STAT 306 - Finding Relationships in Data

Winter Term 1 **(**September – December 2021)

Course description: Modeling a response (output) variable as a function of several explanatory (input) variables: multiple regression for a continuous response, logistic regression for a binary response, and log-linear models for count data. Finding low-dimensional structure: principal components analysis. Cluster analysis.

This course emphasizes (i) applications of statistical methods such as multiple regression, binary regression, principal component analysis; (ii) the use of statistical software to do the computations; and (iii) interpretation of statistical analysis and output of statistical software. There is some linear algebra (with matrix representations) to show how multiple regression is computed in software, and there is some probability (mainly expected values, variances and covariances for linear combinations) to show how standard errors are determined for parameter estimates and predictions.

Objectives: On completing the course, students should be able to demonstrate an understanding of the techniques and applications of well--known ideas in linear modelling, including model fitting, model selection, model diagnostics, as well as basic ideas for generalised linear models and principal components analysis.

Learning outcomes: Detailed learning outcomes are provided on the course website

Pre-requisites: One of MATH 152, MATH 221, MATH 223 and one of STAT 200, STAT 241, STAT 251, STAT 300, BIOL 300, COMM 291, ECON 325, ECON 327, FRST 231, PSYC 218, PSYC 278, PSYC 366 and one of MATH 302, STAT 302.

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: LSK 201(Tuesday and Thursday | **class time**: 8:00am-9:20am)

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

- 9:30am - 10:30am on Tuesday
- 9:30am - 10:00am on Thursday

Head TA: Xinglong Li (xinglong.li@stat.ubc.ca)

Teaching assistants& TA office hours: Online office hours will be held using Zoom. Zoom links are found through the zoom tab.

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.

Recommended texts:
There are a variety of books that cover at most of the material in this course, and it is suggested you try the UBC online library stock to find those that suit you.
The course notes are
Joe, Harry. (2020) Course Notes for STAT 306: *Finding Relationships in Data* which can be ordered from the UBC bookstore.

Amongst other useful texts, both available via the library website, are
Chatterjee, S. and Hadi, A.S. (2006): *Regression Analysis by Example,*(4th edit.). Wiley (In particular chapters 1--6, 11, 9.1-9.7, 12.1-12.7,13.3 are covered.)
Weisberg, S. (2014): *Applied Linear Regression*, (3rd edit.). Wiley.

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 forty--five minutes duration will occur twice a week, with an online pencast describing related materials being available from the course web page in advance. A pre-class activity is set before each class and an accompanying quiz due on the morning of class days. In all sessions an in--class activity will replace at least part of the lecture component. A calculator or (preferably) R will be necessary for many of the in--class activities. Guided reading or other activities will be set at the end of one lecture to be completed prior to the next. There will be required lab assignments most weeks. 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 approximately six hours per week on self--study for the course. A proposed workload for a typical week is as follows:
Classes (including pre-class activity, pencasts, quiz, class): 4 hours
WeBWorK: 2 hours
Lab: 1 hour
Reading/reviewing: 1 hour
Project/assignments: 1 hour

Course Assessment.

Assessment	Date	Percentage
Class question (iClicker Cloud)	in-class	5%
WeBWork	See the schedule in canvas page	10%
Pre-class Quizzes	Complete before every class	5%
Labs	See the schedule in canvas page	8%
Group Project	See the schedule in canvas page	8%
Two Written Assignments	See the schedule in canvas page	6%
Midterm	Thursday, October 28 (in class)	20%
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 **Exam period:** Dec 11-22	38%

Accommodating delayed students
Some students will be delayed (quarantine, travel delays, etc..) in arriving to campus. The Faculty of Science is requiring that these students be accommodated in some way until October 8. If students still cannot make it to class beyond October 8, they should drop the course.

Note: *For those who are delayed until October 8, grades for any missing assignment (lab, Webwork, clickers, lab) will be replaced by the final exam grade. To make it fair to all students, even if you participating in-person classes, still your grades for any assignment until Oct 8 will be replaced by the final exam grade if the final exam grade is higher than the assignment grade.*

Bonus points: There will be opportunities for bonus point. 1 point will be given to the top 10 students that provide the best answers on Piazza discussion board.

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 48 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 306 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 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 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 (online): Lab assignments start the Second week of class. Lab materials will be posted on Canvas course page and you need to submit individual lab handout to Crowdmark. You will have 5 days to submit your solutions to Crowdmark. Please read more information about lab under "Labs" in Canvas course page. Depending in the situation, I might consider running labs in-person after the midterm exam.

