Western Science

Department of Statistical and Actuarial Sciences
SS2857A: Probability and Statistics I

Course outline for Fall/Winter 2020

THRIVE together

Although this academic year might be different, Western University is committed to a **thriving campus**. We encourage you to check out the Digital Student Experience website to manage your academics and well-being. Additionally, the following link provides available resources to support students on and off campus: https://www.uwo.ca/health/.

Technical Requirements and Important Dates:

Stable internet connection

Laptop or computer

Working microphone

Working webcam

Classes Start	Reading Week	Classes End	Study day(s)	Exam Period
September 9	November 2 - 8	December 9	December 10	December 11 - 22

* November 12, 2020: Last day to drop a first-term half course or a first-term full course without penalty

Note: All times listed are local to London, Ontario.

1. Course Information

Course information

Lectures
Lectures will be conducted via Zoom. Links to each meeting can be accessed on OWL and you are required to register (you will only need to do this once).

Monday 12:30-1:30pm (Students with family names starting A through K)
Wednesday 12:30 -1:30pm (Students with family names starting L through S)
Friday 12:30 – 1:30pm (Students with family names starting T through Z)

Tutorial

Tutorials will be conducted as open drop-in times for you to ask questions of the TAs. Sessions will be conducted via Zoom and links to each meeting can be accessed on OWL. Sessions are tentatively planned for the following times:

> Tuesday 4:30-5:30pm (TA Alex Draghici)
> **Thursday** 4:30-5:30pm (TA Hanna Kim)
> **Thursday** 9:00-10:00pm (TA Johanna de Haan Ward)
> Tuesday 9:00-10:00pm (TA Chengqian Xian)

You may attend any sessions and further sessions may be added if demand requires.

List of Prerequisite(s)

A minimum mark of 60% in 0.5 course from (Calculus 1000A/B or Calculus 1500A/B) plus 0.5 course from Calculus 1301A/B (minimum mark 85%) or Calculus 1501A/B (minimum mark 60%). A minimum mark of 60% in Applied Mathematics 1413 may also be used to meet this 1.0 course prerequisite.

As noted in the Senate Guidelines, 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

Dr. Simon Bonner

Office: WSC 276
Phone: 519-661-2111 ext. 88205
E-mail: sbonner6@uwo.ca
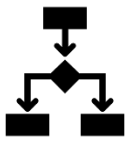Office hours: Wednesdays and Fridays 8:30-9:30am via Zoom or by appointment

I will not be on campus regularly this fall, and so e-mail is the best way to get in touch. Please use your Western (@uwo.ca) email addresses when sending a message. I do my best to respond to e-mail within one business day. If you would like to talk face-to-face but are unable to make my office hours then please send me an e-mail and we can arrange another time to meet.

3. Course Syllabus, Schedule, and Delivery Mode

Course Description

Western's course calendar states that this course will cover: "Probability axioms, conditional probability, Bayes' theorem. Random variables motivated by real data and examples. Parametric univariate models as data reduction and description strategies. Multivariate distributions, expectation and variance. Likelihood function will be defined and exploited as a means of estimating parameters in certain simple situations."

This is a technically correct, but rather boring, description of what you will learn in this class. It's a bit like telling someone that for dinner you are going to eat paste made from ground wheat topped with crushed tomatoes boiled with herbs and garlic, grated coagulated cow's milk, the preserved fruit of *Olea europaea*, and American salami flavoured with paprika. Yes, it's a pizza with black olives and pepperoni – but the final product is much more than a list of its ingredients.

Statistics gives us a way to answer questions about the world around us and make decisions in the face of uncertainty. Life would be much easier if there were no uncertainty. You'd always pick the right clothes for the weather, investors would always choose the best financial products, and doctors would never misdiagnose patients' illnesses. The world isn't like that, and it's probably good thing. Life would be pretty boring if there was no uncertainty. Decisions are hard to make because we can never know all of the necessary information. The field of probability provides a language with which we can talk and reason about uncertainty in the world and forms the underpinnings of all statistical methods. In this class you will learn the mathematics of probability with a focus on real world examples in order that you can understand and apply the statistical methods presented in the follow-up course (SS2858).

Method of Delivery

The majority of the course material will be delivered asynchronously through textbook readings and pre-recorded lectures. The schedule on the following page lists the sections of the textbook and the lectures that you are responsible for covering each week.

