# **STAT 300 -** Intermediate Statistics for Applications

## **2021 Winter Term 2 (**January – April, 2022)

*This course will be online for a portion of the term.. We will start in-person meetings on a date yet to be determined by the University. At the very earliest, this will be Jan 24th. This date may be updated as time goes on. When we resume in-person activities, we will meet in our scheduled classroom space on campus. For meetings prior to that time, we will meet on Zoom*

**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 course page.

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

**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.

**Instructor**: Dr. W. A. Lasantha Premarathna (Email: wpremara@stat.ubc.ca ). Please use the email only for personal matters that you would want to discuss with the instructor. Please use **office hours** and **Piazza Discussion Board** for questions regarding assignment problems/text book problems/labs class note examples etc.

**Class Room:** HENN 200 (class time: 3:00pm-3:50pm on Monday, Wednesday and Friday)

- **Lectures**: **First two weeks: online, after first two weeks: in-person.** Zoom links are found through the zoom tab in the canvas page for the first two weeks.
- **Labs** (please see more information in the Canvas page)
- **office hours**: online (This might change: please see more information in the Canvas page)

**Instructor Office Hours:** online office hours (Zoom links are found through the zoom tab)

- 4:00pm - 5:00pm on Wednesday
- I will also be available for some time after the lectures on Monday and Friday

**Head TA**: Sihaoyu (Sherry) Gao (sihaoyu.gao@stat.ubc.ca)

**Teaching assistants & TA office hours:** To be announced, please check the Canvas course page.

**Course Website**: **canvas.ubc.ca**
Please check the **Canvas** website regularly to keep up-to-date with the course. Everything you need will be available through Canvas and you should get familiar with all the tabs as soon as possible.
If you have any problems related to technical issues, please use **?Help** (see the left side menu in the Canvas course page) to report the problem or to contact IT service.

**Course Assessment:**

| Assessment | Date | Percentage |
|---|---|---|
| Class participation and performance via i>clicker | in-class | 5% |
| WeBWork Online homework (x10) | See the schedule | 10% |
| Labs (x8) | See the schedule | 8% |
| Written Assignments (x2) | See the schedule | 8% |
| Pre-class quizzes | Complete before the lecture | 4% |
| Midterm | Friday, March 11 (in class) | 22% |
| Final Exam (you must pass the final to pass the course) | To be scheduled by Classroom Services. Exam schedule is released about 3 weeks before exams<br>**Exam period:** April 12-27 | 43% |

Bonus points**:** There will be opportunities for bonus points, e.g., 1 point will be given to the top 5 students that provide the best answers on Piazza.

**Policy regarding missing the midterm:**

1. There will be no make-up exam
2. Students who miss an exam should notify the instructor prior to (if possible) or immediately after the exam. Students must supply a supporting document (for example, a doctor's note will be sufficient in case of a medical emergency) within one week of the day of exam.

**Deferred Exam Policy if you miss the Final Exam:**
The policy (UBC policy) is that students who miss the final exam MUST report to their faculty advising office within 72 hours to apply for deferred standing. They must also notify the instructor to receive instructions as to when they will write their deferred final. But they will not be granted a deferred final unless they are granted deferred standing by their faculty advising office.

**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. 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.

**Piazza Discussion Board:**
You can use "Piazza Discussion Board" to post your questions. This is where you can discuss ideas, strategies, and resources for solving the problems with your classmates. Please DO NOT POST ANSWERS to the questions in the WeBWork assignments/written assignments and Labs before the due date. Instead, share your thoughts and approaches to solving the problems. Asking others how to solve a problem without first trying to solve it yourself will not be beneficial for your learning. TAs will not give the solution for assignments questions before the due date. But they will surely give hints as needed and let you know the correct directions. If you need more clarification, its always better to contact TAs or me during our office hours. Don't expect TAs will answer all your questions posted in Piazza page. We are holding lots of online office hours. I highly encourage you to use online office hours. TAs are available on Zoom. Please go to "General Information: Labs" under "Labs" or "TA Office Hours (online)" to see when TAs are available during each day from Monday to Friday. If you have any problems or feedback for the developers, email team@piazza.com.
The 5 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 point added to their grade.
**Access Piazza:** Please go to **"Piazza"** in the left menu in the Canvas course page and it will open in a new window. Then you can sign up for the class page.

