STAD91H3 S

Topics in Statistics

Winter 2026 Syllabus

Course Meetings

STAD91H3 S

Section	Day & Time	Delivery Mode & Location
LEC01	Thursday, 3:00 PM - 6:00 PM	In Person: IA 1160

Refer to ACORN for the most up-to-date information about the location of the course meetings.

Tutorials will start on the second week. See the Quercus site for the course for full details.

Course Contacts

Instructor: Thibault Randrianarisoa
Email: t.randrianarisoa@utoronto.ca
Office Hours and Location: Thursday 10am–1pm @ IA 4064
Additional Notes: Questions about course content can be asked in lectures and tutorials, or directed to the course discussion board. We will be using Piazza as our primary discussion board for the course https://piazza.com/utoronto.ca/winter2026/stad91h3 (access code is n0px27jcbmb if required). Instructors and TAs will check in on a regular basis and selectively participate in discussions. Please do not email questions about course content to instructors or TAs. Questions regarding personal matters should be directly addressed to the instructor by email. Be- fore sending an email, make sure that you are not asking for information that is already available in the course syllabus/website/announcements. All student emails to instructors/TAs should include: a) the course code and term in the subject (e.g., [STAD91H3]), and b) your student number in the body or signature. If either is missing, your email will not be considered. Allow at least 48hr for a response before following up.

Course Overview

Topics of interest in Statistics, as selected by the instructor. The exact topics can vary from year to year. Enrolment is by permission of the instructor only.

This course introduces the core concepts of Bayesian statistics, the theoretical properties of Bayesian estimators and their use in decision-making under uncertainty. You will learn key Bayesian modelling approaches and advanced computational techniques tailored to the needs and structure of different models.

We begin with parametric models to introduce the core ideas of Bayesian analysis, covering prior specification, inference (point estimation, credible sets, and hypothesis testing), its decision-theoretic foundations, and key asymptotic results such as posterior consistency and

the Bernstein–von Mises theorem. We will also study modern computational methods for Bayesian inference and introduce more advanced topics, including high-dimensional and nonparametric models. For these models, we will focus primarily on prior construction and on results about convergence rates and adaptation.

Course Learning Outcomes

KNOWLEDGE AND UNDERSTANDING

At the end of the course, students will be able to...

- Understand the fundamental principles of the Bayesian statistical approach, including prior specification, likelihood-based updating, and posterior inference, and its difference with the frequentist inference procedure.
- Explain the decision-theoretic foundations of the Bayesian approach.
- Explain how the posterior distribution can be used for statistical inference.
- Describe key asymptotic results in Bayesian analysis, such as posterior consistency and the Bernstein–von Mises theorem.
- Gain familiarity with modern computational methods for Bayesian inference (e.g., MCMC, variational methods) and their theoretical motivations.

APPLYING KNOWLEDGE AND UNDERSTANDING

At the end of the course, students will be able to...

- compute the posterior distribution, construct Bayesian point estimators and credible regions.
- Implement modern computational algorithms to approximate posterior distributions and critically assess their performance.
- Formulate Bayesian models for real decision-making problems, making an appropriate choice of a priori laws.

Prerequisites: Permission from the instructor is required. This will typically require the completion of specific courses which can vary from year to year.
Corequisites: None
Exclusions: None
Recommended Preparation: None
Credit Value: None

We will assume that you possess basic knowledge of probability, statistics, elementary calculus, and linear algebra.

Course Materials

Textbook:

The course will be based on some of the content of the book Bayesian Data Analysis by Gelman, Carlin, Stern, Dunson, Vehtari & Rubin. It is freely available online on home page for the book https://sites.stat.columbia.edu/gelman/book/, which also contains additional material (lecture notes, code demo,...).

Piazza:

The course will make use of Piazza as a discussion board. This should be the first place you go to for any questions as the instructor and the TAs will be active. The link is https://piazza.com/utoronto.ca/winter2026/stad91h3 and access code is n0px27jcbmb.

Kahoot:

Part of the course assessment will consist of weekly in-class quizzes conducted through Kahoot. Access and usage guidelines will be explained in the first class, and students will need a phone or laptop to submit their answers.