I will conduct synchronous Zoom meetings in the regularly scheduled lecture times (MWF 12:30 - 1:30). In these sessions, I will work through practice problems based on the readings and lecture topics from the previous week. For example, between September 14 and 18 I will present examples based on Textbook Sections 1.1 and 1.2 and Lecture 1 to 3. You will also have the opportunity to ask questions about the examples during these sessions. I will present the same examples in all three sessions and ask that you attend one session per week as follows:
- Monday: family names starting A through K
- Wednesday: family names starting L through S
- Friday: family names starting T through Z

This will keep the number of students roughly the same across the sessions. If one session is cancelled (e.g., on Thanksgiving day) then you are welcome to attend one of the other sessions.

You will also have time to ask questions of myself and the Teaching Assistants during the tutorials and office hours (see Schedules in Section 1).

Table of Contents and Schedule

Week	Dates	Textbook Sections	Lectures	Topics
1	Sept 8 - 11	1.1-1.2	1-3	Introduction Populations, Samples, and Processes Pictorial and Tabular Methods
2	Sept 14 - 18	1.3-1.4	4-6	Measures of Location and Variability
3	Sept 21 - 25	2.1 - 2.2	7-9	Sample Spaces and Events Axioms of Probability
4	Sept 28 - Oct 2	2.3 - 2.5	10-12	Counting Techniques Conditional Probability Independence
5	Oct 5 - 9	3.1 - 3.3	13-15	Random Variables Probability Distributions for Discrete Random Variables Expected Values
6	Oct 12 - 16	3.3 - 3.4	16-18	Variance Moment Generating Functions
7	Oct 19 - 23	3.5 - 3.7	19-22	The Binomial Probability Distribution The Hypergeometric and Negative Binomial Distributions The Poisson Probability Distribution
8	Oct 26 - 30	4.1 -4.3	23, 24A/B	Probability Density Functions and Cumulative Distribution Functions Expected Values and Moment Generating Functions The Normal Distribution
	Nov 2 - 6			Reading Break
9	Nov 9 - 13	4.4-4.7	25-28	The Gamma Distribution and Its Relatives Probability Plots Transformation of Random Variables
10	Nov 16 - 20	5.1-5.3	29A/B, 30, 31	Jointly Distributed Random Variables Expected Values, Covariances, and Correlations Conditional Distributions
11	Nov 23 - 27	6.1-6.2	32, 33	Sampling Distributions Distribution of the Sample Mean
12	Nov 30 - Dec 4	6.2 - 6.3	34, 35	Distribution of the Sample Mean (ctd) Mean, Variance, and MGF for Several Variables
13	Dec 7 - 9	6.4	36	Distributions Based on a Normal Random Sample

4. Course Materials

The required text for this course is:
> Devore, JL and Berk, KN (2012) Modern Mathematical Statistics with Applications. 2nd Edition. Springer.

You may access a free electronic copy of this book in PDF or EPUB format through Western Libraries by following this link to Springer Link. From there you can also purchase a softcover copy of the book for 25 USD (approximately 34 CAD).

Sections of the text to be covered each week are included in the Schedule in the previous section.

Students should check OWL (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. Students are responsible for checking OWL on a regular basis.

All course material will be posted to OWL: http://owl.uwo.ca. Any changes will be indicated on the OWL site and discussed with the class.

If students need assistance, 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.

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)	20%
Midterm Exam 1	20%
Midterm Exam 2	20%
Final Exam	40%

To pass this course you must submit at least three of the five assignments, complete both midterm examinations, and write the final exam.

The first midterm is tentatively scheduled for the week of October 12 and will cover all of the material from Weeks 1 – 4 (Chapters 1 & 2).

The second midterm is tentatively scheduled for the week of November 16 and will cover the material from Weeks 5 – 8 (Chapter 3 and Section 4.1, 4.2, and 4.3). Note, however, that this material implicitly relies on the material from the earlier part of the course.

The final exam will be cumulative and will cover the material from all lectures and assigned textbook readings.

All exams will be scheduled by the Office of the Registrar. Details will be provided when they are available.

I intend that all assessments for this course will be submitted through Gradescope. Students are responsible for ensuring that their submission are complete and legible and for matching their solutions to each question. Submissions will not be graded if they are not legible or if solutions are not matched to the questions. The time of submission for the entire assessment will be determined by the time of the last submission/resubmission for any question.

