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Stat 312 Course Description
Introduction to Theory and Methods of Mathematical Statistics II

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Objective: This is a self-contained course, that is designed to give students a fundamental understanding of the basic techniques used in statistical data analysis, for engineering and other applications. Challenging exercises emphasize both mathematical concepts, as well as manual and computer calculations using calculus and R.

1. Introduction
   • General overview of statistical reasoning
   • Normal distribution (review of basic properties)
   • Sampling Distributions, Central Limit Theorem (review)

2. Statistical Inference and Hypothesis Testing
   • One Sample
     o Mean (Confidence Intervals, Z- and t-tests, Type I and II Error, Power & Sample Size)
     o Variance (Chi-squared Test)
     o Proportion (Z-test)
   • Two Samples
     o Means (Independent vs. Paired Samples, Nonparametric tests)
     o Variances (F-test, Levene Test)
     o Proportions (Z-test, Chi-squared Test, McNemar Test)
   • Several Samples
     o Proportions (Chi-squared Test)
     o Variances (Bartlett’s Test, etc.)
     o Means (ANOVA, F-test, Multiple Comparisons)

3. Covariance, Correlation and Regression
   • Motivation
   • Linear Correlation and Regression (+ Least Squares Approximation)
   • Extensions of Simple Linear Regression
     o Transformations (Power, Logarithmic,…)
     o Multilinear Regression (ANOVA, Model Selection)
     o Logistic Regression