Introduction to Mathematical Statistics

STAT205 - 101 2025-26 Winter Term 2

Dr. Irene Vrbik

2026-01-05

THE UNIVERSITY OF BRITISH COLUMBIA

Computer Science, Mathematics, Physics and Statistics
Irving K. Barber Faculty of Science
Okanagan Campus

We respectfully acknowledge the Syilx (Okanagan) Peoples and their peoples, in whose unceded territory UBC Okanagan is situated.

Course Information

Teaching Team

Instructor

Name: Dr. Irene Vrbik (she/her)
E-mail: irene.vrbikubc.ca
Office Hour: Monday 1:30 - 2:30
Office: SCI 104

Teaching Assistant (TA)

Canruo Shen

Class Schedule

Location: UBCO | Arts Building (ART) | Floor: 2 | Room: 214
Dates: Tue Thu (2026-01-06 - 2026-02-12)
Time: 8:00 a.m. - 9:30 a.m.

Course Format

The course is delivered through 3 hours of lectures complemented by supplementary readings, out-of-class practice, and assignments. Lecutre will be posted to our course website: https://irene.vrbik.ok.ubc.ca/quarto/stat205/. Assignments and grades will be submitted and posted to Canvas.

Calendar Description

STAT 205 (3) Introduction to Mathematical Statistics academic calendar

Sampling distribution theory. Likelihood. Parameter estimation. Confidence intervals and hypothesis testing; simple regression, analysis of variance and contingency table analysis. Credit will be granted for only one of STAT 205 or STAT 230. [3-0-0] Prerequisite: STAT 203.

Course Overview

STAT 205: Introduction to Mathematical Statistics is a designed to be taken after *STAT 203: Introduction to Probability*. This course will introduce students to the fundamental concepts and techniques in mathematical statistics. The course builds upon the foundation laid in STAT 203 and extends the understanding of statistical methods to more advanced topics. Emphasis is placed on theoretical principles as well as practical applications of statistical analysis in R.

Learning Outcomes

Upon successful completion of this course, students will be able to:

- Define and understand the role of sampling distributions
- Define likelihood in the context of statistical inference
- Apply various methods for parameter estimation
- Compute and interpret confidence intervals
- Identify and construct appropriate hypothesis tests based on the objective and the way in which the data are collected
- Analyze the relationship between variables using regression analysis.

- Apply Analysis of Variance (ANOVA) techniques to compare means across multiple groups.
- Analyze and interpret data using contingency tables.
- Utilize and interpret results obtained from statistical software (R) in the context of the course topics.
- Summarize results in a reproducible document

Textbook

We are using an open source textbook available on the UBC Library website:

- Sheldon M. Ross (2021). *Introduction to Probability and Statistics for Engineers and Scientists (Sixth Edition)*, UBC Library link

Other useful textbooks include:

- Diez, D. M., Barr, C. D., Çetinkaya-Rundel, M. (2016). *OpenIntro Statistics.* United States: OpenIntro, Incorporated. [Link]
- Devore, J. L., Berk, K. N., Carlton, M. A. (2021). *Modern Mathematical Statistics with Applications* (3rd edition) UBC Library link
- Ramachandran et. al (2021). *Mathematical Statistics With Applications in R (Third Edition)* UBC Library link
- Balka, Jeremy. *Making Statistics Make Sense.* https://www.jbstatistics.com/
- Illowsky, B., Dean, S., Openstax. (2022). Introductory Statistics. Brazil: Open Stax Textbooks.
- Hogg, R. V., McKean, J. W., Craig, A. T. (2019). *Introduction to Mathematical Statistics* (8th edition). United Kingdom: Pearson.
- Lock, R. H., Lock, P. F., Morgan, K. L., Lock, E. F., Lock, D. F. (2021). Statistics: Unlocking the Power of Data. United States: Wiley.

Tentative Schedule

Below is the *tentative* course schedule for lectures:

Week	Topics Covered
1	Introduction to Data
2	Summarizing Data
3	Sampling Distribution Theory
4	Likelihood and Parameter Estimation

Week	Topics Covered
5	Confidence Intervals
6	Hypothesis Testing
	Reading week
7	The Chi-squared distribution
8-9	Linear Regression and Correlation
10-11	Analysis of Variance (ANOVA)
12	Contingency Table Analysis
13	Review and Applications

Please refer to the online Important Dates and Deadlines in the UBC Okanagan Academic Calendar. In case of discrepancies, dates listed in the calendar will be honored.

