

## STA261H1F – Probability and Statistics II

### Winter 2016

**Lectures:** L5101: W7-10pm in SF 1105

**Tutorial:** W6-7pm

**Instructor:** Craig Burkett ([burkett@utstat.utoronto.ca](mailto:burkett@utstat.utoronto.ca))

**Office:** SS 6015

**Office Hour:** Wed. 5-6pm

**Web-page:** <http://portal.utoronto.ca> (U of T Blackboard)

**TA office:** SS 1091

Phil: Fri 10-11; Stephen Tues 10-11

*During the office hours, a teaching assistant will be available to answer questions.*

**Overview:** This course introduces the student to the main ideas in the statistical sciences. Topics include the likelihood function and its applications, sampling, estimation, confidence intervals and hypothesis testing, consistency, sufficiency, linear models and regression. This course will also be an opportunity to develop skills in data analysis for which the R software program will be taught.

**Textbook:** The required textbook is *Mathematical Statistics and Data Analysis 3e* by John A. Rice. We will be covering most of Chapters 8, 9, 10 and 11, with the option to go further. Another good textbook previously used in the course is *Mathematical Statistics with Applications 7e* by Wackerly, Mendenhall & Scheaffer.

#### Prerequisite

Students should have STA257 or equivalent preparation. Students are also expected to have the mathematics pre- and co-requisites required by students in all courses leading up to STA261. Students requesting prerequisite waivers should read this first:

<http://utstat.toronto.edu/burkett/PreReqs.html>

#### Practice Problems

Assigned practice problems are **not** to be handed in. They are simply for your own practice, for the quizzes and tests.

## Evaluation

The grading scheme is as follows:

Weekly Quizzes	20%	In tutorial
Mid-term Test	30%	Wed. March 2
Final exam	50%	During exam period

The test room will be posted on the course website prior to the test, if not in the lecture.

## Professor Contact

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There are various ways in which the TAs and I would be happy to serve you. Here are some rough guidelines:

- If you have a personal issue that you believe I can resolve in a few minutes, please speak to me before or after lecture, or during a break. You can also come to office hours if you require more time or privacy.
- If you'd like to discuss the class material in more depth, please come to office hours. You can also try me after class or at a break.
- If you'd like to discuss the solution to homework questions, please ask the TA in tutorial. They will probably be more familiar than me with specific questions.
- If you want to ask a question about the course content, an announcement that was made in class but you missed it because you were not present or not listening, please use the discussion forum on Portal.
- If you have an issue that must be dealt with by me, and can be handled in three sentences of text or less, or to report a problem with Portal or the assigned homework, or to inform me of something relevant to the course (such as a missed test), please send me an email.
  - If your email can be answered by reading this syllabus or the Portal discussion forum, I will not answer it. Please don't be offended.

**NB:** I don't check email constantly as, believe it or not, I don't have a mobile phone. I also teach several hundred students (~ 660 this term), and cannot handle the volume of emails that come through with that number. Further, I don't really like sending/receiving emails, and would much prefer that you speak to me in person. That said, if you believe an email is appropriate, please email me using your [\\*@utoronto.ca](mailto:*@utoronto.ca) or [\\*@mail.utoronto.ca](mailto:*@mail.utoronto.ca) address. You won't get a response if you email from other email addresses, and it probably won't even be read since my spam filter may block it. The reason for this is so that I know whom I am writing to, and so that I don't provide any personal information to someone who shouldn't be receiving it. Also, please put "STA261: " at the start of your subject, as I teach multiple courses most terms.

## Important Notes

- If a test is missed for a valid reason, you must provide appropriate documentation, such as the University of Toronto Medical Certificate, University of Toronto Health Services Form, or College Registrar's Letter. You must submit this documentation to the course Instructor within one week of the test. Print on it your name, student number, course number and date, and have the doctor record the reason for the visit. No notices will be accepted without a CPSO number stamped on the form (ie. they must be a doctor in the *western* sense of the word, not somebody who reads tea leaves).
- If documentation is not received in time, your test mark will be zero. If the test is missed for a valid reason, I reserve the right to force you to make up the test OR to shift the weight to the final exam, at my discretion. Most likely you will be writing a makeup test.
- Any requests to have marked work re-evaluated must be made **in writing** within one week of the date the work was returned to the class. The request must contain a justification for consideration; do not simply write "please see #3".
- The course website will be used to post lecture notes, R examples used in lectures, practice problems, past tests/exams, other course info and important announcements. **Check it regularly.** The website also has an electronic discussion forum that you can use to communicate with other students in the course.
- If an urgent matter arises, I may contact the entire class by email. In order to receive these messages, please make sure that your ROSI account has your **utoronto.ca** email.
- In general, I am not able to answer questions about the course material by email. Before sending an email, make sure that you are not asking information that is already on the course website, or questions about the course material that are more appropriate to discuss through the forum.
- Questions about the course material can be posted on the discussion board on Blackboard. Other students may be able to answer your questions very quickly, and the TAs will check the board regularly as well.



