

## SYLLABUS FOR PROBABILITY AND STATISTICS WRITTEN MASTERS EXAM

1. Probability
  - Sample Space
  - Probability Axioms
  - Probability Rules
  - Combinatorics: Probability on Finite Sample Spaces
  - Conditional Probability and Bayes Theorem
  - Independence of Events
2. Random Variable and Probability Distributions
  - Random Variable
  - Probability Distribution of a Random Variable
  - Discrete and Continuous Random Variables
  - Functions of Random Variable
3. Moments and Generating function
  - Moments of a Distribution Function
  - Expected Value
  - Variance
  - Higher Moments
  - Chebyshev's Inequality
4. Multiple Random Variables
  - Multiple Random Variables
  - Independence of Random Variables
  - Functions of Random Variables
  - Covariance, Correlation, and Moments
5. Some Special Distributions
  - Discrete Uniform
  - Bernoulli
  - Binomial
  - Hypergeometric
  - Geometric
  - Negative Binomial
  - Poisson
  - Multinomial Distribution
  
  - Uniform
  - Gamma
  - Exponential
  - Chi-Square
  - Normal
6. Limit Theorems

Law of Large Numbers

Central Limit Theorem

7. Statistics and Their Distributions

Normal

Chi-Square

t-distribution

F-distribution

8. Point Estimation

Method of Moment Estimators

Maximum Likelihood Estimators

Unbiased Estimation

Efficient Estimation

    Cramer-Rao Lower Bound

    Asymptotically Efficient

Sufficient Estimation

    Factorization Theorem

    Rao-Blackwell Theorem

    Lehmann-Scheffe Theorem

Consistent Estimation

9. Interval Estimation

Confidence Intervals for One-Sample Mean

Confidence Intervals for One-Sample Proportions

Confidence Intervals for Two-Sample Means

Confidence Intervals for Two-Sample Proportions

Sample Size Calculations

10. Hypothesis Testing

Null and Alternative Hypotheses

Type I and Type II errors

Neyman-Pearson Lemma

Generalized Likelihood Ratio Tests

11. Goodness of Fit

Contingency Tables

Tests of Independence

12. Regression

Linear Regression

13. Analysis of Variance

One-Way Analysis of Variance

References:

- Introduction to Mathematical Statistics by Hogg , Craig
- Mathematical Statistics and Data Analysis by Rice

- Introduction to Probability and Mathematical Statistics by Bain, Englehardt
- Probability and Statistical Inference by Hogg, Tanis
- An Introduction to Probability and Statistics by Rohatgi, Saleh
- Mathematical Statistics by Bickel, Doksum