**UNIVERSITY OF CALGARY**
**FACULTY OF SCIENCE**

**Department of Mathematics & Statistics**
MS 476
403 220-5210
math@ucalgary.ca

# COURSE OUTLINE

1. **Course:** STAT 421, Mathematical Statistics - Fall 2022

    Lecture 01 : MWF 10:00 - 10:50 in TRB 102

| Instructor | Email | Phone | Office | Hours |
|---|---|---|---|---|
| Dr Alexander De Leon | adeleon@ucalgary.ca | 403 220-6782 | MS 588 | MWF, 11am-12nn, 1-2pm |

    To account for any necessary transition to remote learning for the current semester, courses with in-person lectures, labs, or tutorials may be shifted to remote delivery for a certain period of time. In addition, adjustments may be made to the modality and format of assessments and deadlines, as well as to other course components and/or requirements, so that all coursework tasks are in line with the necessary and evolving health precautions for all involved (students and staff).

    **In Person Delivery Details:**

    The lectures will be delivered in-person. The Midterm Exam is an in-person exam, to be written in class on Friday, November 4, 2022.

    **Re-Entry Protocol for Labs and Classrooms:**

    To limit the spread of COVID-19 on campus, the University of Calgary has implemented safety measures to ensure the campus is a safe and welcoming space for students, faculty and staff. The most current safety information for campus can be found here.

    **Course Site:**

    D2L: STAT 421 L01-(Fall 2022)-Mathematical Statistics

    **Note:** Students must use their U of C account for all course correspondence.

    **Equity Diversity & Inclusion:**

    The University of Calgary is committed to creating an equitable, diverse and inclusive campus, and condemns harm and discrimination of any form. We value all persons regardless of their race, gender, ethnicity, age, LGBTQIA2S+ identity and expression, disability, religion, spirituality, and socioeconomic status. The Faculty of Science strives to extend these values in every aspect of our courses, research, and teachings to better promote academic excellence and foster belonging for all.

2. **Requisites:**

    See section 3.5.C in the Faculty of Science section of the online Calendar.

    **Prerequisite(s):**
    Statistics 323.

3. **Grading:**

    The University policy on grading and related matters is described in F.1 and F.2 of the online University Calendar.

    In determining the overall grade in the course the following weights will be used:

| Course Component | Weight | Due Date (duration for exams) | Modality for exams | Location for exams |
|---|---|---|---|---|
| Problem Sets[1] | 45% | Ongoing | | |
| Midterm Exam | 35% | Nov 04 2022 at 10:00 am (50 Minutes) | in-person | TRB 102 |
| Project[2] | 20% | Dec 12 2022 | | |

[1] There will be 9 Problem Sets for the entire term, corresponding to the 9 Course Topics listed in the Course Outline. Problem Set 1 is due on Friday, September 16, 2022, while Problem Set 2 is due on Friday, September 30, 2022. The due dates for the rest of the Problem Sets will be determined as we progress through the Course Topics. Problem sets will be done in groups of 3 or fewer students. Students will prepare their complete solutions to Problems Sets using LaTeX – I will provide a template – or Microsoft Word. Handwritten work is perfectly acceptable, provided a PDF copy is created using, for example, a free-to-download document scanner app (e.g., iScanner). Each group will need to upload their solutions as a single PDF file to the corresponding Dropbox folder on D2L by the due dates (see Course Outline). No paper copies of solutions will be accepted in class.

[2] The same group of students who worked together on the Problem Sets will team up again for the Project. Each group will carry out a Monte Carlo simulation study to explore, for example, the impact of the parent distribution (e.g., symmetry, skewness, discreteness) and sample size on (finite-sample) properties of MLEs (e.g., exact/asymptotic unbiasedness, efficiency, asymptotic normality/non-normality) or of large-sample tests (e.g., asymptotic distribution of test statistic, asymptotic power, asymptotic sizes of Type I and Type II errors). A short list of possible studies that students can work on for their project will be provided. Each group will choose their project from the list, and write an R program to carry out the simulation study. A written report is required, prepared using LaTeX – I will provide a template – or Microsoft Word. Guidelines on writing the report will be provided.

Each piece of work (reports, assignments, quizzes, midterm exam(s) or final examination) submitted by the student will be assigned a grade. The student's grade for each component listed above will be combined with the indicated weights to produce an overall percentage for the course, which will be used to determine the course letter grade.

