

CALIFORNIA STATE UNIVERSITY, SACRAMENTO  
Department of Mathematics and Statistics

SYLLABUS

Statistics 115A: Introduction to Probability Theory

Prerequisites: Math 31: advisable but not required  
Stat 1 or 50

Probability, axioms, discrete and continuous random variables, functions of random variables, joint densities, expectation, moment generating functions. Chebyshev's inequality, weak law of large numbers, central limit theorem.

Statistics 115B: Introduction to Mathematical Statistics

Prerequisites: Stat 115A

Interval estimation, point estimation, hypothesis testing, the multivariate normal distribution, non-parametric tests.

This is the traditional upper division mathematical statistics course. The first semester (A) consists mostly of probability theory with emphasis on various distributions and techniques. The second semester (B) is generally entirely devoted to statistics itself: the theories of estimation and hypothesis testing followed by optional coverage of particular examples of these.

OUTLINE: STAT 115A

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|------|--|-------------|
| I.   | Probability                                | 3 1/2 Weeks |
|      | a. Set Functions                           |             |
|      | b. Random variables                        |             |
|      | c. Densities and distributions             |             |
|      | d. Expectation                             |             |
|      | e. Moment generating function and variance |             |
|      | f. Cheyshev's inequality                   |             |
| II.  | Joint Distributions                        | 2 1/2 Weeks |
|      | a. Joint distributions                     |             |
|      | b. Marginal and conditional distributions  |             |
|      | c. Covariance                              |             |
|      | d. Correlation and independence            |             |
| III. | Special Distributions                      | 3 Weeks     |
|      | a. Binomial                                |             |
|      | b. Poisson, Geometric                      |             |
|      | c. Hypergeometric                          |             |
|      | d. Gamma, chi-squared                      |             |

e. Normal, and bivariate normal

IV. Sampling Theory 4 Weeks

- a. Transformations and change of variable
- b.  $t$  and F distributions
- c. Order statistics

V. Limiting Distributions 2 Weeks

- a. Central Limit Theorem
- b. Poisson approximation to binomial, Normal approximation to binomial

OUTLINE: Statistics 115B

I. Estimation 4 Weeks

- a. General Theory
- b. Method of moments
- c. Unbiasedness
- d. Maximum likelihood
- e. Efficiency
- f. Consistency and confidence intervals
- g. Sufficient statistics

II. Hypothesis Testing 4 Weeks

- a. General theory
- b. Including Neymann-Pearson theorem
- c. Uniformly most powerful tests
- d. Likelihood ratio tests
- e. Sequential tests

III. Goodness Fit Tests Last 7 Weeks

- a. Selected topics
- b. Analysis of variance and regression
- c. Nonparametric tests
- d. Sufficiency
- e. Robustness
- f. Multivariate theory