

# UNIVERSITY OF TORONTO

## DEPARTMENT OF STATISTICS

### STA 255H1S– STATISTICAL THEORY Course Outline–Summer 2016

- Lectures:** Tuesdays and Thursdays 7–10 pm in LM 162
- Instructor:** Dr. Luai Al Labadi  
**E-mail:** luai.allabadi@utoronto.ca  
**Office hours:** T and R 4:00–5:00 pm in SS 6011
- Tutorials:** Tuesdays and Thursdays 6–7pm in BF 323 (T5010A; A-Jo),  
or SS 1088 (T5010B; Jp-Ve) or WI 523 (T5010C; Vf-Z)
- Teaching Assistants:** Han (T5010A), Peiliang (T5010B) and Ruilin (T5010C)  
**Office hours :** M 5–6pm, T 5–6pm and R 5–6pm in SS 1091
- Course website:** Available through <https://portal.utoronto.ca> (UT Blackboard)

#### Course content

This course deals with mathematical and computational aspects of topics, discussed in STA220H1. Students will extend their learning of fundamental concepts of statistics, in both theory and application, by using mathematical and statistical software. In particular, topics include probability, discrete and continuous distributions, conditional probability, expectation, moment generating functions, multivariate distributions, functions of random variables, sampling distributions, methods of estimation, hypothesis testing and linear regression.

#### Pre-requisite

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

Exclusion: ECO227Y1/STA257H1/STA261H1/STA247H1/STA248H1

#### Required Textbook

*Mathematical Statistics with Applications, 7th edition* by Wackerly, Mendenhall and Scheaffer  
(Brooks / Cole)

The above textbook packaged with the Student Solutions Manual would be ideal.

#### Evaluation

	Weight	Date	Time	Location
Tutorial quizzes	15%*	June 30–Aug. 4	(10–15 mins)	In tutorials
Term Test	35%*	Thursday, July 14	6:10–8:00pm	EX 100
Final Exam	50%*	TBA	(3 hrs)	TBA

\*If your final exam mark is better than your term test mark then the exam weight will be 65% and the term test weight will be 20%. Your lowest quiz score will be dropped and the rest will be

averaged for 15% of the final grade.

Non-programmable calculators are permitted on the test and exam. A one-sided, handwritten 8-1/2" x 11" aid sheet is allowed in the test (two-sided on the final exam). You must bring your student identification to the term test as well as the final exam.

If the test is missed for a valid reason, you must submit appropriate documentation within one week of the test. If documentation is not received in time, your test mark will be zero. If the test is missed for a valid reason, its weight will be shifted to the final exam. Requests for test remarking must be submitted at the time the test is returned back to you. The request must contain a justification and will only be considered for tests which were written in ink.

### **Tutorials**

Tutorials begin June 30. Tutorials meet every Tuesday and Thursday 6-7pm. Tutorial sections will be posted at the course web site prior to June 28. Practice problems will be assigned weekly and will be posted on the web-site. They are not to be handed in. They will be appropriate preparation for the tutorial discussion and quizzes. Bring your solutions to tutorial, along with your questions about these exercises or the related theory and concepts. There will be a short quiz at the end of every tutorial (except midterm day (July 14) and the last day of classes (August 4)).

### **Statistics Aid Centre (from June 28)**

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 at the course web page. For additional assistance, try using the course's online discussion forum.

### **Computing**

This course requires some basic computing. We will use the R computing package for all examples and provide sample code that would be sufficient for you to complete assignments. Additional help with R will be provided during lectures, and during TA and instructor office hours.

You may use other statistical software such as MINITAB, SAS, Stata or SPSS to complete the assignments but we will not be providing support for their use.

If you wish to use R at Uof T, then you will need to sign up for a CQUEST account. To find out more, go to <http://www.cquest.utoronto.ca>.

### **Course website**

The course website is available through portal and will be regularly updated with lecture notes, practice problems, assignments, and readings. Blackboard will also be used for announcements and your grades. The discussion board will be open to all and you are encouraged to use it for course-related questions. TAs will moderate the discussion and will respond to questions within one business day.

### **Communication**

In general, I am not able to answer questions about the course material by e-mail. Students are encouraged to attend lectures, Instructor and/or TA office hours, or post questions about the course material on the discussion board on Blackboard. E-mail is appropriate for personal matters only.

Use your [utoronto.ca](mailto:utoronto.ca) or [mail.utoronto.ca](mailto:mail.utoronto.ca) account and write a proper email including the addressee, your name and student number. I will generally answer e-mail within one business day.

### 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](mailto:accessibility.services@utoronto.ca) or <http://www.accessibility.utoronto.ca>.

### Academic Integrity

You are responsible for knowing the content of the University of Toronto's Code of Behaviour on Academic Matters at <http://www.artsci.utoronto.ca/osai/students>. If you have any questions about what is or is not permitted in this course, please do not hesitate to contact me.

### Your responsibility

The classroom sessions for this class are designed to actively engage you in the course material. We hope you'll find them interesting, challenging, and fun, and an excellent opportunity to truly learn the material. In order for these sessions to be effective, coming prepared, by learning about the week's concepts through the textbook, is essential.

### Tentative Lecture Schedule

Day	Topics	Text Chapter(s)
June 28	Review of some statistical concepts from last term. Basic concepts and axioms of probability.	1-2
June 30	Probability and counting rules. Random variables and expectation. Binomial distribution.	2-3
July 5	Hypergeometric distribution. Poisson distribution. Negative binomial and geometric distribution. Moment generating function (mgf). Chebyshev's rule.	3
July 7	Continuous distributions. The (cumulative) distribution function and the pdf. Uniform distribution. Normal distribution. Gamma and exponential distributions. Beta distribution. Mgf's again.	4
July 12	Joint, marginal and conditional distributions. Independence. Expected value, covariance and linear combinations of variables. Multinomial and bivariate	5
July 14	<b>Term test.</b> Abbreviated lecture on functions of random variables: the distribution function and transformation methods. The mgf method.	6
July 19	Intro to sampling distributions, sampling distributions related to the Normal. Central Limit Theorem. Normal approximation to Binomial.	7
July 21	Point estimates. Bias and mean square error. Error of estimation. Confidence intervals. Pivotal method. Large sample CIs.	7-8
July 26	CIs for means and proportions. CI for sigma. Methods of estimation: method of moments, maximum likelihood estimation.	8-9
July 28	Tests of hypothesis. Decision errors, and power. P-values. Large sample and small sample tests for means and proportions. Test for variance(s).	10
August 2	Power of tests and Neyman-Pearson Lemma. Likelihood ratio tests. The General Linear Model and least-squares. Simple linear regression.	10-11
August 4	Regression inference. Review.	11