

DSE-3(iii): Mathematical Statistics

Week 1: Joint Distributed Random Variables: Joint probability mass function for two discrete random variables, Marginal probability mass function, Joint probability density function for two continuous random variables, Marginal probability density function, Independent random variables.

[1]: Chapter 5 (Section 5.1 up to page 285).

Week 2: Expected values, covariance, and correlation.

[1]: Chapter 5 (Section 5.2).

Week 3: Linear combination of random variables and their moment generating functions.

[1]: Chapter 5 (Section 5.3).

Week 4: Conditional distributions and conditional expectation, Laws of total expectation and variance.

[1]: Chapter 5 (Section 5.4).

Week 5: Bivariate Normal Distribution.

[1] Chapter 5 (Section 5.5 up to page 334 [Regression to the Mean]).

Week 6: Distribution of important statistics such as the sample totals, sample means, and sample proportions, Central limit theorem (statement with examples and applications), Law of large numbers.

[1]: Chapter 6 (Section 6.1 [up to Example 6.3], and Section 6.2 [except Example 6.7]).

Week 7: Chi-squared, t , and F distributions; Distributions based on normal random samples.

[1]: Chapter 6 (Section 6.3 [Definitions only], and Section 6.4).

Week 8: Concepts and criteria for point estimation, The methods of moments and MLE.

[1]: Chapter 7 (Section 7.1 [up to the Definition, page 408], and Section 7.2 [up to page 423, except Example 7.20]).

Weeks 9 and 10: Assessing estimators: Accuracy and precision, Unbiased estimation, Consistency and sufficiency, The Neyman factorization theorem, Rao-Blackwell theorem, Fisher Information, The Cramér-Rao inequality (statement only), Efficiency.

[1]: Chapter 7 (Sections 7.3, and 7.4).

Weeks 11 and 12: Interval estimation and basic properties of confidence intervals, One-sample t confidence interval, Confidence intervals for a population proportion and population variance.

[1]: Chapter 8 (Section 8.1 [up to Example 8.4], Section 8.2 [up to Example 8.9], Section 8.3 [up to Example 8.13], and Section 8.4 [up to Example 8.16]).

Weeks 13 and 14: Statistical hypotheses and test procedures, One-sample tests about a population mean and a population proportion, P -values for tests; The simple linear regression model and its estimating parameters.

[1]: Chapter 9 (Sections 9.1, 9.2 [up to page 519], 9.3, and 9.4).

[1]: Chapter 12 (Sections 12.1, and 12.2).

Week 15: Chi-squared goodness-of-fit tests, Two-way contingency tables.

[1]: Chapter 13 (Section 13.1 [up to Example 13.4], and Section 13.2 [up to Example 13.11]).

Essential Reading

1. Devore, Jay L., Berk, Kenneth N. & Carlton Matthew A. (2021). Modern Mathematical Statistics with Applications. (3rd ed.). Springer.