



Department of Statistical and Actuarial Sciences. University of Western Ontario
Room 262 Western Science Centre. Phone: 519-661-3607. Fax: 519-661-3813

Course Outline for Statistical Science 3657A Intermediate Probability Fall 2019

1. General Information

Lecture Hours Mon Wed Fri 11:30 AM-12:30 PM Spencer Engineering Bldg 1059

Tutorial Hour Wednesday 17:30 (i.e. 5:30 p.m.) Social Science Centre 2028

List of Prerequisites: A minimum mark of 60% in each of 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

Instructor David Stanford

Office WSC 211

Email stanford@stats.uwo.ca will be seen first; I look at stanford@uwo.ca at least once per day.

Phone 519-661-3612 direct dial, or ext 83612 from campus phones

Office Hours Mondays and Wednesdays 1:15 p.m.-3 p.m., changes can be negotiated

3. Course Information

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.

Course Objectives and Syllabus

This course provides a thorough treatment of the *concepts of probability, properties of random variables, conditional expectation and transformations*. Just as important as the results that are

obtained are the *means* by which they are obtained. Someone who excels in the course will become as adept at carrying out the techniques as in understanding *why* they are needed. Most of the topics we cover were covered in Statistical Sciences 2857A, so the number of new topics introduced is relatively small. The course will introduce conditional expectation. Moment-generating functions will be introduced and used widely. Other new topics will occur. However, students will be expected to **fully understand**, and to be **able to explain** in clear English *why* the subject material is needed, and *where* things can be applied. Students will **also need to become able to master** certain mathematical techniques which they will be expected to be able to use in downstream courses which either have SS36576A as a direct prerequisite, or else because it is a prerequisite for SS3858B next term, which is also a prerequisite for a large number of courses in Statistics and in Actuarial Sciences.

To illustrate, some topics are needed for the development of statistical theory and actuarial topics such as risk theory and loss functions. The course will make use of the prerequisites of first and second year calculus, basic algebra and linear algebra and the prerequisite statistics courses. The student is expected to review these topics as needed. Basic properties of functions will be used, such as: monotone, one to one mappings, many to one mappings. Invertible and noninvertible mappings. Curve sketching from first year calculus will be used. The change of variables theorem for integrals will be used.

Computer work, mainly using R will be used in the lectures and assignments from time to time to illustrate and implement some of the topics. However, MatLab or other software may be used if needed, but the student should speak to me about this.

It bears repeating that **one main objective** of the course is for the student to **master the tools and methods** for finding distributions of functions of random variables (r.v.'s), understanding joint distributions and related topics, and some basic limit theorems or approximations in probability and statistics. Another is to **gain an appreciation** for *why* these techniques are needed. The last objective is to **know and fully understand certain key results** underlying the core of statistical theory (for instance, the Law of Large Numbers and the Central Limit Theorem). **The tools and techniques used are as important as the results, and the emphasis of the course is on the methodology.** Exams will be graded accordingly, with the majority of marks for methods and a smaller amount for the answer. Early mistakes are more costly than later ones, so be careful with your work!

In order to master these skills, students will have to work hard at understanding the *why* behind material presented in class, and to **become adept** at applying the tools (rather than merely memorizing scores of examples and hoping that one of them applies, without understanding why it works).

To summarize: the successful student should be familiar with not just the conclusion, but also the conditions or hypotheses of the results we obtain, be able to present the necessary derivations or proofs, as well as be able to use the result where it applies.

4. Textbook Information

Text Book J. A. Rice, *Mathematical Statistics and Data Analysis*, 3rd edition. This text is a mandatory resource, for many practice & assignment questions. **Only legitimately-obtained copies of the text (hard copy or electronic) will be tolerated when seeking help.**

Resources to help you develop proficiency:

- 1) Take a stab at a question on your own, or in a small group where there is genuine sharing, discussion, either to success or to some point where you get stuck. NEXT:
- 2) My own office hours! USE THEM! No matter how “dumb” you think your question is, I won’t. Nor will I think that you are “dumb”. In fact, What I will remember is that you took the steps needed to gain understanding, one step at a time.
- 3) Special hours each week when the TA can meet with you, Same ideas as above.
- 4) General Stats Help Centre Office Hours.
- 5) Engage actively in the iClicker questions in class! So long as your answer is coherent, you will still get marks even if your answer was wrong. Low risk!

