

STA303/I002

COURSE DESCRIPTION



Prof. Liza Bolton
(she/her)



Head TA: Amin Banihashemi
(he/him)



sta303@utoronto.ca



Synchronous class meetings
Wednesdays

L0101 12:10–1:00 p.m.
L0201 3:10–4:00 p.m.

Prof. office hours will take place in the hour after class.

TA office hours will be announced on Quercus.

The course focusses on using and interpreting advanced statistical methods with applications in a number of different areas. The overall theme of this course is dealing with situations where the assumptions of the regression models developed in STA302 may not apply. The course is a mixture of theory and application. Assignments will involve computing with R and there is a significant focus on written and oral communication.

DELIVERY

This course will be delivered completely **online**. There will be a mix of *synchronous* and *asynchronous* components.

PREREQUISITES

STA302/I001

I.e., we will assume that you are familiar with running linear regression analyses, including checking assumptions and some of the mathematical reasoning behind the models. Material from the second-year statistical theory courses which are prerequisites to STA302 will be drawn on extensively. Knowledge of programming with R is essential.

TEXTBOOKS

You do not have to purchase a textbook for this course. There are three texts that we will use extensively, and they are all freely available to you. Additional readings will be assigned as appropriate.

Wickham. *R for Data Science*. 2019. <https://r4ds.had.co.nz/>

Legler and Roback. *Broadening Your Statistical Horizons*. 2019. <https://bookdown.org/roback/bookdown-bysh/>

Wood. *Generalized Additive Models: An Introduction with R*, 2nd Edition. 2017. <https://ebookcentral-proquest-com.myaccess.library.utoronto.ca/lib/utoronto/detail.action?docID=4862399> (requires you to log in with your UTORid)

HOW TO SUCCEED IN THIS COURSE

- Review weekly readings and videos before synchronous class.
- Attend and participate in synchronous classes.
- Keep up to date with the course—do not leave studying to the last minute!
- **Ask questions!** Post in/watch the course discussion forum on Piazza and visit instructor and/or TA office hours.



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Software

We will be using [RStudio](#) to make reproducible data analysis reports using [R](#) and [R Markdown](#).

You can use RStudio on your personal machine or through the U of T JupyterHub: jupyter.utoronto.ca



Minimal technical requirements

All students should consult

the [minimum technical requirements](#) for participation in online learning.

If you are facing financial barriers to obtaining the required technology, please contact your [College Registrar's Office](#) to obtain information regarding your potential eligibility for a need-based bursary.



Recognized study groups

While not compulsory, I would highly recommend you [get involved with an RSG](#). RSGs are small study groups of 3 to 6 students from the same course who meet weekly to learn course content in a collaborative environment.



Meet to complete

Meet to Complete is an online "study with me" space where you can study alongside other students. To join Meet to Complete, enroll in the [Meet to Complete course on Quercus](#). Online learning doesn't need to be lonely!

LAND ACKNOWLEDGEMENT

Though we are all coming together online, I wish to acknowledge the 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 most recently, the [Mississaugas of the Credit River](#). Today, this meeting place is still the home to many Indigenous people from across Turtle Island and I am grateful to have the opportunity to work on this land.

A land acknowledgement is a way of honouring the Indigenous people who have lived and worked here for thousands of years, and whose land was colonised. It is also an invitation to reflect on the history of this land and I encourage you to consider the history of the land wherever you are now.



<https://www.whose.land/en/>

COURSE FORMAT AND ORGANIZATION

STA303 is a 'flipped' course. Each week, you'll watch videos, do readings and complete a quiz ahead of our Wednesday class meeting. We can then focus on applying new concepts through hands-on examples in our time together on Wednesdays. I hope you will join these sessions live so that you can participate, but I will record and post the sessions on Quercus for revision and to support members of the class in difficult time zones.

TOOLS

ZOOM

To participate in synchronous classes and office hours you will need a U of T Zoom account. If you do not yet have one, go to <https://utoronto.zoom.us/> set one up. To participate fully, you will need Desktop client or mobile app: version 5.3.0 or higher or ChromeOS: version 5.0.0 (4241.1207) or higher. You can check your desktop client or mobile app version by following [these instructions](#).

