STA255H1-S: Statistical Theory

Shahriar Shams

Winter 2021 (last updated on Jan 10, 2021)

1   Course Description

This courses deals with the mathematical aspects of some of the topics discussed in STA220H1. Topics include discrete and continuous probability distributions, conditional probability, expectation, sampling distributions, estimation and testing, the linear model (Note: STA255H1 does not count as a distribution requirement course).

Contents, emphasis, etc. of the course is defined by means of the lecture materials - *not only the texts*. Table 1 shows the tentative lecture guide. Lecture slides will be uploaded every week. However, they are just rough, point-form notes, with no guarantee of completeness or accuracy. They should in no way be regarded as a substitute for attending the lectures or for doing the weekly non-credit homework.

Important announcements, problem sets, additional examples, and other course info will be posted on the course web page on Quercus. Check it regularly.

Prerequisite: STA220H1/STA221H1/ECO220Y1 (note: ECO220Y1 may be taken as a co-requisite)/STAB22H3/STA220H5/ECO220Y5; MAT133Y1 (70%)/(MAT135H1, MAT136H1)/ MAT137Y1/MAT157Y1/(MATA32H3 (70%), MATA33H3 (70%))/(MATA30H3, MATA36H3)/ (MATA31H3, MATA37H3)/MAT133Y5 (70%)/MAT135Y5/MAT137Y5/MAT157Y5

Exclusion: ECO227Y1/STA237H1/STA238H1/STA257H1/STA261H1/STA247H1/STA248H1/ STAB52H3/STAB57H3/STA256H5/STA260H5

Breadth Requirements: The Physical and Mathematical Universes (5)

2   Course Schedule

- **Lectures:**

  – We will have synchronous lectures.

  – Lectures will be on BBcolab.

  – Time: Tue(3-4pm) and Thur(3-5pm)

  – We will not have live tutorials. We will use the tutorial times for quizzes and tests. Students should not sign up for other courses that conflict with the lecture and tutorial times of this course. No accommodation will be provided to students missing assessments due to a conflict with another course.

- **Instructor: Shahriar Shams**,
  PhD in Biostatistics candidate, Dalla Lana School of Public Health,
  Assistant Professor(teaching stream), Department of Statistical Sciences,
  University of Toronto.

- **Email:** sta255@utoronto.ca

- **Office hours:** On BB colab, time to be announced later.

3   Textbooks

Modern Mathematical Statistics with Applications, 2012, by Devore, Jay L., Berk, Kenneth N.

E-book is available through the University of Toronto libraries website (`https://search.library.utoronto.ca/details?8331046&uuid=f5b471dd-de62-4a29-8cd5-e0d00d3fa639#`)

4   Homework

Every week after the lecture a set of exercises will be provided. This homework is **not for credit**. This is only meant to give students opportunities to learn the materials and prepare themselves for the quizzes/tests and exam. Student polls will be used to determine the harder problems for every lecture. Some of the harder problems will be solved by a TA and the session will be recorded offline. Recorded tutorials will be made available for all the students.

5   Quizzes

There will be five quizzes in total. Your lowest mark will be dropped and the best four will worth 10% each. Quizzes will be administered using Crowdmark.

On these dates, students will write their quizzes between 4-5pm. (local Toronto time)

	Date	Coverage
Quiz-1	Feb 02	Lectures 1 and 2
Quiz-2	Feb 09	Lectures 3 and 4
Quiz-3	Mar 09	Lectures 6 and 7
Quiz-4	Mar 23	Lectures 8 and 9
Quiz-5	Apr 06	Lectures 10 and 11

Table 1: Time table and coverage for Quizzes

6   Mid-term

- Mid-term will be held during the first week of March.

    – Mar 02, 3-5pm (local Toronto time)

- It will cover lectures 1 to 5 and will be administered using crowdmark.

- Students will be required to write complete answers on paper (or using electronic devices)

- If written using pen and paper, students will be required to take pictures of their complete answers and upload them to crowdmark.

- If written using electronic devices, students can upload their answers as screenshots or saved images.

- More instructions on how to upload documents to crowdmark will be given later.