- Start of classes: Monday, January 5
- Midterm break: February 16 – 20[1]
- Last day of classes: Thursday, April 9
- Exams Start: Monday, April 13
- Exams Finish: Friday, April 24
- Last day to drop without a W standing through Workday: January 16, 2026

There will be no class, student hours, or labs on the following Statutory holidays:

- Monday, February 16 Family Day
- Reading break: February 16 – 20
- Friday, April 3 Good Friday
- Monday, April 6 Easter Monday

If you celebrate any other holidays that are not listed above, please feel free to contact me directly if you feel that they will potentially conflict with the outlined course structure.

Evaluation

Table 1: *Grading scheme*

Grade Item	Weight	Description
iClicker	5	Mixed grading: effort + accuracy
Assignments	20	3-6 assignments

[1]Inclusive of Family Day statutory holiday observed in British Columbia.

Grade Item	Weight	Description
Midterm 1	15	A closed-book written test held in class on ***Thursday, February 12, 2026***
Midterm 2	15	A closed-book written test held in class on ***Tuesday, March 24, 2026***
Exam	45	A cumulative close-book written test (location and time TBA).

! Passing/Grading Criteria

To pass the course, a student must satisfy **both** of the following requirements:

- a **minimum score of 40% on the final exam**, **and**
- a **minimum overall course grade of 50%**, calculated according to the grading scheme weights in Table 1.

A student who does not meet **both** requirements will receive a final course grade of **Fail**, regardless of performance on other course components.

iClicker Grading

iClicker: Clicker grades are based on both participation and correctness. Final clicker grades are calculated by multiplying participation points by the correctness scaling factor.

Table 2: ***Participation Points Breakdown****: This table outlines the number of participation points earned based on the percentage of clicker questions answered during the course.*

Percent of Final grade	Criterion
5	Answered >80% of all questions.
4	Answered 70–80% of all questions.
3	Answered 60–70% of all questions.
2	Answered 50–60% of all questions.
1	Answered 20–50% of all questions.
0	Answered <20% of all questions.

Table 3: ***Correctness Scaling Factor***: *This table describes how participation points are scaled based on the percentage of correct answers submitted.*

% of Participation Points	Criterion
100	>80% correct
80	70-80% correct
70	60-70% correct
60	50-60% correct
50	20-50% correct
0	<25% correct

Assignments

There will be between 3 and 6 assignments in the course. Assignments will be submitted to Canvas (depending on pace).

i Late policy

Late submissions for assignments are accepted only within 48 hours after the posted deadline.

- Assignments submitted within 24 hours of the deadline incur a 10% penalty.
- Assignments submitted more than 24 hours but within 48 hours incur a 20% penalty.
- Assignments submitted more than 48 hours late will receive a grade of zero.

No alternative submission times will be granted.

Midterms

There will be 2 in-person midterm. These are hand-written and closed-book tests held at the same time and location of the lectures.

i Missed Midterms

Students who miss a midterm must provide a **documented excuse**. Valid excuses include:

- a **documented illness**, or
- participation in a **varsity sport event** (with a letter from the coach).

Notification and documentation requirements:

- **Illness:** Notify your instructor **within 48 hours** of the absence and submit documentation **within 7 days**.
- **Varsity sport:** Notify your instructor **at least 7 days before** the scheduled midterm.

Students who **fail to notify the instructor within these time limits or fail to provide documentation** will receive a **grade of 0** on the missed midterm.

Final Examinations

You can find the Senate-approved term and examination dates here. Except in the case of examination clashes and hardships (three or more formal examinations scheduled within a 27-hour period) or unforeseen events, students will be permitted to apply for out-of-time final examinations only if they are representing the University, the province, or the country in a competition or performance; serving in the Canadian military; observing a religious rite; working to support themselves or their family; or caring for a family member. Unforeseen events include (but may not be limited to) the following: ill health or other personal challenges that arise during a term and changes in the requirements of an ongoing job.

