STAT 300: Intermediate Statistics for Applications
Winter Term 1 2022/2023
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*.

Teaching style: This course is delivered with a flipped-classroom approach, where little time is devoted to seminar-style lectures. Instead, students learn by directly engaging with the material, for example through in-class group activities. See below for more detail.

Pre-requisites: One of STAT200, STAT203, STAT241, STAT251, BIOL300, COMM291, ECON325, ECON327, FRST231, POLI380, PSYC218, PSYC278, PSYC366, or equivalent

Co-requisites: None

Course website: canvas.ubc.ca

Instructors: Marie Auger-Méthé, auger-methe@stat.ubc.ca

Lectures: MWF- 15:00-16:00, Sept 6 - Dec 7 in Hennings 200

Covid statement: If you are sick, it is important that you stay home - no matter what you think you may be sick with (e.g., cold, flu, other). You can do a self-assessment for Covid symptoms here: `https://bc.thrive.health/covid19/en`. If you think you might have Covid symptoms and/or have tested positive for Covid and/or are required to quarantine: Do not come to class! This precaution will help reduce risk and keep everyone safer. The UBC policies on COVID safety changes regularly, please keep an eye on `https://covid19.ubc.ca/`. If you have not yet had a chance to get vaccinated against Covid-19, vaccines are available to you for free. The higher the rate of vaccination in our community overall, the lower the chance of spreading this virus. You are an important part of the UBC community. Please arrange to get vaccinated if you have not already done so.

To make sure that you can miss class if you are sick (or for other valid reasons), I have made a marking scheme that is intended to provide flexibility so that you can prioritize your health and still be able to succeed.

- They are more details below, but in summary, we will automatically drop your: (1) 10 lowest iClicker scores, (2) 2 lowest lab scores, and (3) 2 lowest webwork scores. If you do not hand-in your written assignment, it will be automatically re-weighted into your final. You do not need to notify me, all of

these will be done automatically. Note however that these are put in place to help you if you are sick and to allow you to handle unexpected events. These lectures, labs, and assignments are all created to help you learn the material. If you miss any of these, we strongly encourage you to do the class activities, labs, and assignments on your own time.

- If you are sick on the midterm exam day, do not come to the exam. We will automatically re-weight your midterm into the final (i.e. your final exam will be worth 60% rather than 35%). You do not need to contact the instructor, this will be done automatically.

- If you are sick on a final exam day, do not attend the exam. You must apply for deferred standing (an academic concession) through Science Advising no later than 48 hours after the missed final exam/assignment. Students who are granted deferred standing write the final exam/assignment at a later date. Learn more and find the application online: `https://science.ubc.ca/students/advising/concession`

Course assessment:

Assessment	Date	Percentage
Class question (iClickerCloud)	in-class	5%
WeBWork homework	Weekly*	10%
Labs	Weekly	10%
Written assignment	Nov 18	12%
Peer evaluations of group work	Oct 28, Dec 7	3%
Midterm	**During class time! - Oct 17**	25%
Final exam (cumulative)	Scheduled by UBC, Exam period: Dec 11 - 22	35%

* Dates for the setting and completion of the on-line WeBWorK homeworks will be listed on *Canvas*.

** **Bonus points:** There will be opportunities for bonus points, e.g., points will be given to the top 10 students that provide the best answers on Piazza, bonus points will be given to students that fill in the midcourse survey.

The usual university rules for extenuating circumstances and plagiarism apply.

Canvas: is your go to place for this class! Everything you need will be available through *Canvas* and you should get familiar with all the tabs as soon as possible. See `canvas.ubc.ca`.

iClicker cloud: We will be using iClicker Cloud in lectures. iClicker Cloud is a response system that allows you to use your own computer or mobile device to respond to questions posed by instructors during class, and you will be graded on your participation and performance. You need to set up an iClicker Cloud account and add STAT 300 as a course to this account. To do so, please follow `https://lthub.ubc.ca/guides/iclicker-cloud-student-guide` for details. For us to be able to assign you your participation grade, you must link your iClicker account to *Canvas*. To do so, click the *iClicker sync* button on *Canvas* and follow the instructions. We know many students miss class due to illness, family issues, and personal reasons, and that some students register late, miss the first lectures, or and encounter problems with the iClicker system. As such, we will exclude 10 iClicker sessions from your final grade. These will either be 10 missed classes or the 10 classes with your lowest grades. You do not need to contact the instructor or TAs if you miss class, these concessions will be made by default. Participation points are only for students that are attending lectures. Using iClicker if you are not in class or asking someone else to click for you is considered cheating.

