The University of Western Ontario
Department of Statistical and Actuarial Sciences
STATISTICAL SCIENCE 2857 – Spring 2020
Probability and Statistics I

Instructor:	Joseph Raaymakers, M.Sc.
Contact:	jraaymak@uwo.ca or via forums in OWL
Office Hours:	Online via Zoom (by appointment)
Lectures:	Posted Monday, Wednesday and Friday afternoons
Tutorials:	Online via Zoom on Mondays, 1:30 – 2:30 pm

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.

Anti-requisite(s)
The former Statistical Sciences 2657A.

Students are advised that they are responsible to ensure that they possess the necessary prerequisites (or have written special permission) and that de-registration may occur at <u>any time</u> if they lack the prerequisite or have taken an anti-requisite course.

Text Book
Modern Mathematical Statistics with Applications, 2nd ed., by JL Devore and KN Berk.

You may access a free electronic copy of this book in PDF or EPUB format through Western Libraries by following this link
https://login.proxy1.lib.uwo.ca/login?qurl=https://link.springer.com%2fbook%2f10.1007%252F978-1-4614-0391-3
to Springer Link. From there you can also purchase a softcover copy of the book for 25 USD (approximately 34 CAD).

Course Description
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.
It's actually more interesting than it sounds.

Course Objectives
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 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).

Note

This course is accredited under the Canadian Institute of Actuaries (CIA) University Accreditation Program (UAP) for the 2019-20 academic year. Achievement of the established exemption grade in this course may qualify a student from exemptions from writing certain preliminary exams.

Please note, a combination of this course, Statistics 3859A and Statistics 3860B, is required to achieve an exemption for preliminary exam SRM (minimum of 80% in each course is required). Please see the following link for full details:

http://www.cia-ica.ca/membership/university-accreditation-program---home

Course Outline

Chapter	Topics
1 – Descriptive Statistics	Graphing Data, Sample Statistics: Mean, median, Variance, IQR, Percentiles, Outliers
2 – Probability Theory	Probabilities, Events, Union, Intersection, Conditional Probability, Bayes Rule
3/4 – Random Variables and Probability Distributions – Discrete and Continuous	Discrete and Continuous Random Variables, Expectation, Variance, Moment Generating Functions, Functions of Random Variables Discrete: Binomial, Poisson, Hypergeometric, Negative Binomial Continuous: Uniform, Normal, Exponential, Gamma, Other
5 – Joint Probability Distributions	Joint Random Variables, Expectation, Covariance, Correlation, Conditional Distributions, Transformations
6 – Statistics and Sampling Distributions	Distributions of Statistics, Expectation, Variance and MGF of Several Variables, Distributions Based on Normal Random Samples and the Central Limit Theorem

Course Schedule - Topics and Assessments

A detailed weekly timetable is included on the last page of this syllabus.

Calculator requirements

You will need a pocket (non-programmable) calculator for all assessments. Any such calculator is fine, including statistical calculators.

Course OWL Web Page

The web page will contain:
1. A copy of this course outline
2. Updates and information about the course that you need to know
3. Extra readings (for some topics) that will supplement your class notes
4. Daily lecture notes and other things that are relevant to the course
5. Sample/past exams/tests and solutions
6. Marks of assignments and tests as they are marked

Quizzes
There will be 4 short online multiple-choice quizzes that will be given on the following dates:

Quiz 1: **Friday**, **May 22, 2020** (Topics TBA)
Quiz 2: **Friday, May 29, 2020** (Topics TBA)
Quiz 3: **Friday, June 12, 2020** (Topics TBA)
Quiz 2: **Friday, June 19, 2020** (Topics TBA)

The quizzes are open-book. You are encouraged to make use of my lecture slides and the text when writing the quizzes. However, you must work independently. Before you begin each test, you will agree to an Honour Statement. I will be conducting response and cheating analysis after each quiz. Please honour the Honour Statement.

NOTE: There will be NO make-ups for any of the online quizzes. If you miss a quiz (with a valid reason), the weight will be reassigned to the test and exam components.

Midterm Test
There will be a two-hour online test (most likely all multiple-choice questions) scheduled on the following date:

Midterm Test: **Friday, June 5, 2020** (Topics TBA)

All the same rules apply for the test as with the quizzes. The test is open-book, but you are required to work independently.

NOTE: There will be NO make-up test for any missed tests. If you miss the test (with a valid reason), the weight will be reassigned to the final exam.

Final Exam
The final exam will be a three-hour examination covering all material in the course, with emphasis on material covered since the midterm. The exam may either be multiple-choice questions OR a combination of multiple choice and short written answer questions. It will be scheduled by the Registrar's office.

Evaluation
Your final course grade will be determined as follows;

	Original
Quizzes (4 x 4%)	20%
Midterm	32%
Final Exam	48%

Intellectual Property Statement
Course material (i.e. course content (including lecture notes), videos, solutions, practice questions and other supplementary material posted on OWL) is the intellectual property of your instructors and course developers and is made available to your for your personal use in this course. *Sharing, posting, selling or using this material outside your personal use in this course is considered to be an infringement of intellectual property rights.*

Policy on tests and examinations

Tests and examinations in this course may be conducted using the remote proctoring service Proctortrack. Therefore, completion of this course will require you to have a device that meets the requirements at

https://www.proctortrack.com/tech-requirements/.