MS OFFICE

You will need to be logged in to your U of T account to access the course videos (hosted on MS Stream) and admin forms (on MS Forms).

More information about course tools available on [Quercus](#).

COURSE OUTLINE

Each week there will be a 1-hour synchronous meeting on Wednesdays. You are expected to have worked through the content in the weekly module and completed the weekly quiz before the synchronous class.

Topics listed below are subject to change.

Key: Q = quiz, W = weekly writing and peer evaluation

Week	Week starts (Monday)	Topic	Assessments	Notes
1	Jan 11	Introduction to the course, recap of linear models	Q, W	
2	Jan 18	Statistical communication and review of data wrangling and visualization	Q, W	
3	Jan 25	Ethical considerations in data analysis	Q, W, Professional development proposal due	
4	Feb 1	Beyond least squares: Using likelihoods to fit and compare models; Correlated data	Q, W, Polished writing 1 due	
5	Feb 8	Linear mixed models	Q, W, Data exploration due	
	Feb 15	<i>Reading Week</i>		
6	Feb 22	Mixed assessment 1: No class, 24-hour assessment window for timed component (4:30 p.m. ET Tuesday to 4:30 p.m. ET <u>Wednesday</u>), email monitored during class time for tech support.		
7	Mar 1	Distribution theory; Generalized linear models	Q, W,	
8	Mar 8	Generalized linear models	Q, W, Polished writing 2 due	<i>Daylight savings begins March 14.</i>
9	Mar 15	Generalized linear models	Q, W, Confirm project group/individual	<i>March 15 is the last day to cancel this course</i>
10	Mar 22	Generalized linear mixed models	Q, W	
11	Mar 29	Generalized additive models and generalized additive mixed models	Q, W, Professional development reflection;	
12	April 5	Mixed assessment 2: No class, 24-hour assessment window for timed component (4:30 p.m. ET Tuesday to 4:30 p.m. ET <u>Wednesday</u>), email monitored during class time for support; Polished writing 3 due		
		Final project submission 6:00 p.m. ET <u>Wednesday</u> April 21		

LEARNING OBJECTIVES

After completing this course, you will be able to:

- Wrangle and explore a dataset
- Create appropriate data visualizations
- Describe ethical considerations in data analysis
- Understand the assumptions and appropriate use cases for linear mixed models, generalized linear models, generalized linear mixed models and generalized additive models
- Write and execute R code for linear mixed models, generalized linear models, generalized linear mixed models and generalized additive models
- Interpret the results of the model types covered and communicate these to a range of audiences

ASSESSMENTS

All times are in Eastern Time (Toronto time). Please note that daylight savings will begin in Canada on March 14. If you are not based in Canada this may change the time conversion for you. Please keep this in mind.

Graduate students (STAI002) will be assessed in the same way, with the only exception being the details/requirements of the 30% project, to be discussed.

Assessment	Value	Due dates
Weekly quizzes	12%	Weekly at 6:00 p.m. ET on Tuesday <i>Exceptions: Feb 16 (reading week), Feb 23 (mixed assessment), April 6 (mixed assessment)</i>
Weekly writing and peer feedback	6%	Weekly: Create phase due Thursdays 6:00 p.m. ET Assess phase due Fridays 6:00 p.m. ET Reflect phase due Mondays* 6:00 p.m. ET <i>*February 15 is Family Day so the reflect phase will be due at 6:00 p.m. ET February 16 (reading week)</i>
Polished writing	10%	Polished writing 1 due Friday, Feb 5 at 6:00 p.m. ET Polished writing 2 due Friday, Mar 12 at 6:00 p.m. ET Polished writing 3 due Friday, Apr 9 at 6:00 p.m. ET
Professional development task	Proposal 1% + Evidence and reflection 3%	Proposal due Friday Jan 29 at 6:00 p.m. ET Evidence and reflection due Friday Apr 2 at 6:00 p.m. ET
Data exploration assessment	10%	Due Friday, Feb 12 at 6:00 p.m. ET
Mixed assessment 1	14%	24-hour assessment window for timed component: 4:30 p.m. ET Tuesday, Feb 23 to 4:30 p.m. ET Wednesday, Feb 24
Mixed assessment 2	14%	24-hour assessment window for timed component: 4:30 p.m. ET Tuesday, Apr 6 to 4:30 p.m. ET Wednesday, Apr 7
Final project	30%	Confirm group/individual status by Friday Mar 19 at 6:00 p.m. ET (failure to confirm will result in a 5-percentage point penalty on your final project grade). Final submission due Wednesday, April 21 at 6:00 p.m. ET

