STA457H1 S: Time Series Analysis
Winter 2025
Course Outline

Lecture Schedules:
LEC0101: Tuesday 9:00 - 11:00 AM; Thursday 9:00 - 10:00 AM Room: SF 1105
LEC0201&2001: Tuesday 1:00 -3:00 PM; Thursday 2:00 - 3:00 PM Room: WB 116

Instructor: Lijia Wang

Teaching Assistants:
LEC0101:
Jiayue H. jiayue.huang@mail.utoronto.ca
Hua L. henryhua.lu@mail.utoronto.ca
Bernard M. bernard.miskic@mail.utoronto.ca
Yuyang Z. zyychris.zhang@mail.utoronto.ca
LEC0201&2001:
Vedant C. vedant.choudhary@mail.utoronto.ca
Zijin L. zijinfrank.liu@mail.utoronto.ca
Junhao Z. jh.zhu@mail.utoronto.ca
Tina B. tina.behrouzi@mail.utoronto.ca
Note: The TAs work collaboratively for this course and do not distinguish between sessions.

Course E-mail: sta457@course.utoronto.ca

Office Hours: Wednesday 4:00 - 5:00 PM at Room 9131, 700 University Ave

Course Website: https://q.utoronto.ca/courses/380453

Course Description: An overview of methods and problems in the analysis of time series data. Topics include: descriptive methods, filtering and smoothing time series, theory of stationary processes, identification and estimation of time series models, forecasting, seasonal adjustment, spectral estimation, bivariate time series models.

Pre-requisite: STA302H1/ STAC67H3/ STA302H5; MAT235Y1/ MAT237Y1/ MAT257Y1/(MATB41H3, MATB42H3)/(MAT232H5, MAT236H5)/(MAT233H5, MAT236H5);
Graduate students enrolled in STA2202H1F are exempt from this prerequisite but should be familiar with regression analysis before taking this course.
Co-requisites: None
Exclusion: STAD57H3, STA457H5
Recommended Preparation: None
University of Toronto Mississauga Distribution Category: Science
Arts & Science Breadth Category: The Physical and Mathematical Universes (5)
Credit Value: 0.5

Delivery Mode: This course is to be delivered **in person** as specified on the University Timetable Builder website. In case there is any change in the mode of delivery, the details will be announced on the course website.

Textbook: D. Montgomery, C. Jennings, and M. Kulahci: *Time Series Analysis and Forecasting (2nd edition)* (optional).
R. Shumway and D. Stoffer: *Time Series Analysis and Its Applications with R Examples (4th edition). Springer.* This book is available at the University of Toronto Bookstore and also available online via the University of Toronto Library system; A link is provided here. (optional).

Additional References

- Introduction to Linear Regression Analysis (5th edition) by D. C. Montgomery, E. A.Peck, and Geoffrey Vining (for the regression portion of the course)
- Time Series Analysis Forecasting and Control (4th edition) by George Box, Gwilym Jenk-ins, and Gregory Reinsel.

Statistical Computing: Statistical software R will be used for this course. Students are assumed to have basic knowledge in R programming.

Assessments: Your final grade will be based on the following assessments:

Type	Weight
Assignments	20%
Mid-term Test	20%
Group Project	30%
Final Exam	30%

Assignments: There will be two assignments throughout the term. You should expect the assignment to involve calculations, problem-solving questions, coding in R and/or written communication. Details of the assignments will be posted on Quercus.

Term Tests: There will be one term test during the course with a time limit of 90 minutes. The schedule for the term test: **TBD!**

Group project: There will be a group project for this course. Students are expected to form groups of 3–4 members. In special cases, groups of 2 may be permitted, depending on the total enrollment. For the project, students will given a time-series-related topic and perform a statistical analysis. The final deliverable should be a well-written, professionally formatted report. Detailed project instructions will be provided later.
The assessment of the group project is divided into two components: 20 marks for the overall quality of the project and 10 marks for individual contributions. For the first 20 marks, all group members will receive the same score, and a detailed rubric will be provided alongside the project instructions. The remaining 10 marks will be awarded based on peer evaluations, reflecting each individual's contribution to the project.

Final exam: There will be a closed book final exam at the end of the course. The date and time of the final exam will be determined by the Faculty later on in the term.

Missed Term Work Policy: For a missed term test, students must provide valid documentation such as the Verification of Illness or Injury. For more information, Please check the university policy. ONCE per semester, each student is allowed to miss work without any documentation. In that case you must fill out the ACORN absence declaration form. The form can be used at most ONCE per semester (once in total for all of your courses, not once per course). The absence you declare can be for a maximum of 7 consecutive days. In the case that a student needs other accommodation, please obtain the Letter from College Registrar, Letter of Academic

Accommodation from Accessibility Services, etc.