Further information on Academic Concession can be found under Policies and Regulation in the Okanagan Academic Calendar.

Grading Practices

Faculties, departments, and schools reserve the right to scale grades in order to maintain equity among sections and conformity to University, faculty, department, or school norms. Students should therefore note that an unofficial grade given by an instructor might be changed by the faculty, department, or school. Grades are not official until they appear on a student's academic record.

Further information on Grading Practices can be found in the Okanagan Academic Calendar.

Academic Integrity

The academic enterprise is founded on honesty, civility, and integrity. As members of this enterprise, all students are expected to know, understand, and follow the codes of conduct regarding academic done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you should not cheat, copy, or mislead others about what is your work. Violations of academic integrity (i.e., misconduct) lead to the breakdown of the academic enterprise, and therefore serious consequences arise and harsh sanctions are imposed. For example, incidences of plagiarism or cheating usually result in a

failing grade or mark of zero on the assignment or in the course. Careful records are kept to monitor and prevent recidivism.

A more detailed description of academic integrity, including the University's policies and procedures, may be found in the Academic Calendar. At the most basic level, this means submitting only original work.

Cooperation vs. Cheating

Working with others on assignments is a good way to learn the material and we encourage it. However, there are limits to the degree of cooperation that we will permit. Any level of cooperation beyond what is permitted is considered cheating.

When working on programming assignments, you must work only with others whose understanding of the material is approximately equal to yours. In this situation, working together to find a good approach for solving a programming problem is cooperation; listening while someone dictates a solution is cheating. You must limit collaboration to a high-level discussion of solution strategies, and stop short of actually writing down a group answer. Anything that you hand in, whether it is a written problem or a computer program, must be written by you, from scratch, in your own words. If you base your solution on any other written solution, you are cheating. If you provide your solution for others to use, you are also cheating.

Use of ChatGPT and other generative AI tools

In this course, the use of generative AI tools such as ChatGPT is permitted for assignments under specific guidelines (see below). However, the final submission must be the result of the individual student's own effort and understanding. Furthermore, these tools will not be available during midterm exams or the final exam. As such, it is essential that you engage deeply with course material and develop the skills necessary to complete tests and exams independently. In short, the use of AI should complement your work, not replace it.

Guidelines for Using AI Tools in Assignments

1. **Disclosure Requirement:** If you use generative AI tools to assist with any part of an assignment you are required to clearly declare your use of the tool by providing a brief description (2-3 sentences) of how it was used.
2. **Accountability for Submitted Work**
   AI tools are known to produce content that may include errors, omissions, or inappropriate material. It is your responsibility to ensure the quality, originality, and ethical compliance of your submissions. Plagiarism policies apply to all work, including AI-assisted content.
3. **Avoiding Over-Reliance**
   While AI tools can be helpful, over-reliance may hinder the development of critical thinking and writing skills. Use these tools to enhance your learning, not replace it.

Other Course Policies

Copyright Disclaimer

Diagrams and figures included in lecture presentations adhere to Copyright Guidelines for UBC Faculty, Staff and Students http://copyright.ubc.ca/requirements/copyright-guidelines/ and UBC Fair Dealing Requirements for Faculty and Staff http://copyright.ubc.ca/requirements/fair-dealing/. Some of these figures and images are subject to copyright and will not be posted to Canvas. All material uploaded to Canvas that contain diagrams and figures are used with permission of the publisher; are in the public domain; are licensed by Creative Commons; meet the permitted terms of use of UBC's library license agreements for electronic items; and/or adhere to the UBC Fair Dealing Requirements for Faculty and Staff. Access to the Canvas course site is limited to students currently registered in this course. Under no circumstance are students permitted to provide any other person with means to access this material. Anyone violating these restrictions may be subject to legal action. Permission to electronically record any course materials must be granted by the instructor. Distribution of this material to a third party is forbidden.

