

# Course Outline Form: Fall 2021

## Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings and academic schedules. Any such changes will be announced via Courselink and/or class email. This includes on-campus scheduling during the semester, midterms and final examination schedules. All University-wide decisions will be posted on the [COVID-19 website](#) and circulated by email.

For information on current safety protocols, follow these links:

<https://news.uoguelph.ca/return-to-campus/how-u-of-g-is-preparing-for-your-safe-return/>

<https://news.uoguelph.ca/return-to-campus/spaces/#ClassroomSpaces>

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.

## General Information

**Course Title:** STAT\*4000: Statistical Computing

**Course Description:** The topics in this course will include pseudorandom number generation, numerical optimization as used in statistics, simulation study design, Monte Carlo integration and variance reduction, and bootstrapping. Other topics may include permutation tests, visualization of multivariate data, and big data.

**Prerequisites:** MATH\*2130, STAT\*2050, STAT\*3110

**Credit Weight:** 0.5 credit

**Academic Department (or campus):** Mathematics & Statistics

**Campus:** Guelph

**Semester Offering:** Fall

**Class Schedule and Location:** T/Th 8:30 – 9:50am via Zoom

## Instructor Information

**Instructor Name:** Dr. Lorna Deeth

**Instructor Email:** [ldeth@uoguelph.ca](mailto:ldeth@uoguelph.ca)

**Office location and office hours:** Tuesday and Thursday, 10:00 – 11:00am via Zoom

## Course Content

### **Specific Learning Outcomes:**

By the end of this course, students should be able to:

1. Literacy: Read and extract information from simple articles in the statistical literature.
2. Ethical: Demonstrate professional and ethical behaviour in statistical practice. Practice academic integrity.
3. Communication: Describe various techniques and methods in statistical computing, and effectively communicate the results of statistical computing.

4. Critical and Creative: Select and implement appropriate methods for generating pseudo-random numbers.
5. Critical and Creative: Design and implement simulation studies to test and compare simple statistical methods.
6. Critical and Creative: Gain familiarity in data manipulation.
7. Critical and Creative: Show proficiency in statistical programming including writing, debugging, testing, and commenting code.

**Lecture Content:**

Week 0: September 9 – 10	<ul style="list-style-type: none"> <li>• Introduction to the Instructor, course outline and expectations, R/RStudio, and professional practice.</li> </ul>
Week 1: September 13 – 17	<ul style="list-style-type: none"> <li>• Background: Academic Integrity, basic programming in R (if, loops, functions).</li> <li>• Chapter 4: Data Visualization</li> </ul>
Week 2: September 20 – 24	<ul style="list-style-type: none"> <li>• Simulations in Statistics</li> <li>• Chapter 3: Generating uniforms</li> <li>• RNG: Inverse CDF Transform method</li> </ul>
Week 3: September 27 – October 1	<ul style="list-style-type: none"> <li>• Chapter 3: RNG: Rejection method, Mixtures</li> </ul>
Week 4: October 4 – 8	<ul style="list-style-type: none"> <li>• Chapter 5: Monte Carlo Integration, Variance reduction</li> <li>• Chapter 6: Simulation, estimation – bias and variability</li> </ul>
Week 5: October 11 – 15* <b>NOTE:</b> No class on Tuesday, October 12 due to Reading Day. Class rescheduled to Thursday, December 2	<ul style="list-style-type: none"> <li>• Chapter 6: Simulation, tests – size</li> </ul>
Week 6: October 18 – 22	<ul style="list-style-type: none"> <li>• Chapter 6: Simulation, tests – size, power</li> <li>• Contaminated distributions</li> </ul>
Week 7: October 25 – 29	<ul style="list-style-type: none"> <li>• Chapter 6: Simulation, CIs</li> </ul>
Week 8: November 1 – 5	<ul style="list-style-type: none"> <li>• Chapter 7: Bootstrap and Jackknife</li> </ul>
Week 9: November 8 – 12	<ul style="list-style-type: none"> <li>• Chapter 11: Numerical Methods in Stats</li> </ul>
Week 10: November 15 – 19	<ul style="list-style-type: none"> <li>• Big Data: Data Wrangling</li> </ul>
Week 11: November 22 – 26	<ul style="list-style-type: none"> <li>• Big Data: Other topics</li> </ul>
Week 12: November 29 – December 3	<ul style="list-style-type: none"> <li>• Project Presentations</li> </ul>

The schedule above is approximate, and subject to minor changes. Additional topics may be added if time permits.