The conversion between a percentage grade and letter grade is as follows.

| | A+ | A | A- | B+ | B | B- | C+ | C | C- | D+ | D |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Minimum % Required** | 95 % | 88 % | 84 % | 80% | 76% | 72 % | 68 % | 64% | 60% | 55 % | 50 % |

A t the end of the term, a summary score will be computed from raw marks on midterm test, problem sets, and project as basis for assigning letter grades.

The University of Calgary offers a [flexible grade option](), Credit Granted (CG) to support student's breadth of learning and student wellness. Faculty units may have additional requirements or restrictions for the use of the CG grade at the faculty, degree or program level. To see the full list of Faculty of Science courses where CG is not eligible, please visit the following website: [https://science.ucalgary.ca/current-students/undergraduate/program-advising/flexible-grading-option-cg-grade](https://science.ucalgary.ca/current-students/undergraduate/program-advising/flexible-grading-option-cg-grade)

4. **Missed Components Of Term Work:**

The university has suspended the requirement for students to provide evidence for absences. Please do not attend medical clinics for medical notes or Commissioners for Oaths for statutory declarations.

In the event that a student legitimately fails to submit any online assessment on time (e.g. due to illness etc...), please contact the course coordinator, or the course instructor if this course does not have a coordinator to arrange for a re-adjustment of a submission date. Absences not reported within 48 hours will not be accommodated. If an excused absence is approved, one possible arrangement is that the percentage weight of the legitimately missed assignment could also be pro-rated among the components of the course. This option is at the discretion of the coordinator and may not be a viable option based on the design of this course.

5. **Scheduled Out-of-Class Activities:**

There are no scheduled out of class activities for this course.

6. **Course Materials:**

Recommended Textbook(s):

> R. V. Hogg, J. W. McKean, & A. T. Craig,*Introduction to Mathematical Statistics*: Pearson.

Detailed lecture slides will be posted on the Course D2L at least a week before the lecture topic is to be discussed in class. Other supplemental materials, such as my complete solutions to the Problem Sets, practice tests, and solutions to textbook exercises, as well as links to relevant online articles, will be posted on the Course D2L as well.

In order to successfully engage in their learning experiences at the University of Calgary, students taking online, remote and blended courses are required to have reliable access to the following technology:

- A computer with a supported operating system, as well as the latest security, and malware updates;
- A current and updated web browser;
- Webcam/Camera (built-in or external);
- Microphone and speaker (built-in or external), or headset with microphone;
- Current antivirus and/or firewall software enabled;
- Stable internet connection.

For more information please refer to the UofC ELearning online website.

7. **Examination Policy:**

No aids are allowed on tests or examinations.

Students should also read the Calendar, Section G, on Examinations.

8. **Approved Mandatory And Optional Course Supplemental Fees:**

There are no mandatory or optional course supplemental fees for this course.

9. **Writing Across The Curriculum Statement:**

For all components of the course, in any written work, the quality of the student's writing (language, spelling, grammar, presentation etc.) can be a factor in the evaluation of the work. See also Section E.2 of the University Calendar.

Students need to provide neat, mathematically concise, and detailed solutions to the Problem Sets, written in grammatical English.  Merely giving the correct answer without adequate explanation will not suffice.

Guidelines on writing the Project Report will be provided.

10. **Human Studies Statement:**

Students will not participate as subjects or researchers in human studies.

See also Section E.5 of the University Calendar.

11. **Reappraisal Of Grades:**

A student wishing a reappraisal, should first attempt to review the graded work with the Course coordinator/instructor or department offering the course. Students with sufficient academic grounds may request a reappraisal. Non-academic grounds are not relevant for grade reappraisals. Students should be aware that the grade being reappraised may be raised, lowered or remain the same. See Section I.3 of the University Calendar.

a. **Term Work:** The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within **ten business days** of either being notified about the mark, or of the item's return to the class. If the student is not satisfied with the outcome, the student shall submit the Reappraisal of Graded Term work form to the department in which the course is offered within 2 business days of receiving the decision from the instructor. The Department will arrange for a reappraisal of the work within the next ten business days. The reappraisal will only be considered if the student provides a detailed rationale that outlines where and for what reason an error is suspected. See sections I.1 and I.2 of the University Calendar

b. **Final Exam:** The student shall submit the request to Enrolment Services. See Section I.3 of the University Calendar.