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.

Class website(s): All key information will be posted on the OWL site

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

5. Methods of Evaluation

The overall course grade will be calculated as listed below:

| | | |
|----------------------|-----|---|
| Assignments (5 or 4) | 7% | [These will be scheduled every two weeks, with some gaps. Equal worth. |
| Clicker responses | 5% | [See iClicker https://elearningtoolkit.uwo.ca/terms/iclicker_cloud.html |
| Direct engagement* | 3% | [Measured in terms of comments in class or a visit during office hours] |
| Midterm Tests (2) | 35% | [Tentatively set for two Wednesdays: October 9 th and November 13 th] |
| Final Exam | 50% | |

Classroom engagement is strongly encouraged, with 8% of the final grade being allocated to two mechanisms to facilitate this. Five percent will come from clicker responses taken in class and during the tutorial, and three percent from direct participation in class time or in office hours.

Clicker Scoring: A student will receive five marks for clicker use **within the classroom** if they respond coherently to 90% of the posed questions or more. So long as it is a coherent response, it does not matter if the answer was right or wrong. **The 90% threshold is established to cover all instances of clicker / phone / tablet / laptop malfunction or absence due to illness. No further adjustment will be made for such undesirable events.** Anyone having less than an 85% response rate will receive less than five marks, in direct proportion to the amount of answers that were provided. For

instance, someone answering 72% of questions coherently will receive $5 * (72/90) = 4$ marks.

Direct Participation Scoring: Three percent of your grade will come from direct participation to questions asked in class. A count will be made of all contributions that I deem useful by all students. The student answering the most will get three marks. All other students will receive an amount in proportion to the logarithm of the counts. Everyone is given a starting count of one, so that the logarithm can be calculated for everyone. To illustrate, if the most active student makes 25 useful contributions over the course of the term, then someone providing five useful contributions would earn $3.0 * \ln(5) / \ln(25) = 3/2$.

When exact dates cannot be supplied, a tentative schedule must be issued, with an exact schedule to follow as soon as possible. This regulation does not preclude the administration of surprise assignments and quizzes, as long as the total number, approximate frequency, and value of such assignments are specified in the course outline.

6. Accommodation and Accessibility

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. Approval can be granted either through a self-reporting of absence or via the Dean's Office/Academic Counselling unit of your Home Faculty. If you are a Science student, the Academic Counselling Office of the Faculty of Science is located in NCB 280, and can be contacted at scibmsac@uwo.ca.

Note that if documentation (medical or otherwise) is required, it can only be collected by the student's Dean's Office/Academic Counselling unit.

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.

How will absences from tests be dealt with? There will be no make-up exam for one missed midterm test. Such students will see the missing weight distributed in proportion to the other test and the final exam, so long as the Dean's Office approves the student's absence from the test. A student missing **both** tests will be required to sit for a special exam covering the material of both midterms. This will be set at a mutually agreeable time for student and instructor between the 2nd midterm and the final exam period.

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).

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.

Students may use non-programmable calculators on their tests; similar to those used by the Society of Actuaries for *their own* tests.

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.

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.

Security of clicker responses: The only place where a student's ID number and their login name@uwo.ca will be available is on the OWL site. This information will not be disclosed. Clickers will be used against the name@uwo.ca but not divulged. The repositories where clicker marks are stored is not available to anyone but the student themselves, and the instructor. Choose your iClicker password wisely if your close friends know your login.

8. Support Services

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 661-2147 if you have any questions regarding accommodations.

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

[optional] 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>.