**IMPORTANT:** As the class is scheduled to be a synchronous lecture, the expectation is that students will be attending the live lectures to obtain notes, listen to course announcements, and ask relevant questions. With only a few exceptions, the lectures will not be recorded.

## Course Assignments and Tests:

Course Component	Date	Time	Location	Weight
In-Class Assignments	Every Thursday lecture	Due by 10am	Online	1% each (Best 10 of 11) <b>Total: 10%</b>
Challenge 1	Friday, September 24	Due by 11:59pm	Online	5% each <b>Total: 15%</b>
Challenge 2	Friday, October 15	Due by 11:59pm	Online	
Challenge 3	Friday, November 5	Due by 11:59pm	Online	
Assignment 1	Friday, October 8	Due by 11:59pm	Online	15% each <b>Total: 45%</b>
Assignment 2	Friday, October 29	Due by 11:59pm	Online	
Assignment 3	Friday, November 19	Due by 11:59pm	Online	
Course Project*	Friday, October 22 (proposal)	Due by 11:59pm	Online	2%
	Tuesday, November 30 & Thursday, December 2 (presentations)	8:30am – 9:50am	Online	8%
	Friday, December 10 (paper)	Due by 11:59pm	Online	20%
				<b>Total: 30%</b>

\*See information on Courselink for Course Project details, including exact deadlines and breakdown of grading components.

## Course Resources

### Recommended Text:

Maria Rizzo, *Statistical Computing with R*. Chapman and Hall / CRC (2008).

- First or 2<sup>nd</sup> edition is fine. I have the first edition, but the second edition is available on ARES, Electronic Reserve in the library. I believe the University Bookstore has a few hard copies available if you wish to purchase through them.

### Other Resources:

Also available on ARES, Electronic Reserve:

- Zuur, A.F.; Ieno, E.N.; & Meesters, E.H.W.G., *A Beginner's Guide to R*. Springer (2009)
- Murrell, P. *R Graphics*. Chapman and Hall / CRC (2019)
- Wickham, H. *ggplot2: Elegant Graphics for Data Analysis*. Springer (2016)

Freely available on the internet:

- Wickham, H. & Grolemund, G. *R for Data Science*. O'Reilly (2017). <https://r4ds.had.co.nz/>

**Lecture notes:** A set of incomplete lecture notes will be posted on Courselink each week before lecture. Students are encouraged to have a copy of these in advance of the scheduled lecture time.

**THE LECTURE NOTES ARE FOR INDEPENDENT USE ONLY AND ARE NOT TO BE RE-DISTRIBUTED IN ANY FORM WITHOUT MY WRITTEN PERMISSION.**

**R/RStudio:** This course will exclusively use R/RStudio. If you do not have this software on your personal computer, you can download it for free from:

R: <http://cran.r-project.org>

RStudio: <https://www.rstudio.com>

Make sure you have up-to-date versions of both software!

**Courselink:** Course information and resources will be available on Courselink. Students are encouraged to check the website regularly for updated information and announcements.

## **Course Policies**

**Communication Policies:** Questions regarding course content, general administrative questions, or anything of a non-personal / private nature should be posted on the Courselink Discussion Boards. This allows all students with similar questions to benefit from the posted answer(s), either from myself or a fellow classmate. Any inquiries sent via email that are general (i.e. not private / personal) will be posted (anonymously) on the Courselink Discussion Board for response.

Private inquiries or issues, or a request for a virtual meeting, can be sent via email. Emails must be sent from your University of Guelph email account, and include STAT\*4000 in your subject line, and include your name and student ID number in all correspondence. Emails that do not include a name and ID number, or from non-uoguelph accounts, will not be answered; otherwise, I will try to respond to emails within 3 business days.