HOURS EXPECTATIONS (APPROXIMATION)

While everyone has different work styles and learning needs, I want to provide some guidance around how I expect this course to look for you.

Plan to be doing at least 6–8 hours of work on STA303 each week. This may be comprised of:

- 1–2 hours of videos and readings
- 30 minutes weekly quiz (you'll have an hour, but the intention is that it shouldn't take that long)
- 1 hour of attending synchronous class or reviewing the recording and activities
- 30 minutes weekly writing create phase
- 30 minutes weekly writing assess phase
- 5 minutes weekly writing reflect phase
- Remaining time attending office hours and working on current assessments.

WEEKLY FLOW

Week	Monday	Tuesday	Wednesday	Thursday	Friday	Sat/Sun
X	Week X module available by 9:00 a.m.	Week X quiz due 6:00 p.m.	Week X synchronous class 12:00 p.m. or 3:00 p.m.	Week X writing activity (Create phase) due 6:00 p.m.	Week X writing activity (Assess phase) due 6:00 p.m.	
Y	Week Y module available by 9:00 a.m. Week X Writing activity (Reflect phase) due 6:00 p.m.	Week Y quiz due 6:00 p.m.	Week Y synchronous class 12:00 p.m. or 3:00 p.m.	Week Y writing activity (Create phase) due 6:00 p.m.	Week Y writing activity (Assess phase) due 6:00 p.m.	

FEELING DISTRESSED?

You may find yourself feeling overwhelmed, depressed, or anxious. Lots of people feel the same way. There is help available from mental health professionals 24 hours a day via online and phone-based services listed on [this page](https://q.utoronto.ca/courses/204826/pages/services-and-support) (<https://q.utoronto.ca/courses/204826/pages/services-and-support>) on Quercus, as well as a range of other helpful U of T and community resources.

INTELLECTUAL PROPERTY STATEMENT

Course material that has been created by your instructor is the intellectual property of your instructors and is made available to you for your personal use in this course. Sharing, posting, selling or using this material outside of your personal use in this course is not permitted under any circumstances and is considered an infringement of intellectual property rights. This course, including your participation, will be recorded on video and will be available to students in the course for viewing remotely and after each session. These are intended only for students registered in the course. Course videos and materials belong to your instructor, the University, and/or other sources depending on the specific facts of each situation, and are protected by copyright. In this course, you are permitted to download session videos and materials for your own academic use, but you should not copy, share, or use them for any other purpose without the explicit permission of the instructor.



ACCOMMODATIONS AND ACCESSIBILITY

If you have an accommodation letter from your accessibility advisor that is relevant to this course, please do the following:

- ✉ Email your letter to sta303@utoronto.ca with “Accommodation letter” as part of the email subject, CC your advisor and let us know anything else you wish us to know/any questions you have. Please do this as soon as possible after you enroll in the course/receive this syllabus.
- ✉ Confirm any accommodations for each specific assessment 1 week before the assessment. (I.e., if you receive extra time for timed assessments, confirm this one week prior to the midterm assessment and final assessment, even if we have already discussed this at the beginning of the semester.)

ACCESSIBILITY SERVICES

The University of Toronto is committed to accessibility. If you require accommodations for a disability, or have any accessibility concerns about the course or course materials, please contact Accessibility Services as soon as possible: email accessibility.services@utoronto.ca or visit the website at <http://accessibility.utoronto.ca>.