Calculators:

The course will involve simple calculations. Any calculators used during tests must be nonprogrammable. The calculator application on your smartphones is not acceptable for the assessments.

Marking Scheme

Assessment	Percent	Details	Due Date
Term Test	25%	Term Test 1 covers material from weeks 1–5.	2026-02-23 - 2026-02-27
Weekly Quizzes	20%	Each week, at the end of the two-hour lecture, a quiz will be administered through Kahoot. There will be no quiz in weeks 1 and 10, for a total of 10 weekly quizzes. Each quiz will cover material from the previous one to two weeks. The best 8 of the 10	No Specific Date

Assessment	Percent	Details	Due Date
		quiz results will count toward the final grade.	
Homework Assignments	10%	There will be two assignments (weighted equally). The assignments will be released on Quercus. Submission instructions will be provided with each assignment. In the assignments, you need to write your own programs, debug them, and use them to conduct various experiments, plot curves, etc. You may use any programming language, but Python is preferable. We will provide you a starter code in Python only.	2026-02-15, 2026-03-08
Final Exam	45%	The final exam covers all course material presented during the term.	Final Exam Period

Late Assessment Submissions Policy

- There will be no extensions or make-ups for any assessment (quizzes, term tests or final).
- If you are facing extenuating circumstances that make it impossible for you to write your final exam, such as death of a close family member, submit a petition on eService to request permission to defer writing your exam(s).
- If you are feeling unwell and do not feel well enough to write your exam: You should request to defer your exam. In this case, do not attend your in-person exam sitting and do not begin or open a virtual exam. Review the verification of illness or injury (VOI) eligibility and submit a petition to request permission to defer writing your exam(s).

Course Schedule

Week	Description
Week 1 5–11 January	Introduction and reminders of Statistics and Probability
Week 2	Choice of priors, aspects of the posterior

12–18 January	
Week 3 19–25 January	Decision theory
Week 4 26 January – 1 February	Bayesian tests, Model selection
Week 5 2–8 February	Sampling Algorithms
Week 6 9–15 February	Variational Bayes
Reading Week	
Midterm 16–22 February	
Week 7 23 February – 1 March	Asymptotic properties in parametric Bayesian models
Week 8 2–8 March	Priors for high-dimensional models
Week 9 9–15 March	Dirichlet process
Week 10 16–22 March	Gaussian processes
Week 11 23–29 March	Asymptotics in Bayesian nonparametrics

Policies & Statements

Academic Integrity

The University treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters (http://www.governingcouncil.utoronto.ca/policies/behaveac.htm) outlines the behaviours that

constitute academic dishonesty and the processes for addressing academic offences.

Potential offences in papers and assignments include using someone else's ideas or words without appropriate acknowledgement, submitting your own work in more than one course without the permission of the instructor, making up sources or facts, obtaining or providing unauthorized assistance on any assignment.

On tests and exams, cheating includes using or possessing unauthorized aids, looking at someone else's answers during an exam or test, misrepresenting your identity, or falsifying or altering any documentation required by the University.

University Land Acknowledgement

I wish to acknowledge this land on which the University of Toronto operates. For thousands of years, it has been the traditional land of the Huron-Wendat, the Seneca, and the Mississaugas of the Credit. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.

Use of Generative Artificial Intelligence Tools

Students may use artificial intelligence tools, including generative AI, in this course as learning aids or to help produce assignments. However, students are ultimately accountable for the work they submit.

Students may not use artificial intelligence tools for taking tests, writing research papers, creating computer code, or completing major course assignments. However, these tools may be useful when gathering information from across sources and assimilating it for understanding.

The knowing use of generative artificial intelligence tools, including ChatGPT and other AI writing and coding assistants, for the completion of, or to support the completion of, an examination, term test, assignment, or any other form of academic assessment, may be considered an academic offense in this course.

Accommodations

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the AccessAbility Services Office as soon as possible.

AccessAbility Services staff (located in Rm IA5105, Sam Ibrahim Building) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations 416-287-7560 or email ability.utsc@utoronto.ca. The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course.

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