Western Science

Department of Statistical and Actuarial Sciences
STATISTICAL SCIENCE 3657A – Section 001
Intermediate Probability

Course outline for Fall 2020

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

1. Course Information

Course information

Intermediate Probability
Statistical Science 3657A – Section 001 – Fall 2020

This course is accredited under the Canadian Institute of Actuaries (CIA) University Accreditation Program (UAP). For more information, see Section 6 of this document.

This is a synchronous course with a large portion of asynchronous teaching designed to accommodate students in different time zones. The main vehicles for delivering the course will be OWL and e-mail (rzitikis@uwo.ca). If/when a need arises, other modes of communication will be set up.

List of Prerequisite(s)

A minimum mark of 60% in Statistical Sciences 2858A/B and in Statistical Sciences 2503A/B or Calculus 2503A/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

Course Coordinator	Contact Information
Dr. Ricardas Zitikis	rzitikis@uwo.ca, zitikis@stats.uwo.ca

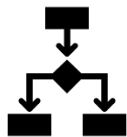| Instructor(s) or Teaching Assistant(s)	Contact Information
Dr. Ricardas Zitikis	rzitikis@uwo.ca, zitikis@stats.uwo.ca

Office Hours	Modes of Communication	Names
Flexible	OWL, e-mail, or other	Dr. Ricardas Zitikis
Flexible	OWL, e-mail, or other	Team of TAs

Students must use their Western (@uwo.ca) email addresses when contacting their instructors and indicate the course number (SS3657) in the subject line.

3. Course Syllabus, Schedule, and Delivery Mode

Course Description
A continuation of the study of multivariate probability and stochastic processes. This course builds on the background developed in the second year courses and focuses on the more advanced aspects of multivariate probability, namely transformations where the domain of random variables must be carefully considered.

Type	Mode	Dates	Time	Frequency
Lecture	Synchronous online	M/W/F	11:30 am - 12:30 pm	weekly
Lecture	Asynchronous online	N/A	Flexible	weekly
Tutorial	Synchronous online	W	5:30 pm - 6:30 pm	weekly
Tutorial	Asynchronous online	N/A	Flexible	weekly

Learning Outcomes

Upon successful completion of this course, students will have a basic understanding of:
- Sample spaces, events, and their classification.
- Calculation of expectations and dealing with (in)dependence.
- Notion of information and its modelling.
- Forecasting the future given the past.
- Concepts of random sequences, time series, and stochastic processes.
- Uses of probability in statistics, finance, actuarial science, and other areas.

Table of Contents and Schedule

Week	Overview	Topics
1	**Dates:** Sept 9 – 13 Course Introduction and start **Ch 1**	Families of sets
2	**Dates:** Sept 14 – 20 **Ch 1:** Measure Spaces	Families of sets on the real line Binary experiments Set functions Limiting results
3	**Dates:** Sept 21 – 27 **Ch 2:** Events	Limiting results for sets Limiting results for probabilities Limiting results for indicators
	Quiz 1: Tentative, as scheduled by the Registrar	
4	**Dates:** Sept 28 – Oct 4 **Ch 3:** Random variables	Measurable functions Random variables Indicators Laws and distribution functions Inverted distribution functions
5	**Dates:** Oct 5 – 11 **Ch 4:** Independence	Independent sets Independence verification for sets Independence verification for rand. variables
	Test 1: Tentative, as scheduled by the Registrar	
6	**Dates:** Oct 12 – 18 **Ch 5:** Integration	The staircase function Properties of integrals Limiting results for integrals Absolute continuity and densities