Group Project: There will be a group project in which students will work in pre-assigned groups on a data set of their selection. You need to present your group project during the week 12 & 13 in the lab. Further details will be available during the week of midterm exam. The final project is a report submitted during the last week of term. There is an interim stage proposal for review, however, during week 10. Due dates for both components are below:

- Proposal Report: November 12
- Project presentation: Nov 22 - Dec 3
- Projects submit: December 7.

Crowdmark:Crowdmark is an online grading and analytics application. You need to submit (upload) your answers to assignments/labs 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 306 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 306 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 (lab or written assignment) is available there.

There follows 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 and motivation. Exploring relationships between two variables.
2. Least squares estimation for the simple linear model.
3. Residuals. Properties of the model.
4. Confidence intervals for the slope and an expected response.
5. Prediction intervals.
6. Distribution theory; why the t distribution?
7. Matrix formulation of linear models.
8. Properties of least squares estimators in matrix form.
9. Properties of residuals and the Residual SS.
10. Dummy variables in linear models.
11. More on categorical variables in linear models.
12. Quadratic models and curve fitting.
13. Examining case studies.
14. Review Activity.
15. Mid--term test. (Oct 28)
16. Model selection, including Mallows' Cp statistic.
17. Leverage, influence, outliers, and the “hat” matrix.
18. Transformations.
19. A case study.
20. Introducing logistic regression.
21. Further logistic regression.
22. Model selection in logistic regression.
23. Introducing Poisson regression.
24. Further Poisson regression.
25. Review session.

Covid Safety in the Classroom

Lectures: in-person
Labs and office hours: moved to online (please see more information in the Canvas page)

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

If you're sick, it's important that you stay home – no matter what you think you may be sick with (e.g., cold, flu, other).

- 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
- Do not come to class if you have Covid symptoms, have recently tested positive for Covid, or are required to quarantine. 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. In this class, the marking scheme is intended to provide flexibility so that 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.

If you are sick on a midterm exam day, please email the instructor as soon as you are confident you should not come to the scheduled exam. It is much better for you to email ahead of time and not attend. Remember to include your full name and student number in your message.

If you are sick on a final exam day, do not attend the exam. You must follow up with your home faculty's advising office to apply for deferred standing: https://students.ubc.ca/enrolment/academic-learning-resources/academic-advising. Students who are granted deferred standing write the final exam/assignment at a later date.

If you're a Science student, you must apply for deferred standing (an academic concession) through Science Advising no later than 48 hours after the missed final exam/assignment. Learn more and find the application online:https://science.ubc.ca/students/advising/concession.

For additional information about academic concessions, see the UBC policy here:http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,329,0,0

Instructor health

If I (the instructor) am sick: I will do my best to stay well, but if I am ill, develop Covid symptoms, or test positive for Covid, then I will not come to class. If that happens, here's what you can expect

- If I am well enough to teach, but am taking precautions to avoid infecting others, we may have a synchronous online session. If this happens, you will receive an announcement in Canvas telling you how to join the class. You can anticipate that this would very likely be a last minute email. Our classroom will still be available for you to sit and attend an online session, in this (hopefully rare) instance.
- You may receive a message from me with a recording of the lecture material for you to watch on your own time.
- My colleague might substitute for me for in-person classes

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 easures: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/CanvasQuizzes) 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/lab 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

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

Week	Dates	Assessments	WeBWork	Labs
1	Sep 7 – Sep 10			
2	Sep 13 – Sep 17			Lab 1
3	Sep 20 – Sep 24		WW 1	Lab 2
4	Sep 27 – Oct 1		WW 2	Lab 3
5	Oct 4 – Oct 8		WW 3	Lab 4
6	Oct 11 – Oct 15		WW 4	Lab 5
7	Oct 18 – Oct 22	**Written Assignment 1 due on Oct 18**	WW 5	Lab 6
8	Oct 25 – Oct 29	**Midterm Thursday, Oct 28**	WW 6	
9	Nov 1 – Nov 5		WW 7	Lab 7
10	Nov 8 – Nov 12			
11	Nov 15 – Nov 19		WW 8	Lab 8
12	Nov 22 – Nov 26		WW 9	Lab 9*
13	Nov 29 – Dec 3	**Written Assignment 2 due on Nov 29**	WW 10	Lab 10*
14	Dec 6 – Dec 7		WW 11	
	Dec 11 - 22	Final Exam Period		

- WeBWork assignments are due on Wednesday
- Lab Assignments are due on Friday
- Written assignments are published two weeks prior to the due date.
- * group project presentations (Lab 9 & 10)