

SS9861B/4861B Time Series Analysis

1. Course Information

Course Information

Statistical Science 4861B/9861B: Time Series Analysis

Winter 2022: Jan 10 – April 30, 2022

Lecture Hours: Tuesdays 12:30 pm – 2:30 pm & Thursdays 1:30 pm - 2:30 pm

Location: WSC 240

List of Prerequisites

A minimum mark of 60% in Statistical Sciences 3858A/B and Statistical Sciences 2864A/B.

List of Antirequisites

The former Statistical Sciences 3861A/B

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

2. Instructor Information

Instructors	Email	Office	Office Hours
Dr. Jingjia Chu	jchu223@uwo.ca	WSC 268	TBA
Teaching Assistants			TBA

Students must use their Western (@uwo.ca) email addresses when contacting their instructors and indicate the course number (SS4861 or SS9861) in the subject line. Office hours will be scheduled in either format (Zoom or in-person) by the instructor and teaching assistants.

For discussions on lectures/course material please see your instructor during the scheduled office hours. The students are expected to use office hours under normal circumstances unless you have concerns about your administration, e.g. midterm/assignment gradings. **All concerns need to be emailed to the instructor no later than a week after posting online. Discussions and questions are expected to be posed either in class or during office hours.**

You can expect a response to your email within 48 hours during the Monday to Friday workweek. Note that emails will generally not be answered, nor will office hours be scheduled within the 24-hour period before exams; this is meant to encourage proactive studying and help-seeking behaviour.

3. Course Syllabus, Schedule, Delivery Mode

Course Description

ARIMA models, seasonality, dynamic regression, model building using an interactive computer package, forecasting, intervention analysis, control, applications in econometrics, business, and other areas.

Learning Outcomes

Upon successful completion of this course, students will have a basic understanding of:

- Various time-series models (AR, MA, ARMA, ARIMA, ARCH, GARCH)
- Model fitting
- Forecasting
- Parameter estimation

Table of Contents and Tentative Schedule

Week	Topics	Note
1 (week of Jan 10)	Introduction	
2 (week of Jan 17)	Autocorrelation and partial autocorrelation	
3 (week of Jan 24)	Autoregressive time series processes (AR)	Assignment 1: Tentative due date Jan 25 before noon 11:59 am EST
4 (week of Jan 31)	Moving average time series processes (MA)	
5 (week of Feb 7)	Autoregressive moving average (ARMA) processes	Assignment 2: Tentative due date Feb 8 before noon 11:59 am EST
6 (week of Feb 14)	Nonstationary models	
7 (week of Feb 21)	N/A	Reading Week
8 (week of Feb 28)	Estimation methods	Assignment 3: Tentative due date March 1 before noon 11:59 am EST
9 (week of Mar 7)	Model discrimination	Midterm: Mar 8 in class
10 (week of Mar 14)	Fitting problems	
11 (week of Mar 21)	Model fitting tests	
12 (week of Mar 28)	Model forecasts	Assignment 4: Tentative due date March 29 before noon 11:59 am EST
14 (week of April 4)	Seasonal Models	

Key Sessional Dates

Classes begin: January 10, 2021

Last day to add a second-term half course: Jan. 14

Reading Week: February 19–27, 2022

Last day to withdraw from a second-term half course without academic penalty: Mar. 7

Classes end: April 8, 2022

April examination period: Apr. 10–30

Contingency plan for an in-person class pivoting to 100% online learning

In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all remaining course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will **not** change. Any remaining assessments will also be conducted online as determined by the course instructor.

4. Course Materials

There is no required textbook.

Textbook: *Time Series Analysis: Univariate and Multivariate Methods, 2nd ed.*, by William W. S. Wei, Pearson Addison Wesley.

Reference books:

Time Series Modelling of Water Resources and Environmental Systems by Keith W. Hipel and A. Ian McLeod.

The analysis of time series: an introduction by Chris Chatfield

Introduction to Time Series and Forecasting, 2nd ed., by Peter J. Brockwell and Richard A. Davis

Students are responsible for checking the course OWL site (<http://owl.uwo.ca>) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class.

All course material will be posted to OWL: <http://owl.uwo.ca>.

Check the course webpage before class. Course slides will be posted with outlines only and the missing part will be presented during class.

The detailed notes will not be posted at any time. You could only request the missing notes from your instructor given proper documentation provided (approval from the Dean's office for absence or self-reported absence for undergraduate students).

If students need assistance with the course OWL site, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

Technical Requirements

A personal computer that has R and RStudio installed (Windows, Mac, Linux) is required to complete the assignments. Computers with R, RStudio, SAS and Python installed are also available in the Department Computing Lab (WSC 258). Computer with working microphone, webcam and stable internet connection is needed for the Zoom office hours and/or in case of 100% online-learning contingency plan.

Google Chrome or Mozilla Firefox are the preferred browsers to optimally use OWL; update your browsers frequently.

Statement on Use of Electronic Devices

No electronic devices except a non-programmable calculator are permitted on the exam.

Important Notes:

Ask your Instructor before you make an audio recording of class. This expectation provides basic respect for their privacy and personal safety and is in keeping with Intellectual Property rights. If you would like to make audio recordings of our lecture sessions, please send an email to me.

