STAT 300: Intermediate Statistics for Applications Syllabus

Winter Term 2 2022/2023

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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: Ben Burr, ben.burr@stat.ubc.ca

Lectures: MWF - 15:00 - 16:00, Jan 9 - Apr 13 in Biological Sciences 1000

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.

Grading Flexibility: To make sure that you can miss class if you are sick (or for other valid reasons), the marking scheme is intended to provide some amount of flexibility so that you can prioritize your health and still be able to succeed. If you find you are missing weeks of class due to illness, it is recommended you contact the Academic Advisor and consider a medical withdrawal for the semester, as this amount of missed class will result in you being unable to catch up with the missed material.

1. **Dropped Scores:** There are more details below, but in summary, we will automatically drop your: (1) 3 lowest iClicker scores, (2) 1 lowest lab score, and (3) 1 lowest WeBWorK score. Please do not contact the teaching team about this. All of these will be done automatically when tabulating final grades **at the end of the term**. Note, however, that this policy is put in place to help you if you are sick and to allow you to handle unexpected events. You are expected to use the concessions listed above to accommodate unforeseen circumstances, and otherwise you are expected to accept with maturity that you were unable to complete it and to make the best of it by re-focusing your efforts on your next goal. There will be no extensions offered. These lectures, labs, and assignments are all created to help you learn the material. If you miss any of these, we will not accept late submissions beyond your Flexibility Time (described below); however, we strongly encourage you to do any missed class activities, labs, and assignments on your own time.

2. **Missed Midterm:** If you have valid grounds to miss the midterm, a concession may be granted. If you are sick on the date of the midterm exam, do not come to the exam and apply for a concession. If you miss the midterm exam for a reason not covered by the Academic Calendar, you will receive a grade of 0. These concessions are intended to allow for legitimate unavoidable circumstances as laid out under the guidelines at https://science.ubc.ca/students/advising/concession. Missing the midterm for a legitimate reason will result in 1 hour of Flexibility Time used.
3. **Missed Final Exam:** If you are sick on the day of the final exam, 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
4. **Missed WeBWorK, Labs, Assignments:** There will be no extensions or deferrals granted on assignments or WeBWorK or labs. No late labs will be accepted. There will be no make-up assignments.
5. **Flexibility Time:** Each student will be given **48 hours in total** of Flexibility Time that can be applied to the WeBWorK. If one of these assignments is handed in within the first hour (00:01 to 60:00), it is counted as 1 hour late. If one of these assignments is handed in within] the second hour after the deadline (60:01 to 120:00 late) it is counted as 2 hours late. And so on. If you hand in a WeBWorK assignment late, your flexibility time will be automatically used to compensate when tabulating grades **at the end of the term** and no marks will be deducted from the assignment. Please do not notify the teaching staff.
6. **Bonus Points:** If you do not use any flexibility time you will be granted 2% bonus on your final grade (e.g., if you score 80% in the course you will receive 82%), to a maximum of 100%.

Course assessment:

- **In-class Questions (iClickerCloud):** In-person only [10%]
- **Labs:** In-person only [10%]
- **WeBWorK Homework:** [10%]
- **Group Assignment:** [8%]
- **Peer Evaluation:** [2%]
- **Midterm Exam:** In-person only [20%]
- **Final Exam:** In-person only [40%]

Dates for the setting and completion of the on-line WeBWorK homework will be listed on Canvas. Labs are due at the end of your lab session. The date for the final exam will be announced by the university around 3 weeks before the end of term. The usual university rules for extenuating circumstances and plagiarism apply.

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 the guide at https://lthub.ubc.ca/guides/iclicker-cloud-student-guide. 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. Please ensure that you use a name that can be matched to your Canvas profile. If you have concerns about privacy, please use the first five digits of your student ID number instead. 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 3 iClicker sessions from your final grade. These will be your 3 lowest iClicker classes and will not include the iClicker sessions from the first two class days. You do not need to contact the instructor or TAs if you miss class; these concessions will be made by default when tabulating grades **at the end of the term**. Participation points are only for students who are attending lectures. Using this class's iClicker if you are not present in class or asking someone else to click for you is considered cheating and will result in a grade penalty.

