STA305 H1S –
Design and Analysis of Experiments
(Online Synchronous)

Summer 2021

*This syllabus is for STA305 (undergraduate) only, not for STA1004 (graduate students).

Lectures and Instructor Information

Instructor: Dr. Ramya Thinniyam

Email: ramya.thinniyam@utoronto.ca
[only for private matters such as missed assessments and remark requests]

Office Hours: Tuesdays   9:30am-10:30am EDT
                 Thursdays 9:30am-10:30am EDT

(Office hours may change before test)

Lecture Times:
Tuesdays   1:00pm-4:00pm EDT
Thursdays 1:00pm-4:00pm EDT

This is an Online Synchronous course, which means students are expected to attend online at the scheduled time for some parts such as live lectures, activities, quizzes, etc. Recordings of live lectures will be posted on Quercus.
Note that some videos may be posted for students to watch before the lecture meeting so that you can participate in activities based on that material during the live lecture.
Lectures and office hours will be conducted via Zoom. Zoom links will be announced on Quercus. Students are expected to keep track of announcements for links and passwords. Lectures will start 10 minutes past the hour (following standard U of T start times). Students should register for a U of T Zoom account using their UTORid and password. (Web Portal Login: https://utoronto.zoom.us) to be able to join the meetings.

Teaching Assistants
TA information, office hours, and Zoom links will be posted on Quercus.

Course Description

Experiments vs observational studies, experimental units. Designs with one source of variation. Complete randomized designs and randomized block designs. Factorial designs. Inferences for contrasts and means. Model assumptions. Crossed and nested treatment factors, random effects models. Analysis of variance and covariance. Sample size calculations.

Prerequisite: STA302H1/STAC67H3/STA302H5
Exclusion: STAC50H3, STAC52H3, STA305H5

Learning Outcomes / Objectives

- Understanding and Describing data
- Designing Experiments
- Model Building
- Assessing Model Adequacy
- Statistical Inference
- Statistical Computing
- Interpretation of Results
- Building research, communication (oral and written), and collaboration skills
- Peer to Peer learning

Course Materials

Textbook:

Design and Analysis: A Researcher's Handbook, by Keppel & Wickens (4th ed)

Additional References:

- *Design and Analysis of Experiments* by Montgomery
- *Designing Experiments and Analyzing Data: A Model Comparison Perspective* by Maxwell and Delaney
- *A Handbook of Statistical Analyses Using R* by Everitt and Hothorn
- *Computational Statistics An Introduction to R* by Sawitzki

Statistical Computing

This course uses the statistical package R. R is free statistical software and it can be downloaded from https://cran.r-project.org/. Various introductions to R are posted on the course website. Students should use R for the final project.

Quercus

The website for this course is accessible via https://q.utoronto.ca/.
The course website is regularly updated with readings, practice problems, examples, and notes, and marks. Be sure to check the site regularly, it's your responsibility to know what's been posted.

Mark Calculation

Type of Assessment	Due Date	Weight
Midterm Test	July 27, 2021	**25%**
Quizzes & Participation in Activities	Ongoing in Lectures	**20%**
Mini Project	July 20, 2021	**15%**
Final Project: *Group member definition* *Proposal* *Progress Report - Data* *Progress Report - Technical* *Final Written Report* *Group Member Assessment*	Components due on: July 29, 2021 Aug 7, 2021 Aug 13, 2021 Aug 16, 2021 Aug 23, 2021 Aug 23, 2021	**40%** total: *2%* *5%* *5%* *10%* *15%* *3%*

Readings and Homework Problems

Readings and exercises for each topic are posted on Quercus. They are for practice only and do not need to be handed in.

Participation and Quizzes

Quizzes are designed to help you keep up with course material, participate in lectures, and get a more interactive and engaging learning experience overall.

- The instructor will ask questions using Slido during the lectures and you respond live during the lecture meeting.
- Slido is a platform for Q&A and polls to engage audience. It is free for students. You can enter the event code shown in the lecture slide on slido.com or scan the QR code shown to participate.
- In some lectures, you will participate in individual or group activities, designing experiments, presentations, peer evaluations, etc. and use the poll to answer questions / evaluate.
- There will be around one or two questions per lecture hour.
- About half of your quiz marks are for participation (just answering the questions) and about half are for answering correctly.
- Missed quiz questions receive a mark of 0. No exceptions. Your lowest 10 questions are dropped: if a total of *n* questions are asked during the term, your mark will be calculated out of (*n-10*). No other adjustments will be made for missed questions.
- **When you register for the online poll, follow the instructions given and enter the required information (*such as utoronto email address*).**
- *If you use a different name/nickname or use other email addresses, your quiz marks will not be counted.* More information on how to use these polls will be shown during lecture and posted on Quercus.
- If you have an extenuating circumstance causing you to miss many questions, email your instructor by August 1st, 2021, using the subject line: "STA305 Quiz Special Consideration". In the body of the email: include your full name, student number, reason for missing quiz questions and how many missed, and proof if applicable. An alternative will be provided at the instructor's discretion.