Course material (i.e. lecture slides, videos, and other supplementary material posted on the course website and discussed in class) is the intellectual property of your instructor and is made available to you for your personal use in this course. Sharing, posting or using this material outside of your personal use in this course is considered an infringement of intellectual property rights.

5. Methods of Evaluation

Assignments: There will be 4 assignments and the tentative due dates are Jan 25, Feb 8, March 1 and March 29. Each assignment will worth 4% toward the course total.

Midterm: There is only 1 midterm test for this course which will be held on Mar 8 in class.

Final Exam: The final exam will be a cumulative examination. It will be scheduled by the Registrar and announced on OWL later in the term.

The overall course grade will be calculated as listed below:

Assignments (4) 16 % (4% * 4)

Midterm Test 34 %

Final Exam 50 %

Both midterm and final exams are **closed book**. No electronic devices except a non-programmable calculator are permitted on the exam.

Accommodated Evaluations

- Late assessments without illness self-reports will be subject to a late penalty 20 % per day or portion thereof, including weekends and holidays. Assessments that are submitted 5 or more days late will not be graded.
- (Undergraduate students only) Late assessments with illness self-reports should be submitted within 24 hours of submission of the last illness self-report, after which they will be subject to a late penalty of 20% per day or portion thereof, and assessments that are submitted 5 or more days late, including weekends and holidays, will not be graded.

- An assessment cannot be submitted after it has been returned to the class; the weight will be transferred to the final grade
- The weight of a legitimately missed midterm (Legitimacy must be determined by a counsellor) will be transferred to the final exam
- If a make-up assessment is missed, the student will receive an INC and complete the task the next time the course is offered

Rounding of Marks Statement

Across the Sciences Undergraduate Education programs, we strive to maintain high standards that reflect the effort that both students and faculty put into the teaching and learning experience during this course. All students will be treated equally and evaluated based only on their actual achievement.

Final grades on this course, irrespective of the number of decimal places used in marking individual assignments and tests, will be calculated to one decimal place and rounded to the nearest integer, e.g., 74.4 becomes 74, and 74.5 becomes 75. Marks WILL NOT be bumped to the next grade or GPA, e.g. a 79 will NOT be bumped up to an 80, an 84 WILL NOT be bumped up to an 85, etc. The mark attained is the mark you achieved, and the mark assigned; requests for mark “bumping” will be denied.

6. Student Absences

Academic Consideration for Student Absences

Students who experience an extenuating circumstance (illness, injury or other extenuating circumstance) sufficiently significant to temporarily render them unable to meet academic requirements may submit a request for academic consideration through the following routes:

- (i) Submitting a Self-Reported Absence (SRA) form provided that the conditions for submission are met. To be eligible for a Self-Reported Absence:
 - an absence must be no more than 48 hours
 - the assessments must be worth no more than 30% of the student's final grade
 - no more than two SRAs may be submitted during the Fall/Winter term
 - **SRA is applicable to undergraduate students only**
- (ii) For medical absences, submitting a Student Medical Certificate (SMC) signed by a licensed medical or mental health practitioner to the Academic Counselling office of their Faculty of Registration.
- (iii) Submitting appropriate documentation for non-medical absences to the Academic Counselling office in their Faculty of Registration.

Note that in all cases, students are required to contact their instructors within 24 hours of the end of the period covered, unless otherwise instructed in the course outline.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling Office of a student's Home Faculty.**

For the policy on Academic Consideration for Student Absences – Undergraduate Students in First Entry Programs, see:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf

and for the Student Medical Certificate (SMC), see:

[http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf.](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf)

Religious Accommodation

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing **at least two weeks prior to the holiday** to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at

[https://multiculturalcalendar.com/ecal/index.php?s=c-univwo.](https://multiculturalcalendar.com/ecal/index.php?s=c-univwo)

Absences from Final Examinations

If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam).

You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (e.g., more than 2 exams in a 23-hour period, more than 3 exams in a 47-hour period).

If a student fails to write a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See the Academic Calendar for details (under [Special Examinations](#)).

7. Accommodation and Accessibility

Accommodation Policies

Students with disabilities work with Accessible Education (formerly SSD), which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

[https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf,](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf)

8. Academic Policies

The mutual expectation of students and instructors is listed on the website of the Department of Statistical and Actuarial Sciences at <https://www.uwo.ca/stats/undergraduate/mutual-expectations.html>

The website for Registrarial Services is <http://www.registrar.uwo.ca>

In accordance with policy,

https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf,

the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

Use of Electronic Devices Students are allowed to use a non-programmable calculator on quizzes, midterms, and the final exam.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

Remote Proctoring Software may be used in this course, including in the event of a health lock-down.

Tests and examinations in this course will be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide **personal information** (including some biometric data) and the session will be **recorded**. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at:

<https://remote-proctoring.uwo.ca>.

9. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic-related matters: <https://www.uwo.ca/sci/counselling/>.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at (519) 661-2147 if you have any questions regarding accommodations.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: <https://www.uwo.ca/se/digital/>.

Learning-skills counsellors at the Student Development Centre (<http://www.sdc.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual

support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Students who are in emotional/mental distress should refer to Mental Health@Western (<http://www.health.uwo.ca/mentalhealth>) for a complete list of options about how to obtain help.

Additional student-run support services are offered by the USC, <http://westernusc.ca/services>.