12. **Other Important Information For Students:**

a. **Mental Health** The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre, Mental Health Services Website) and the Campus Mental Health Strategy website (Mental Health).

b. **SU Wellness Services:** For more information, see their website or call 403-210-9355.

c. **Sexual Violence:** The Sexual Violence Support Advocate, Carla Bertsch, can provide confidential support and information regarding sexual violence to all members of the university community. Carla can be reached by email (svsa@ucalgary.ca) or phone at 403-220-2208. The complete University of Calgary policy on sexual violence can be viewed here.

d. **Misconduct:** Academic integrity is the foundation of the development and acquisition of knowledge and is based on values of honesty, trust, responsibility, and respect. We expect members of our community to act with integrity. Research integrity, ethics, and principles of conduct are key to academic integrity. Members of our campus community are required to abide by our institutional Code of Conduct and promote academic integrity in upholding the University of Calgary's reputation of excellence. Some examples of academic misconduct include but are not limited to: posting course material to online platforms or file sharing without the course instructor's consent; submitting or presenting work as if it were the student's own work; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; borrowing experimental values from others without the instructor's approval; falsification/fabrication of experimental values in a report. Please read the following to inform yourself more on academic integrity:

> Student Handbook on Academic Integrity
> Student Academic Misconduct Policy and Procedure
> Faculty of Science Academic Misconduct Process
> Research Integrity Policy

Additional information is available on the Student Success Centre Academic Integrity page

e. **Academic Accommodation Policy:**

It is the student's responsibility to request academic accommodations according to the University policies and procedures listed below. The student accommodation policy can be found at: https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Student-Accommodation-Policy.pdf

Students needing an accommodation because of a disability or medical condition should communicate this need to Student Accessibility Services in accordance with the Procedure for Accommodations for Students with Disabilities: https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Accommodation-for-Students-with-Disabilities-Procedure.pdf.

Students needing an accommodation in relation to their coursework or to fulfil requirements for a graduate degree, based on a Protected Ground other than Disability, should communicate this need, by filling out the Request for Academic Accommodation Form and sending it to Mark Bauer by email bauerm@ucalgary.ca preferably 10 business days before the due date of an assessment or scheduled absence.

f. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). Students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information, see Legal Services website.

g. **Student Union Information:** SU contact, Email SU Science Rep: sciencerep1@su.ucalgary.ca, Student Ombudsman

h. **Surveys:** At the University of Calgary, feedback through the Universal Student Ratings of Instruction (USRI) survey and the Faculty of Science Teaching Feedback form provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses. Your responses make a difference - please participate in these surveys.

i. **Copyright of Course Materials:** All course materials (including those posted on the course D2L site, a course website, or used in any teaching activity such as (but not limited to) examinations, quizzes, assignments, laboratory manuals, lecture slides or lecture materials and other course notes) are protected by law. These materials are for the sole use of students registered in this course and must not be redistributed. Sharing these materials with anyone else would be a breach of the terms and conditions governing student access to D2L, as well as a violation of the copyright in these materials, and may be pursued as a case of student academic or non-academic misconduct, in addition to any other remedies available at law.

**Course Outcomes:**

- derive distributions of functions of random variables by applying the change of variable technique, the cumulative distribution function technique, and the moment generating function technique;
- define a random sample and statistics (including estimators and order statistics) and obtain their sampling

distributions

- define the multivariate normal distribution and explain some of its applications;
- use different modes of convergence (i.e., convergence in probability, convergence in distributions) and well-known asymptotic results (e.g., Weak Law of Large Numbers, Central Limit Theorem) to study large-sample properties of estimators (e.g., limiting and asymptotic distributions;
- apply the concepts of sufficiency and completeness to derive minimum variance unbiased estimators;
- define most powerful (MP), uniformly most powerful (UMP), and likelihood ratio tests and obtain them via, e.g., the Neyman-Pearson Theorem;
- obtain and apply chi-square goodness-of-fit tests, analysis of variance, regression analysis, the chi-square test of independence, the sign test and some nonparametric tests;
- define the prior and posterior distributions, a conjugate prior, and predictive distributions;
- apply the statistical software R for carrying out probability and statistical calculations.

Electronically Approved - Sep 01 2022 16:19

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**Department Approval**