Late or Missed Evaluations

- Assignments:
    - Late assignments <u>without</u> illness self-reports or other accommodation will be subject to a late penalty 20 %/day
    - Late assignments <u>with</u> illness self-reports or other accommodation should be submitted within 24 hours of the end of the accommodation period. Assignments submitted any later will be subject to a late penalty of 20%/day.
    - Assignments that are more than 5 days late will not be accepted, even with accommodation.
    - An assignment cannot be submitted after solutions have been posted or the assignment is returned to the rest of the class.
- Midterm examinations:
    - If an examination is administered through the Tests and Quizzes tool on OWL then submissions will not be accepted after the exam closes.
    - If an examination requires submission through Gradescope then late submissions will be subject to a penalty of 1% per minute for the first 10 minutes and 5% per minute thereafter.
    - If a student misses one of the midterm examinations with accommodation, then he/she will write a make-up exam at a later date.
    - If a make-up assessment is missed, the student will receive an INC and will complete the assessment 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. 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 Academic Accommodation for Students with Disabilities policy can be found at:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf

If you are a student with a disability and require extra time accommodation, please ensure your accommodations are active on the Accommodated Exams website https://studentservices.uwo.ca/Accommodatedexamssignup/ for this course **at least 10 days before any timed assessment** (i.e., midterm or final examinations). Any accommodations posted there will be applied to your assessment.

Academic Consideration for Student Absence

Students will have up to two (2) opportunities during the regular academic year to use an on-line portal to self-report an absence during the semester, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30% or less of the student's final grade. Students are expected to contact their instructors within 24 hours of the end of the period of the self-reported absence, unless noted on the syllabus. Students are not able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (e.g., December and April exams)
- absence of a duration greater than 48 hours,
- assessments worth more than 30% of the student's final grade,
- if a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-Reported Absence are *not* met, students will need to provide a Student Medical Certificate if the absence is medical, or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation.

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 policy on Academic Consideration for Student Absences - Undergraduate Students in First Entry Programs, see:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Consideration_for_absences.pdf
and for the Student Medical Certificate (SMC), see:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

Religious Accommodation

Students should consult the University's list of recognized religious holidays, and should give reasonable notice in writing, prior to the holiday, to the Instructor and an Academic Counsellor if their course requirements will be affected by a religious observance. Additional information is given in the Western Multicultural Calendar:
https://multiculturalcalendar.com/ecal/index.php?s=c-univwo

You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (see http://www.registrar.uwo.ca/examinations/exam_schedule.html).

7. Academic Policies

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

In accordance with policy, http://www.uwo.ca/its/identity/activatenonstudent.html, 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.

Only non-programmable calculators may be used on the midterm and final examinations. **No other electronic devices are permitted to be used** except as required by the exam format (e.g., to connect to ProctorTrack).

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.

Tests and examinations in this course will be conducted using the remote proctoring service, such as Proctortrack. 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**. More information about this remote proctoring service is available in the Online Proctoring Guidelines at the following link: https://www.uwo.ca/univsec/pdf/onlineproctorguidelines.pdf

Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. Information about the technical requirements are available at the following link:
https://www.proctortrack.com/tech-requirements/

Professionalism & Privacy

Western students are expected to follow the Student Code of Conduct. Additionally, the following expectations and professional conduct apply to this course:

☒ Students are expected to follow online etiquette expectations provided on OWL

☒ All course materials created by the instructor(s) are copyrighted and cannot be sold/shared

☒ Recordings are not permitted (audio or video) without explicit permission

☒ Permitted recordings are not to be distributed

⊠ Students will be expected to take an academic integrity pledge before some assessments

⊠ All recorded sessions will remain within the course site or unlisted if streamed

Copyright Statement

Please be aware that all course materials created by the instructor(s) are copyrighted and cannot be **sold/shared**. Those include materials used in tests/quizzes, midterms, and finals. Any posting/sharing of such materials in part or whole without owner's consent is considered as violation of the Copyright Act and will be considered as a scholastic offence.

In addition, online services such as Chegg are actively monitored. Any questions that are coming out during midterms and finals and are posted to an online service will be searched. Such an activity will be considered as a scholastic offence and will result in academic penalty.

8. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on add/drop 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 Student Accessibility Services (SAS) 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/mental_health) 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.

9. CIA University Accreditation Program

Canadian Institute of Actuaries Actuarial Exam Accreditation

This course is accredited under the Canadian Institute of Actuaries (CIA) University Accreditation Program (UAP). Achievement of the minimum required grades in accredited courses may provide credit for preliminary exams. Please note that a combination of courses may be required to achieve exam credit. Details of required courses and grades at Western University are available at: https://www.cia-ica.ca/membership/university-accreditation-program-home/.

In addition to the university's internal policies on conduct, including academic misconduct, candidates pursuing credits for writing professional examinations shall also be subject to the Code of Conduct and Ethics for Candidates in the CIA Education System and the associated Policy on Conduct and Ethics for Candidates in the CIA Education System. For more information, please visit Obtaining UAP Credits and the CIA FAQ.

Students need both Stats 2857A (minimum grade of 75%) and 3657A (minimum grade of 80%) in order to be eligible to receive a credit for SOA Exam P.