STAT*3110: Introductory Mathematical Statistics II

Winter 2024

For information on current safety protocols, follow these links:`https://news.uoguelph.ca/return-to-campuses/how-u-of-g-is-preparing-for-your-safe-return/`, `https://news.uoguelph.ca/return-to-campuses/spaces/#ClassroomSpaces`
Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.

1 General information

Course description: Estimation, unbiasedness, Cramer-Rao inequality, consistency, sufficiency, method of moments, maximum likelihood estimation; hypothesis testing, Neyman-Pearson lemma, likelihood ratio test, uniformly most powerful test; linear regression and correlation; non-parametric methods.

Prerequisites: STAT*3100 Introductory Mathematical Statistics I.
Lecture Time and Location: MWF 10:30-11:20am at ROCH 105
Method of Delivery: Face-toFace (in-person)
Final Exam: Face-to-Face (in person) TBA

Instructor: Prof. Zeny Feng (zfeng@uoguelph.ca)
Office hour: MW 2:30-3:30pm, F 11:30am -12:30pm, MACN 540
Teaching Assistant: TBA

2 Course Content

Specific Learning Outcomes: After the completion of the course, students should be able to

- find the distribution function of a general rth order statistic, minimum statistics and maximum statistics,

- find a point estimate based on method of moments, maximum likelihood estimation and Bayesian estimation,

- evaluate the performance of a given point estimate based using the 4 criteria: unbiasedness, efficiency, consistency and sufficiency,

- find the Cramér Rao's lower bound of the variance for unbiased estimators,

- determine whether a point estimate is an uniformly minimum variance unbiased estimate (UMVUE),

- find confidence intervals for scale and location parameters,

- understand basic idea and concepts in hypothesis test, formulate a hypothesis test,

- understand the fundamental theory of Neyman-Pearson Lemma and its applications and extensions,

- understand the idea of likelihood ratio test,

- sketch the power function of a test and from there, compute the type I error and the power,

- construct a hypothesis test involving means, variance, and proportions,

- perform the χ^2 test, goodness-of-fit test, know the connection between these two tests and their applications.

Lecture Content:

- Review of expectation, probability distributions, and change of variables

- Order statistics

- Point estimation evaluations: unbiasedness, efficiency, consistency, sufficiency

- Method of finding point estimators

- Interval estimation

- Hypothesis testing: some theories

- Practical solution for test of hypotheses involving means, variances, and proportions

- Nonparametric tests

Assignments and Tests: This is a tentative schedule. The assignment due dates and test dates are subject to change.

- Assignments 35%, due: January 26, February 9, March 1, March 22, and April 5 (all on Friday)

- Midterm 25%, Friday, March 8, in class

- Final exam 40%, TBA

Expected Workload: For each course of 50 minute per lecture and 3 lectures per week, students are expected to spend 3-6 hours out-of-class study time per week to go through and understand the lecture notes, complete assignments, and solve problems on their own. However, when encountering difficulties, I encourage students to seek help as earlier as possible without waiting to the last minute! Come to my office hours, TA's office hours, and statistical learning centre for help.

3 Course Resources

Text: There is no required textbook for this course, as the course notes will serve as the primary resource for students. However, students are encouraged to access the following online textbooks or hard copies (and corresponding chapters), available through the University of Guelph Library, as additional resources:

- John E Freund's *Mathematical Statistics with Applications*, 7th ed., by Miller & Miller, Pearson Education Canada.

- Hogg, McKean, and Craig's *Introduction to Mathematical Statistics*, 7th edition by Pearson Education, Inc.

Lecture Note: An (in)complete set of lecture notes is available from bookstore in advance of lectures. It is expected that students will bring in a copy that can be completed during lectures. Completely filled lecture notes will not be posted online. The Lecture Notes are not to be re-distributed in any form.

Computer Software: The primary statistical software package that will be used in this course is R, which is freely available for download at http://www.r-project.org/. Students are strongly encouraged to install R on their personal computers.

