Statistics 674: Time Series (2 units)

Department of Statistics and Biostatistics, CSU East Bay

Prof. Eric A. Suess

2025-01-22

Spring 2025

Lecture:

- MW 4:00 to 5:40 NSc 112 and on Zoom

Instructor: Prof. Eric A. Suess

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Office Hours: M 11 to noon, Th 2 to 3pm online on Zoom, or by appointment

Communicating:

Email is the preferred method of communication. Please do not send me emails from within Canvas. Class website will be updated weekly with class topics, homework assignment, and other useful information. Assignment grades will be provided in Canvas. Grades will be posted in Canvas.

Course Description:

Analysis of correlated data in time, trends, seasonal patterns, periodicity, autocorrelation, spectral analysis, filtering, time domain versus spectral domain. Decomposition, auto-regression, ARIMA, state-space models, forecasting. Applications using to collect data in economics, engineering, seismology. Report writing. Use of statistical software. **Prerequisites:**

- Stat. 632 Linear and Logistic Regression

Class Website:

- cox.csueastbay.edu/~esuess/statistics674/
- Canvas

Final Exam Dates:

- Final Exam Schedule

Required Text:

- Hyndman and Athanasopoulos, Forecasting: Principles and Practice (3rd ed), 2021.

Reference Texts:

- Josheph, Modern Time Series Forecasting with Python, Packt, 2022.
- Shumway and Stoffer, Time Series: A Data Analysis Approach Using R, CRC Press, 2019.
- Shumway and Stoffer, Time Series Analysis and Its Applications, Fourth Edition, Springer-Verlag, 2016.
- Box, Jenkins, Reinsel, Ljung, Time Series Analysis, Forecasting and Control, Fifth Edition, Wiley, 2015.
- Brockwell and Davis, Introduction to Time Series and Forecasting, Second Edition, Springer-Verlag, 2002.
- Chatfield, The Analysis of Time Series, An Introduction, Sixth Edition, Chapman-Hall, 2003.
- Diggle, Time Series, A Biostatistical Introduction, Oxford Science Publications, 1990.

Further References:

- Whickham, Grolemund, r4ds
- Ismay, Kim, ModernDive
- Phillips, Yarrr
- Kross, Unix Workbench

Technical Requirements:

Access to a modern computer and permission to install software, Python, Anaconda, RStudio. Access to Colab from your Google account. Access to the internet.

Material To Be Covered:

In this course we will cover the fundamentals of Statistical Time Series analysis, the study of correlated random variables over time. Descriptive methods will be introduced to describe trends, seasonal patterns, and autocorrelation in time series data. Time Domain Methods of analysis such as Autoregression and ARIMA modeling will be presented. Frequency Domain methods will be briefly introduced. Neural Networks and Deep Learning methods will also be briefly intoduced. The class will be roughly split between the discussion of theory and computer applications applied to real data. Examples will come from such fields as Economics, Biology, Medicine, Seismology, and Engineering.

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.

Quizzes and Exams: Two short quizzes, one midterm will be given and the final.

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

- Project 30%
- Homework 15%
- Quizzes 5%
- Midterm 25%
- Final 25%

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!

Academic Honesty:

- You are encouraged to work together on homework problems. However, each student must write up the solutions independently. Copying of solutions is not acceptable.
- You are encouraged to study together for the exams. However, each student must take the exam independently.
- Cheating will not be tolerated. Any student caught cheating will receive a reduced grade or zero for the assignment or exam in question. In addition, the student will be reported to the University for further disciplinary action.

Student Learning Outcomes (SLO's):

Student Learning Outcomes - Upon successful completion of this course students will be able to:

1. Graphically display and numerically describe time-dependent data.
2. Derive and understand the theory of point and interval estimation for forecasting.
3. Formulate and model practical problems for solutions using these statistical methodologies.

4. Produce relevant computer output using standard statistical software and interpret results appropriately.
5. Communicate statistical concepts and analytical results clearly and appropriately to others.

Student Services:

To access student services offered at Cal State East Bay, click on the MyCompass to get you to your one-stop online student support hub for information on academic advising, tutoring, financial aid, the library, the health center, technology support, career counseling, campus life, equity programs, and more.

Grade Appeal and Academic Grievances:

If you wish to appeal your course grade at the end of the semester or have other academic concerns related to a course, please visit the Grade Appeals and Academic Grievances (GAAG) section of the catalog, which explains the process. URL: https://catalog.csueastbay.edu/index.php?catoid=31