## Computing

We will be using R in this course. You can download R for free at:

<http://cran.r-project.org/>

Don't forget to select the correct operating system! This site will give you a file to install base R on your system. Other than an initial quick demo of base R, I will demonstrate R using RStudio, a GUI for R that is superior in many ways, in my opinion.

You can find it here, also free:

<http://www.rstudio.com/products/rstudio/download/>

I will not assume that you have used R before, and will teach it from scratch. There are also many good online R tutorials – you can find them easily by searching; here are a few to get you started:

<http://www.r-tutor.com/r-introduction>

<http://www.statmethods.net/about/books.html>

<https://www.datacamp.com>

There is also this free, self-paced online course developed by a colleague of mine:

<http://bigdatauniversity.com/bdu-wp/bdu-course/introduction-to-data-analysis-using-r/>

## Academic Integrity

Obviously, it is an academic offence to use or provide other students with unauthorized aids during quizzes and term tests. Unauthorized aids include but are not limited to: notes, cell phones, another student's paper (direct copying), whispering answers, etc.

Especially note that **it is an academic offence to present someone else's work as your own, or to allow your work to be presented for this purpose**. To repeat: the person who allows her/his work to be copied is equally guilty, and subject to disciplinary action by the university. **Don't copy, and don't let anyone else copy from you**. You are expected to do the work yourself.

For more detail, the latest version of the student handout "How not to Plagiarize" is available at

<http://www.writing.utoronto.ca/advice/using-sources/how-not-to-plagiarize> The Academic

Regulations of the University are outlined in the Code of Behaviour on Academic matters, which can be found in the Arts and Science Calendar or on the web at

<http://www.governingcouncil.utoronto.ca/policies/behaveac.htm>.

## Course Schedule

This schedule represents my estimate of how quickly we will move through the course. It will probably change throughout the year, perhaps drastically. Keep your seatbelt on!

Lecture no.	Date	Rice Reference	Topic	Practice Problems
1	13-Jan	2.3, 4.5	Introduction, review of MGFs, Change of variables, Introduction to R	2: 57, 59, 60, 61, 63 4: 79, 81, 83, 85, 86, 89, 91, 97
2	20-Jan	3.6	Transformations of jointly distributed variables, random number generation	2: 67, 71, 72 3: 1, 2, 3, 7, 9, 19, 43, 52, 55, 59
3	27-Jan	3.7 5	Order statistics, Convergence in distribution & probability, CLT	3: 65*, 66, 67, 69, 77 5: 3, 5, 7, 15, 16, 25, 30
4	3-Feb	7** 8.3-8.4	LLN, Basics of Sampling Estimation, Method of Moments, Sampling Distributions	8: 1, 4a, 5a, 7a, 10, 16a, 17ab, 18a
5	10-Feb	8.5	Sampling Distributions Maximum Likelihood Estimation Numerical methods for MLE	8: 4c, 5bc, 7b, 13, 16b, 17c, 18b, 19ab
	17-Feb	----- <b>Reading Week (no classes)</b> -----		
6	24-Feb	8.7	Unbiasedness, Consistency, Relative efficiency, the German Tank Problem	See Portal note
7	2-Mar	<b>Midterm Test (no quiz this week)</b>		
8	9-Mar	8.7 8.8	Asymptotic variance, Cramer-Rao bound, Sufficiency, Factorization theorem, Rao-Blackwell, MVUE	8: 7c, 16cd, 17de, 18cd, 19c, 21
9	16-Mar	9.1 9.2	Likelihood ratio, the Neyman-Pearson lemma, significance, p-value, UMP tests	9: 1-9, 11, 12, 14, 16
10	23-Mar	9.3-9.4	CIs and hypothesis tests, generalized LRT,	9: 17, 21, 23, 24, 26-28, 32
11	30-Mar	9.5 9.8-9.9	LR t-test, MN distribution, GoF tests, probability QQ plots	9: 33, 36, 37, 40, 56, 57
12	6-Apr	11.1-11.2	Two-sample tests, power, ...	11:

\*  $\lambda$  in the text is  $1/\beta$  from class (inverse of the mean)

\*\* Just skim the chapter, no need to worry about all the formulas and math here