

Math 37600 PR (19364) - Fall, 2024

Syllabus and Assignments [numbering from Seventh Edition if different from the Eighth].

(1) – REVIEW

Sec 1.3: Probability properties, permutations and combinations.

Sec 1.4: Conditional probability definitions, Bayes' Theorem, Law of Total Probabilities, independence.

- Exercises: 1.4.8, 1.4.10.

Sec 1.5, 1.6, 1.7: Random variables with cdf, and pmf (discrete), pdf (continuous), examples Unif(0,1) and Exp(1).

- Exercises: 1.5.5, 1.5.6, 1.6.2, 1.6.9. [due Sept. 05] 1.7.6, 1.7.9(b), 1.7.12, 1.7.14.

Sec 1.8, 1.9: Expectation (mean), variance and mgf.

- Exercises: 1.8.7, 1.8.9, 1.8.12 [1.8.6, 1.8.8, 1.8.11], 1.9.1(b),(c), 1.9.4, 1.9.5.

Sec 3.1, 3.2: Indicator rv, Bern(p), Bin(n,p), Geom(p), Poiss(m) distributions.

- Exercises: 3.1.15, 3.1.27 [3.1.14, 3.1.23]. [due Sept. 12]

Sec 2.1: Distribution and expectation of a pair of rv's, joint cdf, and joint pmf (discrete), joint pdf (continuous), marginal distributions, linearity of expectation.

- Exercises: 2.1.7, 2.1.8 [2.1.6, 2.1.7].

Sec 2.3: Conditional distributions and expectations

- Exercises: 2.3.2, 2.3.3.

Sec 2.4, 2.5: Covariance, correlation coefficient, independence.

- Exercises: 2.4.2[2.5.2].

Sec 2.6: Extension to several rv's.

You should know the pmfs of Bern(p), Bin(n,p), Geom(p) and Poiss(m) discrete distributions as well as the pdfs of Unif(0,1), Exp(lambda) and N(0,1) continuous distributions.

(2) Transformations and Special Distributions

Sec 1.7.2[1.7.1], 2.2, 2.7: Transformations in one variable, linear change for two variables.

- Exercises: 2.7.4.

Sec 3.3, 3.4: The Gamma and Normal distributions.

- Exercises: 3.4.1, 3.4.6. [due Sept. 19]

Sec 4.4: Order statistics.

- Exercises: 4.1.5, 4.4.5, 4.4.6, 4.4.27.

(3) Introduction to Statistical Inference

Sec 4.1.1[4.1]: Maximum Likelihood Estimates.

- Exercises: 4.1.1(b)(c)(d), 4.1.2(b), 4.1.3(a)(b). [due Sept. 26]

Sec 4.1.2[4.1.1]: Nonparametric Estimates.

- Exercises: 4.1.8.

Sec 4.2: Confidence Intervals.

- Exercises: 4.2.2, 4.2.3[4.2.4], 4.2.6[4.2.7], 4.2.15, 4.2.17.

(4) Hypothesis Testing

Sec 4.5: Introduction to Hypothesis Testing.

- Exercises: 4.5.3, 4.5.5, 4.5.9, 4.5.11.

Sec 4.6: Two-Sided Testing and p-Values.

- Exercises: 4.6.8. [due Oct. 08]

[TEST 1 Oct. 10]

Sec. 8.1: Most Powerful Simple Tests.

- Exercises: 8.1.2+8.1.3, 8.1.5.

Sec. 8.2: Uniformly Most Powerful Tests.

- Exercises: 8.2.1, 8.2.2, 8.2.11.

(5) Inequalities and Limits of Distributions

Sec 1.10: Markov's, Chebyshev's and Jensen's Inequality.

- Exercises: 1.10.2, 1.10.3, 1.10.7[1.10.6]. [due Oct. 24]

Sec 5.1: Convergence in Probability.

- Exercises: 5.1.3, 5.1.7[5.1.5], 5.1.9[5.1.7].

Sec 5.2: Convergence in Distribution.

- Exercises: 5.2.2, 5.2.3, 5.2.7.

Sec 5.3: Central Limit Theorem. [due Oct 31]

Nonparametric Estimation, Kolmogorov-Smirnov Test.

(6) Maximum Likelihood Results

Sec. 6.1: Maximum Likelihood Estimation.

- Exercises: 6.1.2, 6.1.4, 6.1.9[6.1.8].

Sec. 6.2: Rao-Cramer Lower Bound and Efficiency.

- Exercises: 6.2.2, 6.2.9, 6.2.10.

Sec. 6.3: Maximum Likelihood Tests.

- Exercises: 6.3.9[6.3.8], 6.3.10[6.3.9], 6.3.16[6.3.15]. [due Nov. 07]

[TEST 2 Nov 14]

(7) Sufficiency

Sec. 7.1: Measures of Estimator Quality.

- Exercises: 7.1.1, 7.1.2 (in 1 and 2 compute the efficiency as well), 7.1.4, 7.1.8. [due Nov. 21]

Sec. 7.2: Sufficient Statistics.

- Exercises: 7.2.3, 7.2.4, 7.2.7.

Sec. 7.3: Sufficient Statistic Properties.

- Exercises: 7.3.2, 7.3.3, 7.3.4. [due Nov. 26]

Sec. 7.4: Completeness and Uniqueness.

- Exercises: 7.4.2, 7.4.3, 7.4.8, 7.4.9

Sec. 7.5: Exponential Families.

- Exercises: 7.5.2, 7.5.3, 7.5.10. [due Dec. 05]

[TEST 3 Dec 10]