



# THE OHIO STATE UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

## **SYLLABUS: STAT 5550** **INTRODUCTORY TIME SERIES ANALYSIS** **SPRING 2025**

### **Course overview**

#### **Instructor**

Instructor: Dena M. Asta  
Email address: [asta.1@osu.edu](mailto:asta.1@osu.edu)  
Class Website: Carmen  
Lectures: MWF at 10:20-11:15am in Evans Lab 2004  
Office hours: Tuesday 11:00-12:00pm, Wednesday 1:45pm-2:45pm, and by appointment (please schedule appointments at least 24 hours in advance). Office in Cockins Hall 427.

#### **Grader**

Grader: Yingyu Cheng  
Email address: [cheng.1753@osu.edu](mailto:cheng.1753@osu.edu)

#### **MSLC Free Tutoring Hours**

Mathematics and Statistics Learning Center (MSLC) offers free online tutoring for students enrolled in selected courses including STAT 5550. The details and tutoring hours can be found at <https://mslc.osu.edu/online-tutoring>

#### **Course description**

Statistics 5550 introduces the statistical methodology and models required to analyze time series data in practice. The course emphasizes both modeling methodology (model identification,

estimation and diagnostics) and the practical implementation of time series modeling using the statistical software R. Familiarity with introductory mathematical statistics and probability (random variables and their distributions, covariance and correlation, maximum likelihood estimation, confidence intervals, hypothesis tests, regression modeling) at the level of the prerequisites listed below is assumed.

Prerequisites: Statistics 4202 and Statistics 5302, or permission of instructor.

## Course learning outcomes

By the end of this course, students should successfully be able to:

- conduct exploratory data analysis for time series data
- understand and execute methods for modeling trend and seasonality
- estimate mean, autocovariance, and autocorrelation functions
- model both stationary and nonstationary processes.

## Course materials

### Required

Time Series Analysis and Its Applications, With R Examples, by Robert H. Shumway and David S Stoffer, Springer, Second Edition.

Note: An e-version is available at the library.

## Course technology

For help with your password, university e-mail, Carmen, or any other technology issues, questions, or requests, contact the OSU IT Service Desk. Standard support hours are available at <https://ocio.osu.edu/help/hours>, and support for urgent issues is available 24x7.

- **Self-Service and Chat support:** <http://ocio.osu.edu/selfservice>
- **Phone:** 614-688-HELP (4357)
- **Email:** [8help@osu.edu](mailto:8help@osu.edu)
- **TDD:** 614-688-8743

### Necessary software

- In this course, you will be required to do some basic statistical analyses on the computer using the statistical software package R (The R Project for Statistical Computing; <http://www.r-project.org/>). This software package is available as Free Software.
  - You can download R for Windows, Mac, and Linux, from the CRAN archive at <https://cran.r-project.org>.

- An in-depth introduction to R is available at <http://cran.rproject.org/doc/manuals/R-intro.pdf>
- Hands-on tutorials are available in the Swirl system, which you can learn about at <http://swirlstats.com/>. In particular, “R Programming: The basics of programming in R” is an appropriate first tutorial for students who have never used R.
- An easier to use interface to R is available in the software package RStudio. This package is available for Windows, Mac, and Linux and can be downloaded for free from <http://rstudio.org>. **Note that RStudio requires R to be installed.**

## Course delivery

Lectures will be delivered live in person. Office hours are in person, but appointments can be made to meet via Zoom.

## Grading and faculty response

### Homework and exams

Assignment or category	Percentage
Homework	15
Midterm Exam I	20
Midterm Exam II	20
Project	20
Final Exam	25
<b>Total</b>	<b>100</b>

Grades will be recorded on the class website.

**Homework** will be due at the beginning of class on the day it is due (10:20am). No late homework will be accepted. You are encouraged to work together on the homework, but do not copy any part of a homework. Each student must produce his/her own homework to be handed in. All homework must be submitted online as a PDF file through the class website. Feel free to ask me for help after you have made an attempt of the questions.

The grader for the course does not have the time to provide detailed explanations on each question that is graded. To make up for this, I will endeavor to create homework solutions that are detailed enough to allow you to understand how the question could be approached.

**Homework preparation rules:** Put your name and the homework assignment number on the top right-hand corner of every page. Submit the problems in order showing all your work.

**Exams:** There will be two midterms and one final exam:

Midterm 1      tentatively on February 19<sup>th</sup> (Wednesday) from 10:20am-11:15am

Midterm 2      tentatively on March 24<sup>th</sup> (Monday) from 10:20am-11:15am

Final            April 24<sup>th</sup> (Thursday) from 10:00am-11:45am

All exams are **closed book/closed notes**– there are no make-up exams. Further details will be given in advance of each exam. A basic calculator is allowed – tablets, laptops, cellphones, and other communication devices are not.

The first midterm covers the material up to and including Monday, February 17<sup>th</sup>. The second midterm covers the material up to and including Friday, March 21<sup>st</sup>. The final will cover all the material for the course.

**Project:** A class project will consist of a written report and will require use of the R software.

## Faculty feedback and response time

I am providing the following list to give you an idea of my intended availability throughout the course. (Remember that you can call **614-688-HELP** at any time if you have a technical problem.)

