

## Statistics 4864A/9864A Course Outline, 2021

### 1. Course Information

#### Course Information

<b>Course Name:</b>	Advanced Statistical Computing
<b>Course Number:</b>	SS4864A/SS9864A
<b>Academic Term:</b>	Fall, 2021
<b>Lecture Hours:</b>	MWF 10:30 – 11:30 AM.
<b>Lecture Room:</b>	B&GS-1056

#### List of Prerequisites

##### Undergraduate Students

A minimum of 60% in SS2864 and SS3859.

##### Graduate Students

Enrolled in the graduate program in the Department of Statistics and Actuarial Sciences at Western (Statistics, Actuarial Science, Financial Modelling, Biostatistics) and have taken a first course in mathematical statistics using calculus and linear algebra. Good understanding of Statistical inferences and Modeling. A previous course in computing programming is preferred.

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

Instructor	Email	Office	Phone	Office Hours
Hao Yu	<a href="mailto:hyu@stats.uwo.ca">hyu@stats.uwo.ca</a>	WSC 217	519-661-3622 (x83622)	Tus 9:30 am to 11:00 am
<b>Teaching Assistants</b>				
Li Yi	<a href="mailto:lyi7@uwo.ca">lyi7@uwo.ca</a>			
Yunxiao Dou	<a href="mailto:ydou29@uwo.ca">ydou29@uwo.ca</a>			

Students must use their Western (@uwo.ca) email addresses when contacting their instructors or TAs.

Office hour format: in-person.

### 3. Course Syllabus, Schedule, Delivery Mode

This course introduces students to ways of implementing various statistical procedures in R. For computation intensive procedures, C programming and R to C interface will be introduced. The aim is to gain a good understanding of how to efficiently use packages to perform data analysis. The approach will be research-orientated and therefore students will learn in detail how various statistical procedures are implemented. If time permits, SAS macro programming will be discussed. Topics covered though not restrict to those will include:

- Data preprocessing
- MLE, Inference including hypothesis tests, bootstrap, and MCMC
- Regression (simple, multiple, glm, smoothing, etc)
- Statistical Monte Carlo simulation
- Data mining and modelling overfitting/underfitting
- Statistical parallel computing
- SAS macro programming (time permits).

#### Learning Outcomes

- Upon successful completion of this course, students will be able to use R efficiently to work with advanced statistical computing problems.
- Break down a big and/or complex computing problem into many small and easy handle tasks.
- Interactive with other languages such a C to speed up computation time.

Classes begin: September 8, 2021

Reading Week: November 1–7, 2021

Classes end: December 8, 2021

#### 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. The main reference book is

Modern Applied Statistics with S. 4th edition, Springer by Venables, W.N. and Ripley, B.D. (2002).

**Software needed:** A personal computer that has R and RStudio installed (Windows, Mac, Linux) is highly recommended since they are required to complete all assignments. The majority of the course will be in R while there might be SAS coding involved in the later part of the course if time permits. If needed, <https://myvlab.uwo.ca> will be used to run SAS codes.

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>.

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

[Google Chrome](#) or [Mozilla Firefox](#) are the preferred browsers to optimally use OWL; update your browsers frequently. Students interested in evaluating their internet speed, please click [here](#).

## 5. Methods of Evaluation

The overall course grade will be calculated as listed below:

Assignments (5)	25%
Midterm	35%
Oral Presentation	10%
Final Project	30%

There are about 5 assignments, given out roughly one every two weeks. All assignments must be done electronically (all assignments must be prepared using RStudio Markdown/Notebook (PDF)) and be submitted to owl before deadline.

### Late Submissions by Graduate Students

- Assignments that are submitted late will be subject to a 20% penalty per day or portion thereof, including weekends and holidays.
- Assignments that are submitted 5 or more days late will not be graded.

### Late Submissions by Undergraduate Students

- Late assignments without illness self-reports will be subject to a late penalty of 20% per day or portion thereof, and assessments that are submitted 5 or more days late will not be graded.
- Late assignments 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 assignments that are submitted 5 or more days late will not be graded.

There will be a 2-hour closed book and in-person midterm, tentatively setting on October 28, 10:00 am to noon. It will be booked and confirmed through the Exam Central. Exam room info will be posted once it is available.

There will be a course project with oral presentation involved. The maximum number of students in each group will be 2 and it might change later depending on the number of students enrolled in this course. The oral presentation will contribute 10% toward the final grade. 30% will be graded based on your written project. Be aware that each member in a group must contribute equally to your project in terms

of preparation, coding, debugging, running, writing slide/project (so that you will be given the same grade). Otherwise, different grade is given based on the amount of work you contribute to.

Presentation Slides Due: Nov 28 11:55 pm. To be submitted through OWL (pdf or PowerPoint).

Last three or four lectures are reserved for your oral presentations. Each group will have about 15 minutes to present including Q & A.

Written Project Due: Dec 20 11:55 pm. To be submitted through OWL with dataset if applicable.

### **Accommodated Evaluations**

No makeup midterm is given. The weight may be redistributed to other categories by the instructor.

### **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 (applicable to undergraduate students only) 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
- (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.

Please send me an email once you file your SRA and I will send back an acknowledgement to give you some options if applicable.

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](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](http://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>.

## **6. 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),

## **7. Academic Policies**

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](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.

**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](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf).

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

## 8. 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>.

This course is supported by the Science Student Donation Fund. If you are a BSc or BMSc student registered in the Faculty of Science or Schulich School of Medicine and Dentistry, you pay the Science Student Donation Fee. This fee contributes to the Science Student Donation Fund, which is administered by the Science Students' Council (SSC). One or more grants from the Fund have allowed for the purchase of equipment integral to teaching this course. You may opt out of the Fee by the end of September of each academic year by completing the online form linked from the Faculty of Science's Academic Counselling site. For further information on the process of awarding grants from the Fund or how these grants have benefitted undergraduate education in this course, consult the Chair of the Department or email the Science Students' Council at [ssc@uwo.ca](mailto:ssc@uwo.ca).