By taking this course, you are consenting to the use of this software and to be monitored during tests and examinations. Furthermore, you are declaring that you have a reliable internet connection with sufficient capacity to support video proctoring.

Policy on e-mail communication

You are welcome to communicate with your instructor by e-mail, but e-mail communication should only be used to provide them with information or to ask a question that requires a brief response. For more lengthy discussions and for discussions on lectures/course material please see your instructor during their scheduled office hours or by appointment. If you do e-mail them, please use your UWO account, as these are often the only emails read (as e-mails sent from other addresses often get spammed).

Attendance

The Department of Statistical and Actuarial Sciences views classroom attendance as a very important part of the learning process. Regular engagement with the online course materials and in online tutorials is strongly encouraged. Students are advised that excessive absenteeism may result in being debarred from the final examination (see Western Academic Calendar).

Classroom Environment

The Department of Statistical and Actuarial Sciences has adopted a "Mutual Expectations" policy governing the classroom environment and all work submitted by students. [The full text of the policy can be found at https://www.uwo.ca/stats/undergraduate/mutual-expectations.html]. Although these were developed with a lecture-based course in mind, the spirit of the expectations applies to this course as well. In summary the policies developed are under the premise that all interactions between student and faculty should be governed by the principles of courtesy, respect and honesty.

Students are encouraged to ask questions on the appropriate forums. Do not use course-related OWL Forums for social conversation unrelated to the course. Keep postings to the OWL Forums positive and productive – the OWL Forums are an important component of our learning environment. vInappropriate or disrespectful postings will not be tolerated.

Department Policy on Missed Course Requirements and Student Health and Wellness

If you are unable to meet a course requirement due to illness or other serious circumstances, you must seek approval for the absence as soon as possible. During the COVID-19 pandemic, medical notes are not required. Medical absence can be reported through the Student Illness Reporting Tool at

https://www.registrar.uwo.ca/academics/academic_considerations/index.html.

If this portal is not available (i.e., if the COVID-19 pandemic has lifted before the end of the course), or if you have missed (or will be missing coursework) for a non-medical reason beyond your control, approval can be granted either through a Self-reported Absence (if the portal is available) or via the Dean's Office/Academic Counselling unit of your Home Faculty. Non-medical reasons must be accompanied by supporting documentation. If you are a Science student, contact information for the Academic Counselling Office for the Faculty of Science is available at

https://www.uwo.ca/sci/counselling/.

In all cases, you must contact your instructor as soon as possible, and no later than 24 hours after the period covered, to clarify how you will be expected to fulfil the academic expectations you have missed (unless other instructions are indicated in this Course Outline). For further information, please consult the University's policy on academic consideration for student absences:

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

For Final Exam: If you miss the Final Exam, please contact your faculty's Academic Counselling Office as soon as you are able to do so. They will assess your eligibility to write the Special Exam (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" (see http://www.registrar.uwo.ca/examinations/exam_schedule.html).

For Midterm Exam: The policy of the Department of Statistical and Actuarial Sciences is that there will be no make-up exams for a midterm missed due to illness. If your accommodation is approved, the weight of the missed midterm will be reassigned to the final exam. If your accommodation is not approved, then you will receive a mark of 0 for your midterm.

If you have any conflict that prevents you from writing a midterm, you must check with your instructor as soon as possible (and prior to the exam) so that alternate arrangements can be made.

For Quizzes: There will be NO make-ups for any of the online quizzes. If you miss a quiz (with a valid reason), the weight will be reassigned to the test and exam components.

Academic Policy
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.
Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at this website:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

Computer-marked, multiple-choice tests and exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

Support Services

Learning-skills counsellors at the Student Development Centre 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: http://sdc.uwo.ca/.

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

Additional student-run support services are offered by the USC: https://westernusc.ca/your-services/.

Accessibility

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 Services for Students with Disabilities (SSD) at 661-2111 ext. 82147 if you have questions regarding accommodation.

The policy on Accommodation for Students with Disabilities can be found here:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic%20Accommodation_disabilities.pdf

The policy on Accommodation for Religious Holidays can be found here:

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

APPROXIMATE Weekly Course Calendar

Lectures – 2020	Section	
May 11-15	Descriptive stats, Probability theory (sections 1.1 - 1.4, 2.1 - 2.2)	
May 18-22	Probability theory, Random variables (sections 2.3 – 2.5, 3.1 – 3.3)	
May 22	**Quiz 1**	
May 25-29	Random variables, Discrete probability distributions, Continuous probability distributions (sections 3.5 – 3.7, 4.1 – 4.3)	
May 29	**Quiz 2** and Tutorial/Class	
Jun 1-5	Continuous probability distributions, Joint probability distributions (sections 4.3 – 4.7, 5.1)	
Jun 5	**Midterm Test**	
Jun 8-12	Joint probability distributions, Conditional probability distributions, Statistics and sampling distributions (sections 5.1 – 5.5, 6.1)	
Jun 12	**Quiz 3**	
Jun 15-19	Statistics and sampling distributions, Central Limit Theorem (sections 6.1 – 6.4)	
Jun 19	**Quiz 4**	
Final Exam – To be scheduled by the Registrar's office (3 hours)		