If an assessment is missed due to valid reasons listed above, please fill out the following form within one week of the missed assessment: https://forms.office.com/r/kxa6BdmCL1. The form will ask you to upload the appropriate documentation, which is one of the following: Acorn absence declaration, Verification of Illness form, Letter from College Registrar, Letter of Academic Accommodation from Accessibility Services. The documentation must be sent to the course email (sta457@course.utoronto.ca) within seven days of the missed assessment. Students who properly fill out the form will receive a confirmation email indicating how the missed assessment will be settled.

See below for a more detailed explanation of the policy regarding missed assessments and possible extensions for each assessment:

- Missed Term Test: Students who miss the term test **with valid documentation or an approved absence declaration** will have the opportunity to shift the weights to the final exam. There will not be make-up tests. Alternatively, if the test is missed **without** valid reasons and/or no valid documentation or an approved absence declaration is provided, a score of **zero** will be given.

- Missed Assignments: If the assignment is missed due to valid reasons stated above and **valid documentation or an approved absence declaration** is provided, the weight of the missed assignment will be shifted to the final project. Alternatively, if the assignment is missed **without** valid reasons and/or no valid documentation or an approved absence declaration is provided, a score of **zero** will be given. Students will be given enough time to work on the assignment, so **late submission will not be accepted.**

- Missed Final Exam: If you are not able to attend your final exam at the scheduled time for reasons outside your control, you may submit a deferred exam petition, which is a request to write your exam at a later time. Please see the Faculty of Arts and Science Deferred Exam policy for more information.

Re-Marking Policy: The course re-mark policy exists to correct mistakes and any request should clearly identify the error (for example, a question that was not marked, or a total incorrectly calculated). Requests to correct such mistakes must be sent by email to the course email address. Before you request for a re-mark, please make sure you review the solutions posted in Quercus. To be considered for a re-mark,

- the email should include student's full name and ID number, and give a specific, clear, and concise reason for each request, referring to a possible error or omission by the marker.

- students should make such requests as soon as reasonably possible after receiving the work back, but no later than 1 week after it was returned.

Note that if a student requests for a re-mark, the entire term test may be re-marked so the new grade may go up, down, or remain the same.

Piazza: Piazza will be used for discussions. This is for student-led discussion. The TAs will check Piazza posts on a regular basis and might participate in discussions. All posts and conduct on Piazza must remain professional. Posts regarding personal matters such as inquiries about grades, reporting absences, regrade requests, etc. should be communicated via email and **NOT** be posted on Piazza. Piazza is intended for students to receive support regarding course information and content and thus should be an overall positive and professional environment. Postings that do not align with this environment will be removed.

Academic Integrity: Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, U of T treats cases of cheating and plagiarism very seriously. Students should familiarize themselves with the University's policies on academic integrity, which can be found at https://www.academicintegrity.utoronto.ca/.

Email Policy: Email is appropriate for personal questions. Before you send an e-mail, make sure that you are not asking for information that is already on the course outline/ website/announcements, or questions about the course material that are more appropriately discussed during office hours or lectures. For personal matters, contact the course email with your U of T email address. The subject line must contain the course number, lecture section number, and a relevant subject (indicating what the email is about). Be sure to include your full name and student number in the body of the message. You will not get a response if you email from other email addresses or do not follow the email policy.

Privacy and Use of Course Materials Notifications: Course materials belong to your instructor, the University, and/or other source depending on the specific facts of each situation and are protected by copyright. In this course, you are permitted to download session materials for your own academic use, but you should not copy, share, or use them for any other purpose without the explicit permission of the instructor. For questions about recording and use of videos in which you appear please contact your instructor.

Accessibility Needs: The University of Toronto is committed to accessibility. If you require accommodations for a disability, or have any accessibility concerns about the course, the classroom,

or course materials, please contact Accessibility Resource Center as soon as possible.

Lecture Schedule: This schedule is tentative and subject to change. Updates will be posted on Quercus.

Weeks	Topics	Notes
Week 1 (Jan. 06 - Jan. 10)	Course Introduction, Classic Approach	
Week 2 (Jan. 13 - Jan. 17)	ETS models, Stationary	Assignment 1 release
Week 3 (Jan. 20 - Jan. 25)	ACF, PACF, MA processes	
Week 4 (Jan. 27 - Jan 31)	AR processes, Backshift Operator,	
Week 5 (Feb. 03 - Feb. 07)	ARMA models, Causality and Invertibility	Assignment 1 due
Week 6 (Feb. 10 - Feb. 14)	ARIMA models	Mid-term Test
Reading Week (Feb. 17 - 21)	-	-
Week 7 (Feb. 24 - Feb. 28)	ARIMA models (cont.), SARIMA Models	Assignment 2 release
Week 8 (Mar. 03 - Mar. 07)	ARCH models, GARCH models	
Week 9 (Mar. 10 - Mar. 14)	ARCH models, GARCH models (cont.)	Group project release
Week 10 (Mar. 17 - Mar. 21)	Multivariate time series	Assignment 2 due
Week 11 (Mar. 24 - Mar. 28)	Frequency domain models	
Week 12 (Mar. 31 - Apr. 04)	Machine Learning models, other topics	Group project due