Resources to Support Student Success:

UBC Okanagan Disability Resource Centre

The DRC facilitates disability-related accommodations and programming initiatives to remove barriers for students with disabilities and ongoing medical conditions. If you require academic accommodations to achieve the objectives of a course please contact the DRC at:

UNC 215 250.807.8053
Email: drc.questions@ubc.ca / earllene.roberts@ubc.ca
Web: https://students.ok.ubc.ca/academic-success/disability-resources/

UBC Okanagan Equity and Inclusion Office

Through leadership, vision, and collaborative action, the Equity & Inclusion Office (EIO) develops action strategies in support of efforts to embed equity and inclusion in the daily operations across the campus. The EIO provides education and training from cultivating respectful, inclusive spaces and communities to understanding unconscious/implicit bias and its operation within in campus environments. UBC Policy 3 prohibits discrimination and harassment on the basis of BC's Human Rights Code. If you require assistance related to an issue of equity, educational programs, discrimination or harassment please contact the EIO.

UNC 325H 250.807.9291
Email: equity.ubco@ubc.ca
Web: www.equity.ok.ubc.ca

Student Wellness

At UBC Okanagan health services to students are provided by Student Wellness. Nurses, physicians and counsellors provide health care and counselling related to physical health, emotional/mental health and sexual/reproductive health concerns. As well, health promotion, education and research activities are provided to the campus community. If you require assistance with your health, please contact Student Wellness for more information or to book an appointment.

UNC 337 250.807.9270
Email: healthwellness.okanagan@ubc.ca
Web: https://students.ok.ubc.ca/health-wellness/

Office of the Ombudperson

The Office of the Ombudsperson for Students is an independent, confidential and impartial resource to ensure students are treated fairly. The Ombuds Office helps students navigate campus-related fairness concerns. They work with UBC community members individually and at the systemic level to ensure students are treated fairly and can learn, work and live in a fair, equitable and respectful environment. Ombuds helps students gain clarity on UBC policies and procedures, explore options, identify next steps, recommend resources, plan strategies and receive objective feedback to promote constructive problem solving. If you require assistance, please feel free to reach out for more information or to arrange an appointment.

UNC 328 250.807.9818
Email: ombuds.office.ok@ubc.ca
Web: https://ombudsoffice.ubc.ca/campus-resources/okanagan-campus/

Independent Investigations Office (IIO)

If you or someone you know has experienced sexual assault or some other form of sexual misconduct by a UBC community member and you want the Independent Investigations Office (IIO) at UBC to investigate, please contact the IIO. Investigations are conducted in a trauma informed, confidential and respectful manner in accordance with the principles of procedural fairness.

You can report your experience directly to the IIO by calling 604-827-2060.
Web: https://investigationsoffice.ubc.ca/
E-mail: director.of.investigations@ubc.ca

Student Learning Hub

The Student Learning Hub is your go-to resource for free math, science, writing, and language learning support. The Hub welcomes undergraduate students from all disciplines and year levels to access a range of supports that include **tutoring in math, sciences, languages, and writing, as well as help with study skills and learning strategies**. Students are encouraged to visit often and early to build the skills, strategies and behaviors that are essential to being a confident and independent learner. For more information, please visit the Hub's website.

LIB 237 250.807.8491
Email: learning.hub@ubc.ca
Web: https://students.ok.ubc.ca/academic-success/learning-hub/

The Global Engagement Office

The Global Engagement Office provides advising and resources to assist International students in navigating immigration, health insurance, and settlement matters, as well as opportunities for intercultural learning, and resources for Go Global experiences available to all UBC Okanagan students, and more.

UNC 227
Email: ubco.global@ubc.ca
Web: https://students.ok.ubc.ca/global-engagement-office/

Sexual Violence Prevention and Response Office (SVPRO)

A safe and confidential place for UBC students, staff and faculty who have experienced sexual violence regardless of when or where it took place. Just want to talk? We are here to listen and help you explore your options. We can help you find a safe place to stay, explain your reporting options (UBC or police), accompany you to the hospital, or support you with academic accommodations. You have the right to choose what happens next. We support your decision, whatever you decide. Visit svpro.ok.ubc.ca or call us at 250-807-9640

Safewalk

Don't want to walk alone at night? Not too sure how to get somewhere on campus? Call Safewalk at **250-807-8076**. For more information see: https://security.ok.ubc.ca/