CourseLink: Course information and material (such as assignments, data sets, etc.) will be posted on CourseLink. Students are responsible to check the website regularly for updated information and announcements.

Scientific Calculators: Students are encouraged to have available a standard scientific calculator which is allowed for all exams. Graphing and programmable calculators are not allowed.

4 Course Policies

Every student is treated the same way according to the evaluation methods and the grading scheme. We will not modify style of tests and exam from in-person to online as this would not be fair to the other students.
Assignment Policies:

- Assignments are due 11:59pm on the due date. Please submit your assignment through the Gradescope.

- No late assignments will be accepted, and late or missed assignments will receive a grade of 0 automatically.

- Assignment will be marked by TA and returned through Gradescope. Therefore, queries on assignments should be presented to the TA.

- If you are under special or serious circumstance that you cannot submit your assignment, please contact me in email with your name, id number, within 48 hours before the due time (with supportive documents

if applicable), the missed assignment percentage will go to your final exam.

- While you are encouraged to discuss approaches to assignment questions with other students, your submitted assignment must be your own work. Copying any part of another student's work is considered academic misconduct. (Please read the section on academic misconduct at the end of this document and in the undergraduate calendar.)

Midterm and Exam Policies: Midterm test will be held in class and therefore no student should have a conflict with the date or time. If a conflict does exist, it is your responsibility to resolve it immediately (e.g. athletic competition). When you find yourself unable to write the midterm please contact me in email with your name, id number, and supportive documents before the midterm, the missed midterm percentage will be distributed to the final exam, or otherwise, no show on midterm will receive a grade of 0. There will be no makeup midterm test.

5   University Policies

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

Academic Accommodation of Religious Obligations
If you are unable to complete a course requirement due to religious obligations, please let the instructor know within the first two weeks of class. See the academic calendar for more information:
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml

Use of electronic devices and recording of lectures: Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

Academic Misconduct: The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community, faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring.

University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.
The Academic Misconduct Policy is detailed in the Undergraduate Calendar:
`http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml`

Copies of Out-Of-Class Assignments: Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

Accessibility: The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required, however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams **at least 14 days in advance, and no later than November 1**. Similarly, new or changed accommodations for online quizzes, tests, and exams must be approved at least a week ahead of time.

More information: `www.uoguelph.ca/sas`

Mental Health Resources: One out of every five students in Canada experiences some sort of mental health issue at some point in their academic career. If you find yourself facing a mental health crisis, or just need to talk to someone, please consider taking advantage of one of the following resources available to University of Guelph students:

- **Counselling Services:** Visit the Counselling Services website (`https://wellness.uoguelph.ca/counselling`) to get information on resources available to you, both online and in-person. You can also visit them at Health Services (J.T. Powell Building, ext 53244) where they offer individual and group counselling sessions by appointment or walk-in.

- **Student Support Network:** is located in the Wellness & Education Promotion Centre in the J.T. Powell Building and offers confidential, peer-based, drop-in support.

- **Good2Talk:** (1-866-925-5454) is a free, 24/7 student hotline that provides professional counselling and referrals for mental health, addictions and well-being.

- **Here 24/7:** (1-844-437-3247) specializes in assessment, referral and appointment booking and is available 24/7 for crisis support.

You are not alone and you will not be judged for asking help.

Course Evaluation Information: Near the end of the term, you will be given the opportunity to evaluate your instructor and provide comments regarding your experience. The evaluations for this class will be done online, but an opportunity to complete them in-class will also be provided. Your instructor will inform you of when these are to take place.

DISCLAIMER: Please note that the post COVID-19 pandemic may still pose challenges, necessitating of a revision of the format of course offerings, classroom schedules, and academic schedules. Any such changes will be announced via CourseLink and/or class email. This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All university-wide decisions will be posted on the university website and circulated by email.

Drop Date: Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
`http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml`
Graduate Calendar - Registration Changes
`https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml`
Associate Diploma Calendar - Dropping Courses
`https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml`