STA255H1-S: Statistical Theory

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Winter 2020 (last updated on Dec 30, 2019)

1 Course Description

STA255 presents basic statistical theory, building upon materials covered in STA220. Mathematical tools (e.g. calculus) will be used and emphasized. Topics to include: probability, discrete and continuous distributions, expectation, moment generating functions, functions of random variables, sampling distributions, estimation and test of hypothesis, the linear model (regression).

Prerequisite: STA220H1/STA221H1/ECO220Y1 (note: ECO220Y1 may be taken as a corequisite), MAT133Y1(70%)/(MAT135H1,MAT136H1)/MAT137Y1/MAT157Y1

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 assignments.

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

2 Course Schedule

- **Lectures:**

    - Room # OI - G162 ; http://map.utoronto.ca/utsg/building/123
    - Time: Tuesday (3-4pm), Thursday (3-5pm)

- **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:** shahriar.shams@mail.utoronto.ca (Please write "STA255" at the beginning of the subject of your email. PLEASE!)

- **Office hours:** Tues 1pm - 2pm, Room # HS 376 (starting from the week of Jan 13th)

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#)](https://search.library.utoronto.ca/details?8331046&uuid=f5b471dd-de62-4a29-8cd5-e0d00d3fa639#)

4 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. There are two software (R and R-studio) that need to be installed. First you will have to install R. Here are the links to download this open source software:

- **for windows:** https://cran.r-project.org/bin/windows/base/

- **for mac:** https://cran.r-project.org/bin/macosx/

After you have installed R, you can install R-studio (an IDE for R) by downloading the version specific to your operating system from https://www.rstudio.com/products/rstudio/download/#download

5 Homeworks

Every week after the lecture a set of exercises will be provided. These homeworks are **not for credit**. They are only meant to give students opportunities to learn the materials and prepare themselves for the quizzes/tests and exam. The instructor will help you solve few of these problems during the weekly office hours. And the TAs will also help you solve few during their office hours.

6 Assignment for credit

Sometime during the middle/end of the term, you will be doing an assignment (worth 3%) which will help you to understand few of the theories that we will be learning in this course. You are allowed to work in groups (maximum 2 members in one group).

7 Tutorials & Quizzes

The tutorials will start on the second week and run until the last week of class except the week of the midterm. Tutorials will cover topics taught in the previous week's lecture. In preparation for the tutorials, you should do weekly non-credit assignments. There will be short **quizzes every other week starting from week 3** based on previous 2 week's lectures and non-credit assignments. You have to write the quizzes in your assigned tutorial (otherwise you will get zero). Out of the 5 quizzes, your lowest one will be dropped. The remaining 4 will worth 12% (3% each). You don't need to submit any paperwork for your first missed quiz as the lowest mark will be dropped. You may shift the weight of one missed quiz (3%) to the final in case it's missed for a valid reason. **If you miss more than two quizzes**, you will get zero for the third and onward quizzes irrespective of the cause. There are no make-up quizzes. You only write your quiz in your tutorial section.

- Quiz-1: will cover Week-1 and Week-2 materials

- Quiz-2: will cover Week-3 and Week-4 materials

- Quiz-3: will cover Week-5 and Week-6 materials

- Quiz-4: will cover Week-7 and Week-8 materials

- Quiz-5: will cover Week-9 and Week-10 materials

8 Evaluation

- **Quizzes + Assignment:** 12% + 3% = 15%

- **Mid-term test:** 35% , (Mar 03, Tue 3-5pm)

- **Final:** 50% (will cover everything taught in the course, scheduled by the faculty of arts and science)

9 Missed test

There are **NO make-up tests**. If a test is missed for a valid reason you need to submit appropriate paper works within three business days its weight will be shifted to the final exam. In that case your final will worth 85%. If you fail to submit appropriate paper works within three business days your midterm grade will be zero.

10 Calculators

Hand calculators will be needed for this course. **No phone calculators** are allowed in tests/exams/quizzes. Any regular one with a square root and logarithmic function will do.

11   Communicating with your Instructor

Please do not email your instructor 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. 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 to set up a one-on-one meeting.

12   Academic Integrity

You are responsible for knowing the content of the University of Toronto's Code of Behaviour on Academic Matters (`https://www.academicintegrity.utoronto.ca/perils-and-pitfalls/`).

Table 1: STA255, Winter 2020 **tentative** lecture guide

Week	Dates	Readings	Quiz
1	Jan 06 - 10	Ch2: Probability, Introduction to R	-
2	Jan 13 - 17	Ch3: Discrete Random Variables and Probability Distributions	-
3	Jan 20 - 24	Ch3 cont... & Ch4: Continuous Random Variables and Probability Distributions	1
4	Jan 27 - 31	Ch4 cont...	-
5	Feb 03 - 07	Ch5: Joint Probability Distributions	2
6	Feb 10 - 14	Ch6: Statistics and Sampling Distribution	-
-	Feb 17 - 21	Reading week (No lecture/tutorial/office hours)	-
7	Feb 24 - 28	Ch7: Point Estimation	3
8	Mar 02 - 06	Ch8: Interval Estimation	Week of Midterm No tutorial
9	Mar 09 - 13	Ch9: Test of Hypothesis	4
10	Mar 16 - 20	Ch10: Inferences based on two samples	-
11	Mar 23 - 27	Ch12: Regression and Correlation	5
12	Mar 30 - Apr 03	Ch12 cont... & Review	-