RELIGIOUS ACCOMMODATION

At the University of Toronto, we are part of a diverse community of students, staff and faculty from a wide range of cultural and religious traditions. For this course, I have sought to avoid scheduling compulsory activities in ways that will clash with religious holy days (not captured by statutory holidays). If you anticipate missing a course activity due to a religious observance, please let me know as early in the course as possible. With sufficient notice—at least three weeks—we can work together to make alternate arrangements.

MISSED WORK POLICIES

WEEKLY QUIZZES

Your final score for weekly quizzes will be calculated as your **BEST 7 of 10 quizzes**. Late submissions (i.e., not accepted by Quercus) will not be accepted.

Note: The week 1 quiz is due January 12 but will be available and accepted until January 26 with no penalty.

In some weeks we may have a Team Up! activity in synchronous classes that may be used to earn *bonus* points towards your final total weekly quiz score. The bonus points can only be earned during the synchronous class. Calculation of bonus to be announced.

Accommodations and extension policy: There will be no exemptions or extensions for weekly quizzes. In extreme cases, another assessment may be arranged (this may be an oral exam) but you or your registrar should email sta303@utoronto.ca as soon as possible to discuss this if there is reason for a prolonged absence.

WEEKLY WRITING AND PEER FEEDBACK

Your final score for participation in the weekly writing activities will be calculated as your **BEST 6 of 10 activities**. Late submissions (i.e., not accepted by peerScholar) will not be accepted.

While I believe taking part every week will be of most use to you in preparing your polished writing submissions, preparing for the final project and general skills development, I know there are many deadlines to remember. For this reason, even if you only participate fully in half the weeks of the semester, you can still earn all 6% toward your final grade.

Accommodations and extension policy: Same as weekly quizzes above.

LARGE COURSEWORK

TYPE 1: DATA EXPLORATION ASSESSMENT, POLISHED WRITING, PROFESSIONAL DEVELOPMENT PROPOSAL AND REFLECTION, FINAL PROJECT

For assessments in **Type 1**, late assessments will still be accepted but you will lose 10 percentage points on the assignment, per day, with submissions accepted for up to 3 days after the due date. I.e., 72 hours after the initial due date.

Accommodations and extension policy: If you miss a type 1 assessment due to illness or a serious personal emergency, please complete [this form](#) within ONE week of the due date of the assignment. Upon receipt of your form, we will contact you via email within 3 business days to arrange an accommodation. Please note that technical difficulties knitting an Rmd or getting the due time wrong **do not** constitute personal emergencies.

Any requests for penalty-free extensions that are *not related to illness or emergency* (i.e., something that is predictable) **MUST** be made to sta303@utoronto.ca at least 2 business days **before** the due date.

TYPE 2: MIXED ASSESSMENTS (1 AND 2)

For assessments in **Type 2**, late assessments will **NOT** be accepted.

Accommodations and extension policy: If you miss a type 1 assessment due to illness or a serious personal emergency, please complete [this form](#) within ONE week of the due date of the assignment (i.e. the end of the timed assessment window).

IMPORTANT NOTES

1. If too much work is missed, even for valid reasons, an oral exam may be required to calculate a fair mark, at the discretion of the instructor. Please ensure you and/or your registrar get in touch with me as early as possible if this may be the case for you.
2. If you have accommodation letters from an accessibility advisor, make sure you read the instructions in the 'Accommodations and accessibility' section above.
3. Unless discussed with your instructor first and an agreement is come to, if you submit an assessment, it will be assumed that you deemed yourself fit enough to do so and your grade will stand as calculated. No accommodation will be made based on claims of medical, physical, or emotional distress *after* the fact.

ACADEMIC INTEGRITY

PLAGIARISM



You may be at risk of plagiarising if you do not understand the rules and your responsibilities. You must not present the work of others as your own. This includes, but is certainly not limited to, copying text and including it in your writing without a citation and quotation marks.


