hazard, Gamma, Chi-Squared ( $\chi^2$ ), Dirichlet, Erlang, Error, Exponential, Gumbel, Fischer- Snedecor (F), Weibull, Cauchy, Beta, Laplace, Logistic, Lognormal, Pareto, Poisson, Rayleigh, Student (t), von Mises, Wishart, and Birnbaum.

**Outline of the Course:**

**Suggested Pace:**

I	Joint Distributed Random Variables (review) Joint pdfs and pmfs, covariance, correlation, independence, marginal distributions, conditional distributions, & applications.	Chapter 6	2.5 weeks
II	Properties of Expectation Expectation of a sum of random variables, covariance, moment generating functions, conditioning, and applications.	Chapter 7	2.5 weeks
III	Limit Theorems Tchebyshev's inequality, weak law of large numbers, the Central Limit Theorem, the strong law of large numbers, bounding, and applications.	Chapter 8	3 weeks
IV	Estimation Sufficiency, bias, efficiency, consistency, robustness, the method of maximum likelihood, and applications.	Handouts	3 weeks
V	Hypothesis Testing Statistical hypotheses, the Neyman-Pearson lemma, point estimates, confidence intervals, inferences about $\mu$ , inferences about $\sigma^2$ , the F and t distributions, and applications.	Handouts	4 weeks
V	Regression Linear regression, the method of least squares, parametric inferences, and applications.	Handouts	3 weeks