

Land Acknowledgement

The land on which the University of Toronto operates has for thousands of years been the traditional land of the Huron-Wendat, the Seneca, and most recently, 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 live, work, learn, and grow on this land.

Statistical Computation / Computational Techniques in Statistics

- STA410H1S LEC5101+LEC2501 / STA2102H LEC5101

Winter 2024 / Prof. Scott Schwartz sta410@utoronto.ca

- [Quercus](#)
- [piazza \(sign-up\)](#)
- sta410@utoronto.ca
- [Course GitHub Repo](#)
- Code on <http://jupyter.utoronto.ca> / <http://colab.research.google.com>
- Submit code [MarkUs](#)

Teaching Assistant Ziang Zhang

Summary

- Theoretical / Conceptual lectures and exams
- Python coding Homework assignments and Coding Challenges

Calendar

Jan 10	Sampling: Inverse CDF, Rejection, and Importance Sampling
Jan 17	Estimation: Monte Carlo (MC) integration, estimation error, improving efficiency, antithetic sampling and control variates (correlation)
Jan 24	Markov Chain Monte Carlo (MCMC): High dimensional integration, Gibbs Sampling, Slice Sampling, Metropolis-Hastings, PyMC, Hamiltonian Monte Carlo (HMC)
Jan 31	Numerical precision and error and condition and linear algebra (floating point behaviour and SVD)

Feb 07	Linear Algebra: SVD/PCA/ICA/PRC, Condition, Regression VIFs, and Matrix Decompositions for Least Squares
Feb 14	Coding Challenge
Feb 21	Reading Week
Feb 28	Midterm
Mar 06	Iterative Methods: Gauss-Seidel (GS), Successive Overrelaxation, Coordinate Descent (Nonlinear GS), Line Search, Gradient Descent, etc.
Mar 13	Optimization, Hessians and Jacobians, Maximum Likelihood Estimation (Score function, etc.), Variational Inference, and Newton's Method
Mar 20	Newton's Method Sandwich Estimators and IRLS (iteratively reweighted least squares) (including M and Quasi-Likelihood estimation)
Mar 27	TBA
Apr 03	Coding Challenge

Course Resources

The course is largely self-contained, with material for the course primarily provided through github as jupyter notebooks; however, some students may also be interested in the textbooks upon which these notebooks are based

- [Computational Statistics](#) by James E. Gentle (Springer)
- [Computational Statistics \(Second Edition\)](#) by G. H. Givens and J. A. Hoeting (Wiley)

Weekly Schedule

Offset	Event	Day	Time	Location	Recorded?	Piazza Monitored?
0	Lecture	Wednesday	7:10-10 (19:10-22) PM ET	MS 3154	Yes	No
+1	Prof Hybrid OH	Friday	6:30-8:00 PM ET	Scott zoom + Loc TBD	Yes	No
+2-4		Fri-Sat-Sun				Yes

Offset	Event	Day	Time	Location	Recorded?	Piazza Monitored?
+5	TA Hybrid OH	Monday	5:30-7 PM ET	Ziang zoom + Loc TBD	No	Yes
+7	Homework Due	Wednesday	11 AM ET		NA	No

- OH all weeks except Reading Week
- TA OH subject to change

Grades

Homework	Coding Challenges	Midterm	Final	
Most Weeks	Feb 14 and Apr 03	Feb 28	TBA	
2 × 8	2 × 12	24	36	
16	24	24	36	100 points total

Details

Homework and in-person Coding Exams will use UofT JupyterHub and MarkUs

Missed work

- Homework may be submitted after the deadline for half credit until marks have been released
- Missed Midterms will reweight to the final by emailing sta410@utoronto.ca your ACORN Absence Declaration
- One Coding Challenge can be missed and reweighted to the final by emailing sta410@utoronto.ca your ACORN Absence Declaration
- [Petition for deferrals of the final exam must be made through FAS](#)

Absence Declaration Policy

The course policies regarding absense conform to the new [absence declaration policy](#). If special consideration appears necessary for a particular assignment beyond the policies indicated above, a review of the situation can be initiated once per term using the [Acorn Absence Declaration Tool](#) (and providing the necessary documentation to sta410@utoronto.ca).

Remarking

Remark requests must be made within one week of the release of the return of marks or solutions for the associated assignment

Late Enrollments

Students who miss the Jan 10 and/or Jan 17 lectures due to late enrolment may submit missed Homework assignments by Wednesday Jan 24

- Solutions for the Jan 10 Homework will have a delayed return on or after Jan 24

Religious Accommodations

If you anticipate missing a course activity due to a religious observance, please let us know at least three weeks ahead of your observance, and we will provide alternate assignment arrangements

Accessibility and Additional Accommodations

For course accommodations please contact [Accessibility Services](#) or your [College Registrar](#) and alert sta410@utoronto.ca

If the policies above do not appear sufficient for your circumstances contact your [college registrar](#) (<https://www.artsci.utoronto.ca/current/academic-advising-and-support/college-registrars-offices>)

Collaboration and Academic Integrity

Working with peers within the constraints of the academic integrity policies is highly encouraged

- for example participation in RSGs is strongly recommended: <https://sidneysmithcommons.artsci.utoronto.ca/recognized-study-groups/>

All students, faculty and staff are expected to follow the University's guidelines and policies on academic integrity: <https://www.artsci.utoronto.ca/current/academic-advising-and-support/student-academic-integrity> (and see also, e.g., <http://academicintegrity.utoronto.ca> and <https://www.academicintegrity.utoronto.ca/smart-strategies/>)

- violations will be processed through department and institutional SAI protocols and procedures

AI Support

Generative artificial intelligence large language models such as Bard or ChatGPT are allowed for this class

- however, I don't currently suspect they will be particularly helpful for this course; so... it would be very helpful for me and would be greatly appreciated if
- when you submit work that relies on this kind of tool, you would please be so kind as to briefly describe how you used this resource ...this would help me determine if we might be able to leverage and provide practice using these kinds of tools in future iterations of the

TA Assignment

		Total	Notes
Online OH	8 × 2 hrs	16	
HW Marking	8 × 4 hrs	32	
Coding Demos	8 × 2 hrs	16	
Midterm	0 hrs		Midterm is Feb 28
Final	0 hrs		Final date TBA
Coding Challenges	2 × 5 hrs	10	Coding Challenges are Feb 14 and Apr 03
Invigilation	6 hrs	12	CC Feb 14 + Apr 03 + MT Feb 28 + Final Exam
Other	4 hrs	4	
		90	