7   Assignment for credit

At the middle/end of the term, you will do an assignment which will help you to understand few of the theories that we will be using in this course. The assignment will be a bit tedious if you are doing the calculations by hand. But using a software (like R) will make it a really easy one to complete. It will worth 15% and clear instructions will be given on how to complete and submit your work. More information on this will be announced on Quercus in mid-March.

8   Evaluation

- **Quizzes:** 10% * 4 = 40%

- **Mid-term:** 20%

- **Assignment for credit:** 15%

- **Final assessment:** 25% (3 hours timed assessment, will cover everything taught in the course, date and time will be fixed by faculty of Arts and Science and will be announced later)

9 Missed assessment

There are NO make-up assessments of any form in this course.

- Taking the final assessment and submitting the assignment is **mandatory** for every student in order to pass this course.

- For quizzes, the lowest mark will be dropped. So missing one quiz will not affect your grade. If you miss two quizzes, your other three quiz scores will be counted and the missing 10% will be distributed to all your timed assessments (quiz, mid and final). If you miss more than two quizzes, you will get a zero for your third and onward (fourth or fifth) missed quiz irrespective of reason missed.

- If you miss the midterm, your midterm weight will be distributed among the other timed assessments.

- Students are not required to submit any doctor's note for missing any assessment.

10 Computing

Statistical software **R** will be used in the course. Students will learn solving basic probability problems and demonstrating some well known theorems using simulations in R. *No previous exposure is expected* and R will be introduced starting from the basics. Any code used in the lectures will be available on the course web-page for students to practice at their own time.

11 Communicating with your Instructor

sta255@utoronto.ca is the only email id that the students should be using for this course. Please do not email asking questions like "how to do problem 10.3.4?", "when is the midterm?", "how to submit the assignment?". Emails like these will be ignored. Otherwise, students should expect a reply within 48 hours. If you need help with any problem you can either talk to your instructor right after the class if you expect the answer to be brief or come during the office hour. If you have any question/concern that you don't want to ask in front of others you can email the instructor (sta255@utoronto.ca) to set up a one-on-one meeting.

12 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 Accessibility Services as soon as possible at `accessibility.services@utoronto.ca` or `http://www.accessibility.utoronto.ca`

13 Academic Integrity

Academic integrity is fundamental to learning and scholarship at the University of Toronto. Participating honestly, respectfully, responsibly, and fairly in this academic community ensures that the University of Toronto degree that you earn will be valued as a true indication of your individual academic achievement, and will continue to receive the respect and recognition it deserves. Familiarize yourself with the University of Toronto's Code of Behaviour on Academic Matters available at (https://www.academicintegrity.utoronto.ca/perils-and-pitfalls/)

Students are not allowed to share quizzes, assignment, tests and exam questions or answers with anyone (not even with other students taking this course) at any point in any platform. Sharing questions or answers and submitting work completed by someone else is a huge academic offence. Please stay away from this type of behavior.

14 Copyright

Students agree to the following terms:

- Course materials (i.e. slides, recordings, assessment questions) are your instructor's intellectual property and have been created by your instructor for students' personal use and under no circumstances should be shared, posted or distributed anywhere.

- Non-compliance with these terms violates an instructor's intellectual property rights and the Canadian Copyright Act. Students violating this agreement will be subject to disciplinary actions under the Code of Student Conduct.

Table 2: STA255, Winter 2021 **tentative** lecture guide

Week	Week of	Readings	Quiz
1	Jan 11	Ch2: Probability, Introduction to R	-
2	Jan 18	Ch3: Discrete Random Variables and Probability Distributions	-
3	Jan 25	Ch3 cont... & Ch4: Continuous Random Variables and Probability Distributions	-
4	Feb 01	Ch4 cont...	1
5	Feb 08	Ch5: Joint Probability Distributions	2
-	Feb 15	Reading week (No lecture/tutorial/office hours)	-
6	Feb 22	Ch6: Statistics and Sampling Distribution	-
7	Mar 01	Ch7: Point Estimation	Midterm
8	Mar 08	Ch8: Interval Estimation	3
9	Mar 15	Ch9: Test of Hypothesis	-
10	Mar 22	Ch10: Inferences based on two samples	4
11	Mar 29	Ch12: Regression and Correlation	-
12	Apr 05	Ch12 cont... & Review	5

Final assessment will be scheduled by the faculty of arts and science. Date and time will be announced later.