

STATISTICS 421 "MATHEMATICAL STATISTICS"

Calendar Description: H(3-1T)

Multivariate Normal distribution. Limit distributions. Sufficient statistics. Completeness of families of distributions. Exponential families. Likelihood ratio tests. Chi-square tests. Analysis of variance. Sequential tests. Introduction to nonparametric methods. Bayesian theory, the general linear model.

Prerequisite: Mathematics 323.

Suggested Texts:

1. Hogg & Craig, Introduction to mathematical statistics
2. Casella & Berger, Statistical Inference

Syllabus

| <u>Topics</u> | <u>Number of Hours</u> |
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| Review – Handouts with examples, review problems on: common univariate distributions; use of cdf, mgf, pdf; variable transformations (Jacobians, graphical domain transformation); distribution of order statistics. | 2 |
| Multivariate Normal Distribution definition, mgf, joint marginals, constant density contours; distributions of linear combinations of MVN random variables. | 3 |
| Limit Distributions concept of a degenerate distribution; convergence in distribution (use of the cdf, mgf); convergence in probability; proof of the CLT; use/proof of Slutsky's theorem. | 5 |
| Sufficiency and Completeness concept of a sufficient set of statistics, factorization theorem; Rao-Blackwell theorem; concept of a complete family of distributions; completeness and uniqueness (Lehmann-Scheffe theorem); minimal sufficient and ancillary statistics; completeness and independence (Basu's theorem); minimum variance unbiased estimation; Cramer-Rao inequality. | 8 |
| Exponential family of distributions | 2 |
| LR Tests review of likelihood ratio, Neyman-Pearson lemma; power of a test, uniformly most powerful test; noncentral t, chi-square, F distributions. | 5 |
| Normal Models Cochran's theorem on quadratic forms (no proof); chi-square tests; analysis of variance. | 5 |
| Additional Topics - Selections from the following topics should constitute about 6-8 hours. - sequential tests - general linear model - nonparametric tests (sign, Wilcoxon) - Bayesian theory | 6 |
| TOTAL | 36 |