Labs: Labs start the second week of class. **All labs will be counted equally.** You registered for a lab session when you enrolled in the course. You must attend the lab session in which you are registered. Only under exceptional circumstances should you switch from this session to another. Attendance will be taken. We will use the programming language R throughout through interactive online activities created via the *learnr* package. 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. We will also explore some important concepts using Shiny apps. A common and fair grading scheme will be used to grade all such assignments. No requests for re-evaluation of specific questions will be considered that would result in a student's assignment being evaluated differently than the others. We understand that many students miss labs for illness, family issues, and personal reasons, and that some students may register late and miss the first lab session. As such, we will exclude the 1 lab with the lowest score from your final grade. You do not need to contact the instructor or TAs if you miss labs. These concessions will be made by default when tabulating grades **at the end of the term**. 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.

WeBWorK homework: WeBWork homework is online homework 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. **All WeBWorK assignments will be counted equally.** The WeBWork homework is 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 may register late and miss the first WeBWork. We will drop your lowest WeBWorK grade. You do not need to notify the teaching staff; this concession will be done automatically when tabulating final grades **at the end of the term**.

Group assignment: There will be one group assignment that will be completed in class. This written assignment is meant to help you master some of the material covered after the midterm. Preparatory material will be released a few days before and the assignment will be completed with your groups on an assigned day. The assignment must be submitted at the end of the class session in which it occurs. The assignment is a great way to assess your understanding of some very important material and will help you do well on the final. If your grade has been incorrectly entered on the assignment, you will need to submit a request to correct it. A common and fair grading scheme will be used and all students will be graded the same way. No requests for re-evaluation of specific questions to dispute the grading rubric will be considered that would result in one student's assignment being evaluated differently than the others. If you miss the assignment day, you will receive a grade of 0 and no deferred or alternative assignment is available.

Midterm and Final Exams: There will be one midterm exam and one final exam. If you miss the midterm exam you will receive a grade of 0 on it. If you have **valid grounds** for an **academic concession** regarding the midterm, one may be granted if you apply for it. 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.

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 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 among 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 improve 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. It is expected that students will act with respect and maturity in their interactions with their teammates and peers at all times, both in person and in written interactions. An attempt should be made to resolve conflicts early and directly with the affected person. This demonstrates an essential skill. Should a conflict be unresolved privately, students must explain to the instructor professionally and in writing what measures they have taken to resolve the conflict, with dates and explanations when requesting mediation.

Canvas: Canvas is your place to look for information 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.

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.

Programme of work: The study time for this class 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 a topic can look at the following books. Note that 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, and topics discussed are based on studies published in scientific articles. These articles will be referenced in the particular 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* https://scholar.google.ca or through the

UBC library search engine https://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 https://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.

- Introduction, motivation, review of fundamental ideas
- Review of fundamental ideas
- Nonparametric methods: The sign test.
- The rank sum test.
- The Kruskal-Wallis test.
- Permutation tests.
- The power of hypothesis tests.
- The Chi-squared test of goodness-of-fit.
- Goodness-of-fit for contingency tables.
- Investigating the fit of a model.
- Fisher's exact test.
- Probability plots for model fitting: Normal scores plots
- Introduction to the bootstrap
- Bootstrap testing and interval estimation
- Review
- Midterm test
- Experimental design review: response variables, factors, blocking.
- ANOVA: Review of concepts.
- Analysing variance by breakdown of sums of squares.
- Multiple comparisons
- Contrasts
- Interaction in two-way ANOVA
- Inference in two-way ANOVA
- Further design
- Group Assignment
- Review of regression concepts
- Sums of squares in regression
- Properties of estimators in regression
- Multiple linear regression
- Curve fitting via regression
- Residuals in regression
- Dummy variables in regression
- Odds ratios for 2x2 tables
- Introduction to logistic regression
- Introduction to time series: descriptive methods
- Smoothing time series
- Review

Reference letters: I do not write reference letters for students in this class. Unfortunately, in a class this size, there is no way to form the type of academic relationship that would allow me to write an informative academic reference letter.

Being a TA for this Class: If you have extra time, I highly recommend that you TA or that you get involved in a research project. The STAT department is always looking for TAs, and often the professors for whom you are TAing will be happy to write you letters. If you are still at UBC next fall, the department often considers the best students from STAT 300 as potential TAs for STAT 300. If you are interested in being a TA, please take a look at https://www.stat.ubc.ca/teaching-assistants-graduate-and-undergraduate to learn about the application process.

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.