There are many resources to help you learn more:

- <https://guides.library.utoronto.ca/plagiarism>
- <https://www.academicintegrity.utoronto.ca/smart-strategies/>

YOU are responsible for knowing the content of the [University of Toronto's Code of Behaviour on Academic Matters](#). The University of Toronto treats cases of academic misconduct very seriously. Academic integrity is a fundamental value of learning and scholarship at the U of T. Participating honestly, respectfully, responsibly, and fairly in this academic community ensures that your U of T degree is valued and respected as a true signifier of your individual academic achievement.

Other potential offences include, but are not limited to:

- Looking at someone else's answers.
- Letting someone else look at your answers.

- 
- Misrepresenting your identity.
 - Falsifying or altering any documentation required by the University.
 - Falsifying institutional documents or grades.

All suspected cases of academic dishonesty will be investigated following the procedures outlined in the Code of Behaviour on Academic Matters. If you have any questions about what is or is not permitted in this course, please do not hesitate to contact me.

SPECIFIC ADVICE ON TYPE 1 ASSESSMENTS AND THE UNTIMED COMPONENT OF TYPE 2 ASSESSMENTS

As a general rule, for untimed assessments, I encourage you to discuss course material with each other and ask others for advice. However, **it is not permitted to share R code or written answers for anything that is to be handed in.** For example, “For question 2 what R function did you use?” is a fair question when discussing course material with others in the class; “Please show me your R code for question 2” is not an appropriate question. If writing or code is discovered to match another student’s submission or outside source, this will be reported as an academic offence. When asked to hand in code and the output it creates, the code you submit *must* have been used to generate the document. If it does not (i.e., the submitted code does not match the submitted output), this is also considered an academic offence.

RULES FOR TIMED ASSESSMENTS (WEEKLY QUIZZES AND TIMED COMPONENTS OF TYPE 2 ASSESSMENTS)

While all timed assessments in STA303 are open-book, they are not “open-person”. You **MUST NOT** discuss any details of the assessment with anyone else during the assessment window, regardless of your completion status. This includes, but is not limited to, current classmates, friends and tutors. For example, even asking someone “which slide did you look at to answer question 3” is not appropriate for timed assessments.

NOTE: BE CAREFUL ABOUT PRIVATE TUTORING COMPANIES

You may have been contacted by private tutoring companies trying to sell their services to you for statistics courses. Please be *extremely* careful with these services as some forms of tutoring can pose an academic offence risk. A good tutor helps you understand the subject area and supports your learning. A good tutor does *not* give you answers. **There are no short cuts to learning. Learning takes time and effort.**

Be cautious about giving money to companies whose motivation is profit. They may tell you they have insider information. They don’t. They may even offer you the opportunity to commit academic offences. Please do not put your University of Toronto education at risk by participating in these kinds of unacceptable behaviours. If you have any questions or concerns about what is okay and what is not in your course, please ask!

MARKING CONCERNS

Any request to have an assessment remarked must be submitted to [this form](#) under the following conditions:

- Wait 24 hours after the release of grades. Use this time to go over sample solutions and course materials.
- After the 24-hour period has finished, you will have one week to submit your regrade request.
- Your request must include a detailed **justification** referring to your answer and the relevant course material to be considered.

Please note that I reserve the right to **review the grading of all questions or parts** when you re-submit an assessment for reconsideration (i.e., your grade could go down).

COMMUNICATION POLICY

AKA HOW TO GET YOUR QUESTIONS ANSWERED

Course logistics? e.g.

- What is the deadline for the weekly quiz?
- Where do I submit the assignment?

Course content? e.g.

- Why do we sometimes use `glm()` and sometimes use `glmer()`?
- My code won't run for question #1 (please include screenshots of your code and the error message!)

Info to share with class? e.g.

- I have a link/resource/opportunity to share with my classmates

Missed an assessment due to illness or personal emergency?

- Doctor's note **not** required, but if you have one you can upload it as supporting documentation.

Want to request a regrade of an assessment?


- Be prepared to provide a detailed justification and possible supplementary materials. "I worked hard on this so I should get a better mark" is not an appropriate justification (yes, I do receive emails like that).