Projects

There are two group projects: one mini project and one final project.

Mini Project:

In this project, you and your group will design an experiment to assess a specific claim or answer a question of interest (that was assigned to you) and make a presentation to the class. You will also participate in the discussion of other groups' presentations by asking questions and doing peer evaluations.

Final Project:

In this final assessment, you and your group will choose your own target population and question of interest based on a non-human population, design an experiment, collect data, apply statistical methods learned in the course, interpret/make conclusions, and submit a written report.

These projects give you an opportunity to collaborate with others and work as a team, often as research is done. All work you submit must be original (your own)!

- ***Project components should be uploaded on Quercus and are due by 11:59 pm EDT on their respective due dates. Late submissions are not accepted.***
- **Submissions will be assessed using *Turnitin*.** Plagiarism will be dealt with seriously.
- *Normally, students will be required to submit their course essays to Turnitin.com for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the Turnitin.com reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of the Turnitin.com service are described on the Turnitin.com web site.*
- Students who wish to opt-out of submitting on Turnitin must inform the instructor by Aug 1, 2021. These students could be asked to show their rough work (in addition to submitting the required components of the project), group meeting chats and evidence of work done on the project and data collection, and attend a meeting to answer questions about the methodologies used in the project.

Test Policies

- The Midterm Test will be administered on Quercus/crowdmark during the lecture time on the midterm test date.
- You cannot base your justification on any procedure/fact that is not covered in the lecture notes, discussed in class, or in the assigned readings or problems.
- As this is an online course, it is the STUDENTS' responsibility to ensure they have a reliable Internet connection.
- The test duration is 90 minutes.
- Late submissions will not be accepted.
- Solutions submitted via emails will not be accepted.
- In case you have a technical problem, and you cannot submit the solution, you may report yourself as being absent on ACORN. The policy on missed tests will be applied. In this case, we will check your activity on Quercus/crowdmark to avoid any invalid claim.

Missed Term Tests:

 ➢ If you miss the test due to medical reason/emergency or some other legitimate reason, report your absence on ACORN.
 ➢ If you miss the midterm test due to a legitimate reason, then a make-up test combining all material covered in the course will be held on Saturday August 14th.
 ➢ If you miss the make-up test, then the mark of missed midterm test will be zero.

Remark Policy:

 ➢ If you feel there is an issue with the marking of a test/assessment, you may request that it be re-marked. The course remark policy exists to correct mistakes, and any request should clearly identify the error (for example, a question that was not marked, a total incorrectly calculated, an answer that matched criteria of the correct solution but did not get the allocated marks). Requests to correct such mistakes must be sent by *email to your instructor* and not to the TA. For consideration for a remark, your request:
   ✓ must be received within three days of the date that the marks for the assessment became available,
   ✓ must include the following words in the subject line of the email:
     STA305, Remark Request, and Midterm Test / Assessment Name,
   ✓ must include the following in the body of your email:
     your full name, student number, a specific, clear, and concise reason for each remark request, stating each question number/part and referring to a possible error or omission by the marker or explaining why you believe your solution deserves more marks. Remark requests without justification will not be accepted.
 ➢ Note: that your entire test/assessment may be remarked when you submit a remark request

Piazza Discussion Board

This is for student-led discussion. Instructors and TAs will check in on a regular basis and participate in discussions if other students do not reply. You can expect a reply within 48 hours (but we usually reply much sooner). Please do not email questions about course content/projects to instructors or your TA! Instead, post your question in Piazza. Please make sure to post your question under the correct folder in order to receive a timely response. Before your post a question, make sure to check you are not asking for information that is already on the course outline/ website/announcements.
Here is the sign-up link to our course:
www.piazza.com/utoronto.ca/summer2021/sta305h1
Access Code: STA305summer2021

Email Policy

In online courses, most communication is visible to all (via discussion boards and meetings). Email is most appropriate for personal questions or private issues. In general, we are unable to answer technical questions about the course material by email. Before you

send an email, make sure that you are not asking for information that is already on the course outline/ website/announcements, or questions about the course material that are more appropriately discussed during office hours or the discussion board on Piazza. If you do not get a response, this may be why.

Please email using your University of Toronto email address (do not use Canvas notifications or reply to announcements from Quercus). The **subject line should contain the course number (STA305) and a relevant <u>subject (indicating what the email is about)</u>**. Be sure to **include your full name and student number in the body** of the message. You will not get a response if you email from other email addresses or do not follow the email policy.

