

STAT 300: Intermediate Statistics for Applications
Winter Term 1 2018/2019
Syllabus

Aims and objectives: The course aims to be a second course in statistical science, reinforcing and extending ideas encountered in a typical first course in the discipline. The course will expose learners to a wide range of applied statistical methodology, complementing concepts appearing in their first course. Detailed learning objectives for the course will be available on-line on *Canvas*.

Pre-requisites: One of STAT200, STAT241, STAT251, COMM291, BIOL300, FRST231, ECON325, or equivalent

Co-requisites: None

Course website: canvas.ubc.ca

Instructors: Melissa Lee & Marie Auger-Méthé

Lectures: MWF- 15:00-16:00, Hennings 200

Course assessment:

Assessment	Date	Percentage
Class participation and performance via iClicker	in-class	5%
WeBWork Online homework	Weekly	10%
Labs	Weekly	10%
Three written assignments	Fri Sep 28, Fri Nov 2 & Fri Nov 23	10%
Midterm	Fri Oct 12 (50 min, in class)	20%
Final exam (you must pass the final to pass the course)	To be scheduled by Classroom Services	45%

The usual university rules for extenuating circumstances and plagiarism apply. Dates for the setting and completion of the on-line WeBWorK homeworks will be listed on *Canvas*.

Clickers: We will be using iClicker in lectures. iClicker is a response system that allows you to respond to questions posed by instructors during class, and you will be graded on your participation and performance. You are required to purchase an iClicker remote for in-class participation. You must register your clicker on *Canvas*. Your lowest three clicker sessions will be excluded from your final grade at the end of the semester.

Labs: Labs start the second week of class. We will use R Commander for data analysis. You will have registered for a lab when you enrolled in the course, and only under exceptional circumstances should you switch from this session to another.

Piazza discussion forum: This term we will be using Piazza for class discussion. The system is highly catered to getting you help fast and efficiently from classmates, the TAs, and your instructors. Rather than emailing questions to the teaching staff, we encourage you to post your questions on Piazza. If you have any problems or feedback for the developers, email team@piazza.com.

Teaching methods: This class uses a flipped classroom approach, where students engage with course material before class and participate in activities during class time. Classes of approximately fifty minutes of duration will occur three times a week, with sets of notes being available from *Canvas* in advance. In all sessions, an in-class activity will replace at least part of the lecture component. Guided reading or other activities may be set at the end of one lecture to be completed prior to the next. On-line *pecasts* are available covering some of the course material. There will be required lab sessions most weeks. *Canvas* will include detailed material covering the course content, plus other sundry resources like solutions to exercises when appropriate and an on-line forum. A calculator will be necessary for many of the activities, so please bring one to class.

The current education literature suggests that the flipped classroom model can increase student performance in tests, quizzes, and homework, as well as improve students' understanding and retention of new material. To learn more about the flipped classroom model, go to: <http://flexible.learning.ubc.ca/research-evidence/research-articles-2/flipped-classroom/>

Programme of work: The study time should total around eight hours per week. So in addition to the contact hours, it is essential that learners spend no less than four hours per week on self-study for the course. It is suggested at least two hours per week are spent on revising and assimilating the material covered in the lectures or on guided reading, and at least two hours should be spent attempting the exercises and assignments that are set.

Feedback: After all assignments have been submitted and marked, individual feedback will be provided in the form of brief notes on marked work. Detailed written comments will also be provided on *Canvas* where appropriate.

Recommended texts: There is no core text, but there are numerous books that cover at least some of the material in this course, and it is suggested you try the UBC library stock to find those that suit you. There are few books that aspire to support a second course in Statistics. A good one though is

- Ramsey, F.L. and Schafer, D.W. (2002): *The Statistical Sleuth: A Course in Methods of Data Analysis* (2nd edition). Brooks/Cole.

It is likely that the textbook used for a pre-requisite course will cover some of the material in this course. In particular, later chapters of

- Moore, D.S. and McCabe, G.P. (2012): *An Introduction to the Practice of Statistics*. (7th edition). Freeman.

include content relevant to this course. Similarly other introductory texts are useful in containing parts of the content of the course, such as

- Walpole, R.E, Myers, R.M., Myers, S.L. and Ye, K. (2007): *Probability and Statistics for Engineers and Scientists*. Pearson/Prentice Hall.
- Whitlock, M. and Schluter, D. (2008): *The Analysis of Biological Data*. Roberts and Company.

There are useful books available electronically via the library. These include the following which provide details for implementing methods used using the statistical software package R:

- Ekstrom, C. T. (2012): *The R Primer*. Chapman and Hall/CRC
- Hay-Jahans, C. (2012): *An R Companion to Linear Statistical Models*. Chapman and Hall/CRC
- Hothorn, T. and Everitt, B.S. (2010): *A Handbook of Statistical Analyses Using R*. (2nd edition) Chapman and Hall/CRC

Searching for additional readings: Many of the activities, assignments, etc are based on studies published in scientific articles. These articles will be referenced in the activity and you can find them on-line using the title of the article or the last names of the authors as keywords. If you are on campus you can find these either by using *Google scholar* (scholar.google.ca) or through the UBC library search engine (www.library.ubc.ca). If you are off-campus, it might be easier to use the UBC library search engine. But if you want to use Google scholar, you can use UBC library EZ-proxy tools available at services.library.ubc.ca/electronic-access/connect/ezproxy-toolkit.

Schedule: Below is a provisional guide to the lecture slots available. It is possible the material covered in the classes will differ slightly from the description below.

1. Introduction, motivation. Pre-test.
2. Review of fundamental ideas.
3. Nonparametric methods: The sign test.
4. The rank sum test.
5. The Kruskal-Wallis test.
6. Permutation tests.
7. The power of hypothesis tests.
8. The Chi-squared test of goodness-of-fit.
9. Goodness-of-fit for contingency tables.
10. Investigating the fit of a model.
11. Fisher's exact test.
12. Probability plots for model fitting: Normal scores plots
13. Experimental design review: response variables, factors, blocking.
14. ANOVA: Review of concepts.
15. Review
16. Midterm test
17. Analysing variance by breakdown of sums of squares.
18. Multiple comparisons
19. Interaction in two-way ANOVA
20. Inference in two-way ANOVA

21. Contrasts
22. Introduction to the bootstrap
23. Bootstrap testing and interval estimation
24. Selected alternative designs: nested, factorial and fractional designs
25. Review of regression concepts
26. Sums of squares in regression
27. Properties of estimators in regression
28. Multiple linear regression
29. Curve fitting via regression
30. Residuals in regression
31. Dummy variables in regression
32. Odds ratios for 2x2 tables
33. Introduction to logistic regression
34. Introduction to time series: descriptive methods
35. Smoothing time series
36. Review