Statistics 640: Advanced Statistical Theory (4 units)

Department of Statistics and Biostatistics, CSU East Bay

Prof. Eric A. Suess

2023-08-23

Course Description:

Theory of point and interval estimation and hypothesis testing from the Neyman-Pearson point of view. May include: decision theory, non-parametric inference, multivariate analysis, Bayesian methods, computer intensive methods, and statistical bootstrapping and simulation.

Lecture:

- Section 1: MW 2:00 - 3:40pm, Art and Education, Rm. 0238
- Section 2: MW 6:00 - 7:40pm, Web Online Synchronous Class

Instructor: Prof. Eric A. Suess

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Office Hours:

- Thursday online 10:00 - 11:00am Here is the Zoom link: https://csueb.zoom.us/j/89647106693
- Friday NSc 319 2:00 - 3:00pm
- or by appointment

Communicating:

Email is the preferred method of communication. Class website will be updated weekly with class topics, homework assignment, and other useful information. Assignment grades will be provided in Canvas.

Class Website: cox.csueastbay.edu/~esuess/statistics640

Required Texts:

- Rice, John, Mathematical Statistics and Data Analysis, 3nd Edition, Duxbury 2007.

Reference Texts:

- Bain and Engelhard, Introduction to Probability and Mathematical Statistics, 2nd Edition, Duxbury 1992.
- Casella and Berger, Statistical Inference, 2nd Edition, Duxbury 2002.
- Hogg and Craig, Introduction to Mathematical Statistics, 5th Edition, Prentice Hall 1995.
- Roussas, A Course in Mathematical Statistics, 2nd Edition, Academic Press 1997.
- Stone, A Course in Probability and Statistics, Duxbury 1996.
- DasGupta, Probability for Statistics and Machine Learning, Springer, 2011.
- Efron and Hastie, Computer Age Statistical Inference, Cambridge, 2021.

Further References:

- Wickham, Grolemund R for Data Science
- Ismay, Kim, ModernDive
- Speegle, Probability, Statistics, and Data: A Fresh Approach Using R
- Boehmke, Greenwell, Hands-On Machine Learning with R
- Silge, Robinson, TidyText
- Baumer, Kaplan, Horton, Modern Data Science with R, 3rd edition, CRC Press, 2017.

Technical Requirements:

Access to a modern computer and permission to install software, R and RStudio. Access to the internet.

Material To Be Covered:

This is the first course in the sequence of Advanced Statistical Theory courses offered by the Department of Statistics and Biostatistics for the MS in Statistics, Stat. 640, Advanced Statistical Theory is followed by Stat. 641, Bootstrapping Methods.

The main topics to be covered in the 640 and 641 sequence are applications of Limit Theorems, Estimation, Confidence Intervals, Hypothesis Testing, Bootstrapping and Bayesian Estimation.

Probability simulation will be used to demonstrate the theory presented. Data modeling and data analysis will be included to show the theory in action.

Homework:

The material in this course can only be learned through working many problems. Most of the homework assigned during the course will be graded for *content* and *clarity*. Comments will be made and graded problems submitted that need further work should be re-submitted for a final grading.

Homework will be assigned weekly on Mondays. Homework will be "due" on the following Monday, which means you should complete the homework and come to class prepared to ask

questions. Homework will be "submitted" though Canvas through the end of the day Friday, of the same week.

Grading: >= 90% A, >= 80% B, >= 70 C, >= 60% D, <60% F

- Homework 30%
- Quizzes 10%
- Midterm I 20%
- Midterm II 20%
- Final 20%

Policy on Make-up Exams:

You are expected to take the quizzes and exams at the scheduled times. In case of genuine emergency, illness or hardship, for which you can present written documentation I may agree to arrange for a make-up exam. Make-up exams must always be arranged BEFORE the regular exam is given and always take place AFTER the regular exam. Quizzes may not be made up!

Statistics 640 SLOs

Student Learning Outcomes (SLO's):

Students graduating with an M.S. in Statistics from Cal State East Bay will be able to:

1. Apply statistical methodologies, including a) descriptive statistics and graphical displays, b) probability models for uncertainty, stochastic processes, and distribution theory, c) hypothesis testing and confidence intervals, d) ANOVA and regression models (including linear, and multiple linear) and analysis of residuals from models and trends at the Master's level.
2. Derive basic theory underlying these methodologies.
3. Model practical problems for solutions using these methodologies.
4. Produce relevant computer output using standard statistical software and interpret the results appropriately.
5. Communicate statistical concepts and analytical results clearly and appropriately to others; and,
6. Employ theory, concepts, and terminology at a level that supports lifelong learning of related methodologies.