Course Communication - Office Hours and Discussion Board

There are plenty of office hours offered by the TAs and instructor (office hours and Zoom links are posted on Quercus). The TAs and instructor are here to help you! Ask questions and let the instructor/course coordinator know if there are any concerns.

We also encourage you to connect with other students through the Discussion Board and during lecture activities, projects, and engage in peer-to-peer learning!

Copyrights and Privacy Notification

All the course materials are copyrighted. If they are from the textbook, the copyright belongs to the textbook publisher. If they are provided by an instructor (for example, lecture notes/videos, computer code, assignments, tests, solutions) the copyright belongs to the instructor. Distributing materials online or sharing them in any way is a copyright violation and, under some circumstances may constitute an academic offence.

Notice of video recording and sharing (Download permissible; re-use prohibited):
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. Course videos and materials belong to your instructor, the University, and/or other source 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. For questions about recording and use of videos in which you appear please contact your instructor.*

Academic Integrity
Honesty and fairness are fundamental to the University of Toronto's mission. Plagiarism is a form of academic fraud and is treated very seriously. The work that you submit must be your own and cannot contain anyone else's work or ideas without proper attribution. You are expected to read the handout How not to plagiarize (https://www.writing.utoronto.ca/advice/using-sources/hownot-to-plagiarize) and to be familiar with the Code of behaviour on academic matters.

For each assessment, students will be required to fill out the University of Toronto's Honor Pledge statement to confirm that the work they have submitted is their own.

With regard to remote learning and online courses, U of T wishes to remind students that they are expected to adhere to the Code of Behaviour on Academic Matters regardless of the course delivery method. By offering students the opportunity to learn remotely, we expects that students will maintain the same academic honesty and integrity that they would in a classroom setting. Potential academic offences in a digital context include, but are not limited to:
- Accessing unauthorized resources (search engines, chat rooms, Reddit, etc.) for assessments.
- Using technological aids (e.g. software) beyond what is listed as permitted in an assessment.
- Posting test, essay, or exam questions to message boards or social media.
- Creating, accessing, and sharing assessment questions and answers in virtual "course groups."
- Working collaboratively, in-person or online, with others on assessments that are expected to be completed individually.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources.

Accessibility Needs

The University of Toronto is committed to accessibility. If you require accommodations for a disability, or have any accessibility concerns about the course, the classroom, or course materials, please contact Assessibility Services:
https://studentlife.utoronto.ca/task/register-with-accessibility-services/

Student Responsibilities

- It's up to you to know all course policies and important dates - read the course outline. It's up to you to know about any important announcements - these will come to your inbox. Check Quercus regularly! Check your utoronto email inbox regularly! Check your marks on Quercus regularly and notify the TA/instructor if there are any errors.
- You're responsible for your own learning. We're happy to help you learn, but in the end it's up to you! Use office hours early, and use them often. Keep asking questions until you're satisfied by posting on the Discussion Board or asking individually during office hours. Ask about big concepts or small details – there is no such thing as a stupid question! Always take advantage of extra help – don't wait until it's too late!
- You must follow the U of T code of Behaviour (see above on Academic Integrity and Copyright policies).

What you get out of the course depends on what you put into the course!

Instructor Responsibilities

- Lectures will be clearly presented, organized, and have plenty of examples.
- The instructor will endeavour to make online lectures engaging and interactive for students.
- Your emails will be answered in a timely fashion.
- Every student in the class will be treated with fairness and respect. Students who wish to excel are encouraged to consult regularly with the instructor. Students who abuse the U of T code of behavior will be dealt with appropriately.
- The lecturer works closely with your TA(s). TAs are trained to offer quality help, and mark consistently and fairly!

Approximate Lecture Schedule

Elements of the course schedule may be subject to change.
Material coverage in each lecture and related homework problems may be revised due to time availability. Any changes will be promptly updated Quercus.

Topic	Lecture Dates
Introduction to Experiments, Types of Data, Elements of Experiment: Control, Blocking, Randomization, Replication	July 6
One-Way ANOVA	July 8, 13
Contrasts, Post-Hoc Analysis	July 13
Linear Model, ANOVA coding schemes, Effect size, sample size calculations, and Power	July 15
Mini Project PRESENTATIONS	July 20, 22
MIDTERM TEST	July 27
Two-Way ANOVA	July 29, Aug 3
Blocked Designs: Randomized Complete Block (RCB) design	Aug 5
Incomplete Block Designs	Aug 10
General Linear Model, Analysis of Covariance (ANCOVA)	Aug 12

Last Date to Drop Course is August 2, 2021.