

Course Syllabus

STAT 442: Mathematical Statistics

- Description:** *A continuation of STAT 441. Topics include Central Limit Theorem, covariance, moments, estimation, tests of hypotheses, and sampling theory.*
- Credit Hours:** 3
- Frequency:** Offered every third semester
- Audience:** Required for actuarial science and statistics majors; elective for mathematics majors, mathematics minors, and applied statistics minors
- Prerequisites:** STAT 441
- Format:** 3 class sessions (50 min each) per week
- Textbook:** *Mathematical Statistics with Applications, 7th ed.*, by Wackerly, Mendenhall, and Schaeffer. ISBN: 978-0495110811 (*recommended, not required*)
- Technology:** A calculator that is not on a cell phone/tablet/laptop is required for the exams, and should also be brought to class daily for in-class activities. Microsoft Excel may be useful on occasion. Course material and grades are maintained in Blackboard.
- AARC:** The Access and Accommodations Resource Center (AARC) is the campus office that works with students to provide access and accommodations in cases of diagnosed mental or emotional health issues, attentional or learning disabilities, vision or hearing limitations, chronic diseases, or allergies. You can contact the office at aarc@valpo.edu or 219.464.5206. Students who need, or think they may need, accommodations due to a diagnosis, or who think they have a diagnosis, are invited to contact AARC to arrange a confidential discussion with the AARC office. Further, students who are registered with AARC are required to contact their professor(s) if they wish to exercise the accommodations outlined in their letter from the AARC.
- Notice of Cancellation:** In the unlikely event class is cancelled, you will be notified through your Valparaiso University e-mail account.

Student Learning Objectives:

- A. Students gain a strong foundation in statistical theory with an awareness of the relevance and importance of the theory in solving practical problems in the real world.
- B. Students understand the conceptual framework of statistical inference and can perform and interpret a wide range of inferential methods.

Topical Objectives:

Students will learn about the following topics:

Unit 1: Estimation (Ch. 8 of textbook)

1. Bias and Mean Square Error of Point Estimators
2. Common Unbiased Point Estimators
3. Evaluating the Goodness of a Point Estimator
4. Confidence Intervals
5. Selecting the Sample Size

Unit 2: Properties of Point Estimators and Methods of Estimation (Ch. 9 of textbook)

1. Relative Efficiency, Consistency, and Sufficiency
2. Rao-Blackwell Theorem and Minimum-Variance Unbiased Estimation
3. Method of Moments
4. Method of Maximum Likelihood

Unit 3: Hypothesis Testing (Ch. 10 and 14 of textbook)

1. Elements of a Statistical Test
2. Common Large-Sample Tests
3. Calculating Type II Error
4. Relationship between Hypothesis-Testing Procedures and Confidence Intervals
5. Small-Sample Hypothesis Testing
6. Testing Hypotheses Concerning Variances
7. Power of Tests and the Neyman-Pearson Lemma
8. Likelihood Ratio Tests
9. Chi-Square Goodness-of-Fit Test and Test for Independence

Unit 4: Linear Models and Estimation by Least Squares (Ch. 11 of textbook)

1. Linear Statistical Models
2. Method of Least Squares
3. Simple Linear Regression
4. Inferences Concerning the Coefficients
5. Prediction
6. Correlation
7. Nonlinear Models

Unit 5: Nonparametric Methods (Ch. 15 of textbook)

1. Sign Test and Wilcoxon Signed-Rank Test
2. Wilcoxon Rank-Sum Test and Mann-Whitney U -Test
3. Runs Test
4. Spearman's Rank Correlation Test