Personal/sensitive circumstances? (i.e., something which is not appropriate to share with the whole class) e.g., requesting an extension prior to a due date for a 'predictable reason' (not personal illness or emergency). For example, unavoidable travel.

PIAZZA FORUM

See link in the course navigation menu on left-hand side of Quercus.


Posts can be anonymous for your classmates, but instructors and TAs will be able to see your name.


 Before posting a question, search to see if someone else has already asked a similar question (you can edit the question to add yours or post a follow-up at the bottom).

 Try to answer your classmates' questions—this is a great way to reinforce your own understanding while also helping your classmates! *Don't worry if you aren't 100% sure of the answer—answers will be reviewed/endorsed/completed by the teaching team!*

FORM


Use the appropriate form linked on the ['Forms' page](#) on Quercus for these situations.


 If you cannot meet a deadline because you are ill, please also refer to the "Missed Work" section in this syllabus.


 If you wish to request a regrade, please also refer to the "Marking Concerns" section in this syllabus.

COURSE EMAIL: sta303@utoronto.ca

(only send emails from your utoronto.ca email address to ensure they doesn't automatically go to a Junk folder and be sure to include your full name and UTORid)

 This account will be monitored by the head TA and course instructor; if you want to reach Prof. Bolton or a TA specifically please include their name in the subject line: do not email them directly.

 Allow at least 24 hours for a response during the week (Monday to Friday, ET) and do not expect responses on the weekend. Do not send a follow-up email until at least **two business days** (Toronto time) later.

 Questions about course content won't be answered here, but rather redirected to Piazza or office hours.



COURSE DESIGN PRINCIPLES

Here are some of the principles around which I have designed this course. I hope they might provide some useful insight in to *why* some things are the way they are, and help you think about how to navigate this course and make the best of it.

HUMANS LEARN BETTER 'LITTLE AND OFTEN'

I know some students absolutely hate weekly tasks and how common they have become with online learning, and that all the little tasks and deadlines can become overwhelming. I also know that cramming is the absolute worst way to learn and actually retain that learning.

This is why this course:

- Has low-% weekly tasks to try to reward/place value on working on the course every week.
- Has larger summative tasks (type 1 and type 2 assessments) that along with the weekly tasks aim to facilitate and reward spaced repetition, the way science says is the best way to learn (this free course is fantastic for learning more about how to learn: <https://www.coursera.org/learn/learning-how-to-learn>).
- Acknowledges that despite our best intentions, sometimes there is just too much going on to give every small weekly task your best effort, by calculating your final quiz grade as the average of your best 7 of 10 and your final weekly writing and peer feedback grade as the average of your best 6 of 10.

WRITING IS GOOD FOR STATISTICIANS

Writing not only helps you explain yourself to others, it can also be a fulfilling act of creative personal expression and a way to clarify your own understanding of a concept. Writing is an important part of this course because it is an important a skill for your future careers/next steps in education. Lots of support and information here:

<https://writing.utoronto.ca/>.

ASSESSMENT AND SUPPORT IS TIME ZONE FRIENDLY

I want this flipped and online iteration of this course to as friendly to the range of time zones folks are in as possible. That is why there are windows of at least 24 hours in which to complete all timed assessments.

All synchronous classes will be recorded, and activities made available. Wednesday classes are NOT OPTIONAL but attending them *live* is. You are still expected to keep up to date with announcements made in class and content covered in class is assessable regardless of whether it is mentioned in the pre-recorded module.

I am also trying to keep time zones in mind with scheduling office hours, though welcome feedback if you're struggling to get access to course supports in the time zone you are in.

COURSE CONTENT IS ACCESSIBLE

My intention is to make this course accessible as possible with captions for all video and audio and Quercus design that is easy for folks using screen readers to navigate. If there is something I could do differently in this area that would make your life easier and you're comfortable to tell me, please do! One thing I know isn't great but, regrettably, don't have the resources to change, is the 'quality assurance' of the autogenerated captions for videos. Please reach out on Piazza if you're ever unsure about something they say.