7	**Dates:** Oct 19 – 25	
	Ch 6: Expectation	Limiting results Basic properties Infinite sums Inequalities Sets of random variables Absolute continuity and densities
	Quiz 2: Tentative, as scheduled by the Registrar	
8	**Dates:** Oct 26 – Nov 1	
	Ch 7: An Easy Strong Law	Independence and expectation Strong law of large numbers
9	**Dates:** Nov 2 – 8	
	Reading Week	N/A
10	**Dates:** Nov 9 – 15	
	Ch 8: Product Measure	Families of sets Double integrals Frequently used formulas Joint distributions Role of independence
	Test 2: Tentative, as scheduled by the Registrar	
11	**Dates:** Nov 16 – 22	
	Ch 9: Conditional Expectation	Basic properties Convergence Inequalities Taking out what is known Role of independence
12	**Dates:** Nov 23 – 29	
	Ch 9 (continuation)	
	Quiz 3: Tentative, as scheduled by the Registrar	
13	**Dates:** Nov 30 – Dec 6	
	Ch 10: Martingales	Properties Gambling and the total winning Stopping time Stopped martingales
14	**Dates:** Dec 7 – 9	
	Finish **Ch 10** and prep for final	

Online Participation and Engagement

⊠ Students are expected to participate and engage with content as much as possible.

⊠ Students can post on OWL Forum their questions, answers, and have discussions with their peers, TA's, and the instructor.

4. Course Materials

Textbook: Williams, D. (1991). *Probability with Martingales*. Cambridge University Press, Cambridge, UK.

> "The book, which is essentially the set of lecture notes for a third-year undergraduate course at Cambridge, is as lively an introduction as I can manage to the rigorous theory of probability. [...] In planning this book, I decided for every topic what things I considered just a bit too advanced, and, often with sadness, I have ruthlessly omitted them." (Preface, page xi)

"Problems and Solutions," which very closely follow the material covered in the textbook, will be incrementally prepared by the instructor, and posted on OWL.

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

A) Problems and Solutions
"Problems and Solutions" prepared by the instructor will be good practice and useful to your learning, preparing for quizzes and tests.

B) Midterm Tests
There will be 2 tests, each containing two parts, and all administered through OWL.

Students will have 1 continuous hour to complete each part of each test.

The exact dates for Tests 1 and 2 will be scheduled by the Registrar and announced on OWL as soon as possible.

Chapters and topics for the tests will be announced in advance through OWL. Students shall upload their hand-written calculations/work in a single pdf file into their Dropbox folder on OWL within 30 minutes of completing each test.

C) Quizzes
The goal of our quizzes is to make sure that students keep up with the course material between our major examinations. There will be three quizzes administered through OWL.

Students will have 1 continuous hour to complete each quiz.

The exact dates for Quizzes 1, 2 and 3 will be scheduled by the Registrar and announced on OWL as soon as possible.

A student's "Quizzes" component in the marking scheme is based on their top two quiz grades (i.e., we drop the single lowest quiz grade). Students shall upload their hand-written calculations/work in a single pdf file into their Dropbox folder on OWL within 30 minutes of completing each quiz.

D) Final Exam
The final exam will be a three-hour cumulative examination. It will be scheduled by the Registrar's office (Examination period Dec 11 to 22, 2020). Students shall upload their hand-written calculations/work in a single pdf file into their Dropbox folder on OWL within 30 minutes of the end-time of the final exam.

Note: Quiz and test topics will be finalized and announced closer to their dates.

The overall course grade will be calculated as listed below:

Quizzes (best 2 of 3)	30%
Test 1	20%
Test 2	20%
Final Exam	30%

Accommodated Evaluations
- There is NO makeup test to either Test 1 or Test 2. If you miss either test (with a valid reason), the weight of the test(s) will be moved to the final exam.
- Due to the flexibility of the marking scheme, there are no accommodations for missing quizzes. Accommodation is already taken into consideration within the marking scheme.
- To pass the course, a student must complete the final exam.

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.

Proctortrack

Tests and examinations in this course will be conducted using the remote proctoring service, 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/

6. Canadian Institute of Actuaries (CIA) 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.

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 Academic Accommodation for Students with Disabilities policy can be found at:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf

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).

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 Academic Calendar for details (under Special Examinations).

8. 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.

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.

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.

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.

9. 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.