### Grading and feedback

For weekly assignments, you can generally expect feedback within **7-10 days**.

### E-mail

I will reply to e-mails within **48 hours on school days**.

## Other course policies

### Academic integrity policy

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct <http://studentlife.osu.edu/csc/>.

### Religious accommodation

Ohio State has had a longstanding practice of making reasonable academic accommodations for students' religious beliefs and practices in accordance with applicable law. In 2023, Ohio State updated its practice to align with new state legislation. Under this new provision, students must be in early communication with their instructors regarding any known accommodation requests for religious beliefs and practices, providing notice of specific dates for which they request alternative accommodations within 14 days after the first instructional day of the course. Instructors in turn shall not question the sincerity of a student's religious or spiritual belief system in reviewing such requests and shall keep requests for accommodations confidential. With sufficient notice, instructors will provide students with reasonable alternative accommodations with regard to examinations and other academic requirements with respect to students' sincerely held religious beliefs and practices by allowing up to three absences each semester for the student to attend or participate in religious activities. Examples of religious accommodations can include, but are not limited to, rescheduling an exam, altering the time of a student's presentation, allowing make-up assignments to substitute for missed class work, or flexibility in due dates or research responsibilities. If concerns arise about a requested accommodation, instructors are to consult their tenure initiating unit head for assistance. A student's request for time off shall be provided if the student's sincerely held religious belief or practice severely affects the student's ability to take an exam or meet an academic requirement and the student has notified their instructor, in writing during the first 14 days after the course begins, of the date of each absence. Although students are required to provide notice within the first 14 days after a course begins, instructors are strongly encouraged to work with the student to provide a reasonable accommodation if a request is made outside the notice period. A student may not be penalized for an absence approved under this policy.

If students have questions or disputes related to academic accommodations, they should contact their course instructor, and then their department or college office. For questions or to report discrimination or harassment based on religion, individuals should contact the Office of Institutional Equity ([equity@osu.edu](mailto:equity@osu.edu)). (Policy: [Religious Holidays, Holy Days and Observances](#))

## Statement on title IX

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at <http://titleix.osu.edu> or by contacting the Ohio State Title IX Coordinator at [titleix@osu.edu](mailto:titleix@osu.edu).

## Mental health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing.

If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting [ccs.osu.edu](http://ccs.osu.edu) or calling 614-292-5766. CCS is located on the 4th floor of the Younkin Success Center and 10th floor of Lincoln Tower. You can reach an on-call counselor when CCS is closed at 614-292-5766 and 24-hour emergency help is also available through the 24/7 by dialing 988 to reach the Suicide and Crisis Lifeline.

## Accessibility accommodations for students with disabilities

The university strives to maintain a healthy and accessible environment to support student learning in and out of the classroom. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: [slds@osu.edu](mailto:slds@osu.edu); 614-292-3307; [slds.osu.edu](http://slds.osu.edu); 098 Baker Hall, 113 W. 12th Avenue.

## Accessibility of course technology

This course requires use of Carmen (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with your instructor. [Carmen \(Canvas\) accessibility](#).

## Course schedule (tentative)

Week	Dates	Topics, Readings, Assignments, Deadlines
1	1/6-1/10	Topics: time series intro, probability review, and IID, WN, and moving averages Readings: 1.1-1.2
2	1/13-1/17	Topics: R intro, autoregression, random walks Deadlines: student presentations and Homework 1
3	1/22-1/24	NO CLASS on Monday 1/20 Topics: ACVF and stationarity Readings: 1.3-1.4
4	1/27-1/31	Topics: estimating the mean and ACVF of stationary time series, sampling distribution of sample ACF, and tests for WN Readings: 1.5 Deadlines: Homework 2
5	2/3-2/7	Topics: sample ACFs for stationary and non-stationary time series, additive models, and regression review Readings: 2.1
6	2/10-2/14	Topics: regression, and estimating seasonal components Deadlines: Homework 3
7	2/17-2/21	Topics: estimating seasonal components, and differencing Readings: 2.2, 3.2 Deadlines: Homework 4
8	2/24-2/28	Topics: smoothing, ARMA, AR(p), AR(1), MA(q), and MA(1) Readings: 2.3, 3.1
9	3/3-3/7	Topics: general ARMA models, ACFs, PACF, and forecasting Readings: 3.3-3.4
10	3/17-3/21	Topics: forecasting, and prediction errors Deadlines: Homework 5
11	3/24-3/28	Topics: Yule-Walker estimation for AR(p) models, and MLEs Readings: 3.5

<b>Week</b>	<b>Dates</b>	<b>Topics, Readings, Assignments, Deadlines</b>
<b>12</b>	<b>3/31-4/4</b>	<b>Topics: MLE, Steps for ARMA modeling, and ARIMA models</b> <b>Readings: 3.6</b>
<b>13</b>	<b>4/7-4/11</b>	<b>Topics: ARIMA models and SARMA models</b>
<b>14</b>	<b>4/14-4/21</b>	<b>Topics: SARIMA models</b> <b>Deadlines: Project</b>