Labs: Labs start the second week of class. We will use the programming language R throughout through interactive online activities created via `learnr`. These lab activities will be hosted online via RStudio Connect. You will get a link to these lab activities via the *Assignments* tab on *Canvas* and a TA will guide you through the lab. The activity will be group based and you must attend the lab session in which you are registered! We will also explore some important concepts using Shiny apps. 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. We understand that many students miss labs for illness, family issues, and personal reasons, and that some students register late and miss the first lab sessions. As such, we will exclude 2 labs from your final grade. These will either be 2 missed labs or the 2 labs with your lowest grades. You do not need to contact the instructor or TAs if you miss labs, these concessions will be made by default. While you cannot submit a lab answer sheet past the due date, you can catch up on the material by doing the activity on your own.

Piazza discussion forum: 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 ask you to post your questions on Piazza. If you have any problems or

feedback for the developers, email team@piazza.com. The 10 students that have answered the most statistics-related questions in a way that explains concepts well but does not reveal the answer to an assignment, lab, or webwork question will get a bonus 1% added to their grade.

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 minute 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 *pencasts* are available covering some of the course material.

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`. For you to learn and enjoy the flipped classroom approach, it is essential that you actively participate in class and work with your group.

Group work/Peer evaluations: You will be assigned to a group early in the term. You will work with this group during the labs and the class activities. Group work has many benefits including refining one's understanding of topics through discussion, and learning important teamwork skills. In addition, team-working skills are amongst the most prized skills from employers. However, for group work and peer learning to be productive, all members of the group must actively participate. UBC Chapman learning commons provide helpful tools to help imporve group work: `https://learningcommons.ubc.ca/student-toolkits/working-in-groups/` To help support good group working habits, there will two peer evaluations. The first peer evaluation will be formative, and it will help students receive the feedback necessary for them to improve their teamwork skills. The second peer evaluation will be summative, and will be used to grade and assess the student contribution to the group work.

Webwork homework: Webwork homeworks are online homeworks that will take you through detailed case studies. You will get access to Webwork via *Canvas* and you will have one week to complete them. The webwork homeworks are meant to help you learn rather than assess your knowledge (it's a formative assessment). All of the webwork questions allow for multiple attempts, and thus give you the chance to learn from your mistakes. Again, we understand that many students to be unable to work for a week due to illness, family issues, and personal reasons. We also know that some students register late and miss the first webworks. As such, we will exclude 2 webwork homework from your final grade. These will either be 2 missed webworks or the webworks with your lowest grades. You do not need to notify the teaching staff, these concessions will be done automatically.

Exams: There will be one midterm exam and one final exam. If you miss the midterm, your midterm will be automatically re-weighted into the final (i.e., your final will be worth 60% rather than 25%). In addition, if your final grade is higher than the midterm grade we will use the final grade instead. However, we highly discourage that you miss the midterm for no good reason, the midterm provides a good opportunity to assess your current knowledge of the material, and helps you prepare for the final. The final exam will be cumulative (cover all the material covered in class). If you are sick on the day of the final, do not come to the exam. You must apply for deferred standing (an academic concession) through Science Advising no later than 48 hours after the missed final exam/assignment. Students who are granted deferred standing write the final exam/assignment at a later date. Keep in mind that all academic concessions are meant to support students in difficult situations, and should not be used lightly. Learn more and find the application online: `https://science.ubc.ca/students/advising/concession`.

Written assignment: There will be one written assignment. This written assignment is meant to help you master some of the material covered after the midterm. The will be a late penalty of 10% per day late for up to 2 days, and if you do not hand in the written assignment, it will be automatically re-weighted into the final (i.e., your final will be worth 47% rather than 35%). We highly recommend that you complete the assignment, as it is a great way to assess your understanding of some very important material and will help you do well on the final.

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: We provide our own course notes on *Canvas*. Students interested in reading more on the topic, can look at the following books (note none of them cover the full material from the class)

- Ramsey, F.L. and Schafer, D.W. (2013): The Statistical Sleuth: A Course in Methods of Data Analysis (3rd edition). Brookes/Cole.

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

- 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.

- 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 online 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 that the material covered in the classes will differ slightly from the description below.

1. Introduction, motivation, review of fundamental ideas

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. Introduction to the bootstrap

14. Bootstrap testing and interval estimation

15. Review

16. Midterm test

17. Experimental design review: response variables, factors, blocking.

18. ANOVA: Review of concepts.

19. Analysing variance by breakdown of sums of squares.

20. Multiple comparisons

21. Contrasts

22. Interaction in two-way ANOVA

23. Inference in two-way ANOVA

24. Further design

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

UBC policies and resources to support student success: UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious and cultural observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available at `https://senate.ubc.ca/policies-resources-support-student-success`.

Land acknowledgement: We acknowledge that the UBC Vancouver campus is situated within the traditional, ancestral and unceded territory of the Musqueam.