

Math 37600 LM (22081) - Fall, 2021

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, 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].

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.

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).

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.

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].

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.

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].

(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.

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.

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.