**WeBWork:**
Please see the WebWork assignments open and due dates in the Canvas course page.
**Access WeBWork:** Please go to **"WebWork"** in the left menu in the Canvas course page.

**Labs**: There are 10 Lab assignments. Please read more information about lab under "Labs" in Canvas course page.

**Crowdmark**: Crowdmark is an online grading and analytics application. You need to submit (upload) your answers to assignments in Crowdmark. Graded assignments will also be available one week after the due date. I will provide Crowdmark link when assignments are posted. You also will receive an email when a Crowdmark assignment available. If you cannot see STAT 300 course in Crowdmark, you are probably using the wrong email address. Then try with your other emails. The correct email will show you the STAT 300 course. If you still have problems, please contact lt.hub@ubc.ca . Do not use multiple email addresses to access Crowdmark. If you use multiple emails, your grade will not be correctly sync with the Canvas grade book.
**Access Crowdmark:** you can see where to upload your assignment when they are ready. You will be able to access Crowdmark only when the first assignment is available there.

**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 pencasts 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 nine 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.

**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. (2013): The Statistical Sleuth: A Course in Methods of Data Analysis (3rd edition). Brookes/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.

**Lecture 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, 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. Experimental design review: response variables, factors, blocking.
16. ANOVA: Review of concepts.
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. Selected alternative designs: nested, factorial and fractional design
23. Review
24. Midterm test
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

## Academic Integrity: Class Policies on Exams and Assignments

**Exams:**

- Exams are in-person

**Assignments/Canvas quizzes/WeBWork/Labs:**

- Discussion of ideas leaned in class is encourage (with other students, TAs or the instructor). This helps the leaning process. But individual work turned in by each student should be your own work. Do not copy or paraphrase solutions from other students or from other sources. Do Not provide your solutions to another student. Failure to comply with these rules will result in an automatic 0 for your work, and additional academic penalties.

For more information, please see

Academic Honesty and Standards: http://www.calendar.ubc.ca/Vancouver/index.cfm?tree=3,54,111,958

Academic Misconduct: http://www.calendar.ubc.ca/Vancouver/index.cfm?tree=3,54,111,959

Disciplinary Measures:http://www.calendar.ubc.ca/Vancouver/index.cfm?tree=3,54,111,960

**Note:**

- Please check the Canvas course page regularly.
- No late submission (WebWork/Written Assignments/Labs/Exams) will be accepted.
- You are allowed to discuss lab assignment/WebWork/ Written Assignment questions with other students via Piazza discussion board. But DO NOT post answers in the Piazza page.
- Grades change request forms (for midterm and assignments) should be submitted within one week after grade released/post solution on canvas page. Remarking request should only be raised when you are sure that the markers have made a mistake in marking your paper when you compare your paper with marking scheme. Remarking is not meant to give students a way to ask for more marks
- I will not be able to answer your questions about assignment problems/text book problems/ class note examples etc. by emails. I hope you can understand that as there are around 600 students in

my class in this term and how hard to explain answers to your questions through emails. Please use **online office hours** and **Piazza Discussions** for those kind of questions**.** Please use the instructor email only for personal matters (eg. if you are going to miss the midterm exam due to some unavoidable circumstance etc. or some other important matter related to the course) that you would want to discuss with the instructor. We are always there to help you guys during our (TAs and mine) online office hours.