### **Grading Policies:**

**Assignments and Challenges:** Details regarding each of the Assignments/Challenges will be posted on Courselink. These must be handed in by the posted due date/time. Late assignments will be accepted at a penalty of 5% per day late, up to a maximum of three days after the posted deadline. Assignments submitted beyond the three-day grace period will receive a grade of 0. **NO EXCEPTIONS.**

Work is required to be submitted to both Crowdmark (for grading) and Courselink (for Turnitin). Failure to submit to both locations will result in a 5% penalty per day that the assignment is late to one of the two locations, up to a maximum of three days after the posted deadline. Assignments not submitted to both locations after this grace period will receive a grade of 0. **NO EXCEPTIONS.**

**Turnitin:** In this course, we will be using Turnitin, integrated with the CourseLink Dropbox tool, to detect possible plagiarism, unauthorized collaboration or copying as part of the ongoing efforts to maintain academic integrity at the University of Guelph.

All submitted coursework will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. Use of the Turnitin.com service is subject to the Usage Policy posted on the Turnitin.com site.

Work that is flagged on Turnitin will be subject to further examination, however this does not automatically mean that academic misconduct has occurred. If a more detailed examination does in fact suggest academic misconduct may have occurred, an official investigation will be launched through the CEPS Dean's Office.

**Course Project:** Detailed information about the course projects will be posted on Courselink by Week 4.

### **Regrade and Accommodation Request Policies:**

In the event you wish to have coursework regraded, you must submit a **Regrade Request Form** (available on Courselink) within two weeks of the graded work being returned. After two weeks, the grade in question is considered final, and regrade requests can no longer be submitted. Note that in the event you submit a question for regrading, I reserve the right to regrade the entire assessment.

Requests for accommodation should be made before the assessment is due. If this is not possible, the request should be made within 3 business days of the due. Accommodation will be provided at my discretion and should not be assumed. If an accommodation is not granted, you will be expected to complete the assessment.

If you cannot meet a deadline for mental health or are seeking accommodation on compassionate grounds, you must speak with your Program Counsellor (and include them in all communication with me) before any accommodations will be considered.

### **Course Policy on Group Work:**

Students are encouraged to work together to discuss course content, share ideas, and ask/answer questions. However, all assessments are to be completed independently unless explicitly stated otherwise. You may be asked to declare any submitted work to be your own independent work.

Any unauthorized collaboration, completing another student's work, or having another student complete your work, will constitute academic misconduct and will be charged as such.

### **Recording of Lecture Materials:**

By enrolling in a course, unless explicitly stated and brought forward to their instructor, it is assumed that students agree to the possibility of being recorded during lecture, seminar or other "live" course activities, whether delivery is in-class or online/remote.

If a student prefers not to be distinguishable during a recording, they may:

- turn off their camera
- mute their microphone
- edit their name (e.g., initials only) upon entry to each session
- use the chat function to pose questions.

Students who express to their instructor that they, or a reference to their name or person, do not wish to be recorded may discuss possible alternatives or accommodations with their instructor.

## **University Policies**

### **Email Communication:**

As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

## **When You Cannot Meet a Course Requirement:**

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

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>

## **Accommodation due to Illness:**

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g. final exam or major assignment).

## **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

<https://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>

## **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 7 days in advance and not later than the 40th Class Day.

For Guelph students, information can be found on the SAS website <https://www.uoguelph.ca/sas>

For Ridgetown students, information can be found on the Ridgetown SAS website <https://www.ridgetownc.com/services/accessibilityservices.cfm>

### **Academic Integrity:**

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 encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: 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.

Undergraduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08- amiconduct.shtml>

Graduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

### **Recording of Materials:**

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. Recorded material that is posted on Courselink or elsewhere cannot be redistributed without the permission of the Instructor.

### **Resources:**

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars

<https://www.uoguelph.ca/academics/calendars>

## **Mental Health Services:**

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](tel: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](tel: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 for help.