STA255 - Statistical Theory - Winter 2019

Instructor: Fode Tounkara

- **Office:** SS 6011
- **E-mail:** f.tounkara@utoronto.ca

- **Office hours:**
  - LEC0201: Wednesday 3-4 pm or by appointment
  - LEC0301: Wednesday 4-5 pm or by appointment

Meeting Information:

Section	Lectures	Tutorial
LEC0201	Tuesday 3-4pm in PB B150 Thusday 3-5pm in PB B150	Tuesday 4-5pm
LEC0301	Wednesday 1-2pm in PB B150 Friday 1-3pm in PB B150	Wednesday 2-3pm

Textbooks:

- *Mathematical Statistics with Applications*, 7th edition by Wackerly, Mendenhall and Schaeffer

The above textbook comes with the Student Solutions Manual which is also available for purchase.

Course website

- Course materials are available through the learning portal at **https://q.utoronto.ca**.

Course Description:

This courses deals with the mathematical aspects of some of the topics discussed in STA250H1. 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).

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

Important Note: I strongly encourage you to attend lectures and take notes. You are also strongly encouraged to take advantage of the office hours to discuss any questions that you have.

Tutorials

Tutorials begin in the week of Jan 14-18. Tutorials meet every Tuesday 4-5pm (for LEC0201) and every Wednesday 2-3pm (for LEC0301). Tutorial rooms will be posted on the course web site prior to Jan 14. Assignments will be posted on the course web site, consisting of suggested exercises, mostly from the textbook. Bring your solutions to tutorials, along with your questions about these exercises or the related theory and concepts.

Statistical Software

In this course, **Statistical programming language and environment R** will be used to analyse data. **R** is freely available for download at

- **R** : https://www.r-project.org/

Rstudio is a good integrated development environment to **R**. It is also freely available at:

- **Rstudio** : https://www.rstudio.org/

Good online reference

- https://cran.r-project.org/doc/contrib/Torfs+Brauer-Short-R-Intro.pdf

For assignment, you will use **Rmarkdown** to write your solution.

Statistics Aid Centre

Your primary source of help with difficulties is your TA in the scheduled tutorial, but additional assistance can be obtained at the Statistics Aid Centre, Room 1091, in Sidney Smith Hall. Your own TA will be on duty one hour per week, but you may drop in on any of the TAs for the course. Schedules will be posted on the course web page. Also, check out the New College Aid Centre, where an experienced Statistics TA will hold regular hours – check http://www.utstat.utoronto.ca and click on Statistics Aid Centres, for schedule.

Evaluation

Weekly Quizzes

- In class, tutorial time
- 15 % of the final mark

Midterm exam

- LEC0201: Tuesday February 26th (provisional)
- LEC0301: Wednesday February 27th (provisional)
- 30 % of the final mark

Programmable calculators are not permitted on tests and exam. A one-sided 8-1/2"x 11" aid sheet, hand-written, is allowed on the test (two-sided on final exam). You must bring your student identification to the term test as well as the final exam. The day and time for the final exam will be announced later.

Final exam

- Scheduling by the faculty
- 55 % of the final mark

Weekly Quizzes

Quizzes will be given in tutorial. A typical quiz will be a sort question. Your TA will record your mark for each quiz. So be sure to attend the correct tutorial, and to know your TA's name. If any problems regarding quizzes arise, please contact your TA first.

Midterm Test/ Final Exam

Programmable calculators are not permitted on tests and exam. A one-sided 8-1/2"x 11" aid sheet, handwritten, is allowed on the test (two-sided on final exam). You must bring your student identification to the term test as well as the final exam. The day and time for the final exam will be announced later.

Note: I do not negotiate grates unless a mathematical error has been made on my part.

Missed Tests:

If a test is missed for a valid reason, you must submit the University of Toronto Student Medical Certificate, completed by your doctor, to your instructor within one week of the test. Print on it your name, student number, and date. If documentation is not received in time, your test mark will be zero. If a test is missed for a valid reason, its weight will be shifted to the final exam.

Course Outline (Subject to change, and will update gradually)

Topics covered will be selected from the corresponding chapters/sections in the textbook :

Week 1: Review of some statistical concepts. Basic concepts and axioms of probability. (ch. 1, ch. 2 (sec 1-4))

Week 2: Probability and counting rules: the sample-point method, tools for counting sample points, conditional probability and independence of events, two laws of probability, the event-composition method, Bayes' rule. Random variables. (ch. 2 (sec 5-13))

Week 3: Probability distribution for a discrete random variable. Expected value of a random variable or a function of a random variable. Binomial distribution. Geometric distribution. Hypergeometric distribution. Poisson distribution. Moments and moment generating functions. (ch. 3 (sec 1-9))

Week 4: Probability distribution for a continuous random variable. Uniform distribution. Normal distribution. Gamma and exponential distributions. (ch. 4 (sec 1-6, 9))

Week 5: Bivariate and multivariate probability distributions. Marginal and conditional distributions. Independence. Expected value, covariance and linear combinations of variables. Multinomial probability distributions. (ch. 5 (sec 1-9))

Week 6: Functions of random variables: the distribution function and transformation methods. (ch. 6 (sec 1-5))

READING WEEK: NO CLASSES

Week 7: // TERM TEST tentatively set for Feb 26 (LEC0201) Feb 27 (LEC0301) on weeks 1- 6 material //

Week 8: Sampling distributions related to the Normal distribution (t, chi-square, F). Central Limit Theorem. Normal approximation to the binomial distribution. (ch. 7 (sec 1-6))

Week 9: Estimation: Point estimates and confidence intervals. Normal estimators. Pivotal method. Large-sample CIs. Sample size. CI for sigma. (ch. 8)

Week 10: More on estimation: efficiency, sufficiency, consistency. Method of maximum likelihood. (ch. 9 (sec 1- 7))

Week 11: Tests of hypothesis. Decision errors, and power. P-values. Large sample and small sample tests for means and proportions. Test for variance(s). Power of tests and Neyman-Pearson Lemma. Likelihood ratio tests. (ch. 10)

Week 12: Linear regression models and the General Linear Model. (ch. 11 (sec 1-7))

Marking concerns:

Any requests to have marked work re-evaluated must be made in writing within two weeks of the date the work was returned to the class. The request must contain a justification for consideration.

How to communicate with your instructor

- Questions about course material such as:
  - How do I do question 3.7 in the textbook?
  - What is standard deviation?
  - When is the midterm?

should be posted on the discussion forums on Piazza. Questions can be posted anonymously (so that the author is anonymous to other students but not to the instructors), if desired.

- For private communication, such as:
  - I missed the test because I was ill.

e-mail your instructor, and include your full name and student number..

Note: I will only respond to e-mails you send me if they come from your e-mail account *@utoronto.ca.*

University of Toronto academic integrity

You are responsible for knowing the content of the University of Toronto's Code of Behaviour on Academic integrity at http://www.governingcouncil.utoronto.ca/Governing_Council/policies.htm. If you have any question about what is or is not permitted in this course, please do not hesitate to contact your instructor.

Students with Disabilities

I am committed to teach every student in this course. 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 Service as soon as possible at https://www.

utoronto.ca/accessibility. Students who may need course adaptations because of disability are welcome to make an appointment to see me during office hours.

Your responsibility

The course is designed to actively engage you in the course material. We hope you'll find the subject of statistics interesting, challenging, and fun, and an excellent opportunity to truly learn the material. In order for these sessions to be effective, preparing by learning about the week's concepts through the notes is essential.