**Reach Out for Success**

- University students often encounter setbacks from time to time that can impact academic performance. Discuss your situation with your instructor or an academic advisor. Learn about how you can plan for success at: www.students.ubc.ca
- For help addressing mental or physical health concerns, including seeing a UBC counsellor or doctor, visit: https://students.ubc.ca/health-wellness

**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.

## Covid Safety in the Classroom (when Classes are in-person)

**Masks:** Masks are **required** for all indoor public spaces on campus, including classrooms, as per the BC Public Health Officer orders and UBC policy. For our in-person meetings in this class, it is important that all of us feel as comfortable as possible engaging in class activities while sharing an indoor space. For the purposes of this order, the term "masks" refers to medical and non-medical masks that cover our noses and mouths. Masks are a primary tool to make it harder for Covid-19 to find a new host. You will need to wear a medical or non-medical mask for the duration of our class meetings, for your own protection, and the safety and comfort of everyone else in the class. You may be asked to remove your mask briefly for an ID check for an exam, but otherwise, your mask should cover your nose and mouth. Please do not eat in class. If you need to drink water/coffee/tea/etc, please keep your mask on between sips.
Students who need to request an exemption to the indoor mask mandate must do so based on one of the grounds for exemption detailed in the PHO Order on Face Coverings (COVID-19). Such requests must be made through the Center for Accessibility (info.accessibility@ubc.ca).

Mask wearing protects you as well as others in your environment. Let's do everything we can as a community to stop the spread of this virus.

**Vaccination**: If you have not yet had a chance to get vaccinated against Covid-19, vaccines are available to you, free, and on campus (http://www.vch.ca/covid-19/covid-19-vaccine) 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.

**Seating in class:** To reduce the risk of Covid transmission, **please sit in a consistent area** of the classroom each day. This will minimize your contacts and will still allow for the pedagogical methods planned for this class to help your learning.

**Your personal health**

- A daily self-health assessment is required before attending campus. Every day, before coming to class, complete the self-assessment for Covid symptoms using this tool: https://bc.thrive.health/covid19/en

- You can check this website to find out if you should self-isolate or self-monitor: http://www.bccdc.ca/health-info/diseases-conditions/covid-19/self-isolation#Who.

- Your precautions will help reduce risk and keep everyone safer. You can prioritize your health and still be able to succeed

**If you do miss class because of illness:**

- Make a connection early in the term to another student or a group of students in the class. You can help each other by sharing notes. If you don't yet know anyone in the class, post on the discussion forum (Piazza) to connect with other students.
- Consult the class resources on Canvas.
- Use the online discussion forum (Piazza) for help.
- Come to online office hours (instructor and TAs) to contact us and discuss.

**Schedule:** This is a **tentative** schedule and may be subject to change. Any updates will be announced in class and posted on Canvas page

| Week | Lecture Dates | Assessment | WeBWork | Labs |
|---|---|---|---|---|
| 1 | Jan 10 – Jan 14 | | | |
| 2 | Jan 17 – Jan 21 | | | |
| 3 | Jan 24 – Jan 28 | | WW 1 | Lab 1 |
| 4 | Jan 31 – Feb 4 | | WW 2 | Lab 2 |
| 5 | Feb 7 – Feb 11 | | WW 3 | Lab 3 |
| 6 | Feb 14 – Feb 18 | | WW 4 | Lab 4 |
| | Feb 21 – Feb 25 | Mid-term Break | No WW | No Lab |
| 7 | Feb 28 – Mar 4 | **Written Assignment 1 due: Mar 4** | WW 5 | Lab 5 |
| 8 | Mar 7 – Mar 11 | **Midterm Friday, March 11** | WW 6 | Lab 6 |
| 9 | Mar 14 – Mar 18 | | WW 7 | Lab 7 |
| 10 | Mar 21 – Mar 25 | | WW 8 | Lab 8 |
| 11 | Mar 28 – Apr 1 | **Written Assignment 2 due : Apr 1** | WW 9 | Lab 9 |
| 12 | Apr 4 – Apr 8 | | WW 10 | Lab 10 |
| | April 12 - 27 | Final Exam Period | | |

- WeBWork assignments are due on Tuesdays (You have one week to complete a WW)
- Written assignments are published at least two weeks prior to the due date