

# Course Outline Form: Fall 2023

## 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:** [REDACTED]

## Instructor Information

**Instructor Name:** [REDACTED]

**Instructor Email:** [REDACTED]

**Office location and office hours:** [REDACTED]

For the most part, I will try to stay after class to answer most questions.

For

## 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 7 – 8	<ul style="list-style-type: none"> <li>• General Introductions: Instructor, classmates, course, and expectations</li> </ul>
Week 1: September 11 – 15	<ul style="list-style-type: none"> <li>• Basic R Programming</li> <li>• Introduction to the Tidyverse</li> </ul>
Week 2: September 18 – 22	<ul style="list-style-type: none"> <li>• Tidyverse continued</li> <li>• Introduction to Data Visualization (ggplot)</li> </ul>
Week 3: September 25 – 29	<ul style="list-style-type: none"> <li>• Data Visualization continued, Random Number Generation</li> </ul>
Week 4: October 2 – 6	<ul style="list-style-type: none"> <li>• Random Number Generation, continued</li> </ul>
Week 5: October 9 – 13* <b>NOTE:</b> No class on Tuesday, October 10 due to Reading Day. Class rescheduled to Thursday, November 30	<ul style="list-style-type: none"> <li>• Monte Carlo Methods</li> </ul>
Week 6: October 16 – 20	<ul style="list-style-type: none"> <li>• Monte Carlo Methods continued</li> </ul>
Week 7: October 23 – 27	<ul style="list-style-type: none"> <li>• Monte Carlo Methods continued, Bootstrapping and Jackknife</li> </ul>
Week 8: October 30 – November 3	<ul style="list-style-type: none"> <li>• Bootstrapping and Jackknife, continued</li> </ul>
Week 9: November 6 – 10	<ul style="list-style-type: none"> <li>• Non-Parametric Statistics</li> </ul>
Week 10: November 13 – 17	<ul style="list-style-type: none"> <li>• Overview of Numerical Methods</li> </ul>
Week 11: November 20 – 24	<ul style="list-style-type: none"> <li>• Simulation Studies</li> </ul>
Week 12: November 27 – December 1	<ul style="list-style-type: none"> <li>• Project Presentations</li> </ul>

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

Classes may consist of a combination of lectures and/or computer work. I will try to let you know in advance if you should bring a laptop (if possible), but you may prefer to have it with you for each class. In some weeks, additional reading may be assigned.

### Course Assignments and Tests:

Course Component	Date	Time	Location	Weight
In-Class Assessments	Tuesday, October 17 Tuesday, November 14	Due by 10am	In-class / Online	10% each <b>Total: 20%</b>
Assignment 1	Friday, October 6	Due by 5:30pm	Online	15% each <b>Total: 45%</b>
Assignment 2	Friday, November 3	Due by 5:30pm	Online	
Assignment 3	Friday, December 1	Due by 5:30pm	Online	
Course Project*	Thursday, November 23 – Thursday, November 30 (presentations)	8:30am – 9:50am	In-class / Online	15%
	Friday, December 8 (paper)	Due by 5:30pm	Online	20%
				<b>Total: 35%</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!

We will also be using RMarkdown for all assignments and assessments (where applicable). Information about RMarkdown is available at <https://rmarkdown.rstudio.com/index.html>

**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 an additional meeting, can be sent via email. Emails must be sent from your University of Guelph email account 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:** Details regarding each of the assignments will be posted on Courouselink. 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.**

While students are encouraged to consult with classmates, or investigate online resources, all submitted work must represent each student's independent ability, and 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. Further details regarding collaboration and resource use will be posted on each assignment and/or assessment.

**In-Class Assessments:** Details regarding the in-class assessments will be provided closer to the date. These may consist of an in-class quiz or assignment, to be completed individually or in a small group. You may be required to use a computer during an in-class assessment; if this is not possible, please speak to me as soon as possible. In-class assessments must be submitted by the end of class, and late submissions will not be accepted. As these assessments are scheduled during lecture time, it is your responsibility to resolve any conflicts. If you must miss an assessment due to illness or another valid reason, you must contact me as soon as possible after the missed assessment. In this case, you may be required to complete an alternate assessment in a format of my choosing.

**Course Project:** The course project will consist of a class presentation and written report. Class presentations will take place during the last 2 - 3 classes of the semester (November 23<sup>rd</sup>, 28<sup>th</sup>, and 30<sup>th</sup>). Students are expected to attend all presentations, as their own presentation grade will include a participation mark for other presentations. Detailed information about the course projects will be posted on Courouselink later in the semester.

**Turnitin:** In this course, we will be using Turnitin, integrated with Gradescope, 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.

I reserve the right to use other methods to verify work authenticity, including online searchers or other originality check systems.

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

In the event you wish to have coursework regraded, you must submit a **Regrade Request Form** (available on Courouselink) 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 date. 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 regarding use of electronic devices and recording of lectures:**

Electronic recording of classes is expressly forbidden without consent of the instructor. When recordings are permitted, they are solely for the use of the authorized student and may not be reproduced, or transmitted to others, without the express written consent of the instructor. This also applies in the event any lecture material must be presented via recording, or in the case of a guest lecturer or project presentation.

## **University Policies**

### **Disclaimer:**

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via Courselink and/or class email. This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (<https://news.uoguelph.ca/2019-novel-coronavirus-information/>) and circulated by email.

### **COVID-19 Safety Protocols:**

For information on current safety protocols, follow these links:

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

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

### **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. See the Undergraduate Calendar for information on regulations and procedures for [Academic Consideration](#).

### **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:**

Courses that are one semester long must be dropped by the end of the last day of classes; two-semester courses must be dropped by the last day of classes in the second semester. The regulations and procedures for [Dropping Courses](#) are available in the Undergraduate Calendar.

### **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 make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

More information: [www.uoguelph.ca/sas](http://www.uoguelph.ca/sas)

### **Academic Misconduct:**

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 discourages misconduct. 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.

The [Academic Misconduct Policy](#) is outlined in the Undergraduate Calendar.

### **Recording of Materials:**

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

### **Resources:**

The [Academic Calendars](#) are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.

### **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.