Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

Applied Statistical Analysis I | POP77003

Year	1 Year
ECTS Credits	10
Contact Hours	TBC
Pre-requisite	TBC
Semester	1
Module Leader & Lecturer	Dr Jeffrey Ziegler
Contact Email	Zieglerj@tcd.ie

Module Outline

Description:

This is the first course in the quantitative methods sequence, which introduces the linear regression model as a fundamental tool in applied statistical analysis. Students will apply concepts of statistical analysis, specifically multi-variable analysis and model building, to a broad set of real-world data and problems from the social sciences. We will cover the assumptions that underlie the linear regression model, including issues of estimation and inference, as well as methods used to diagnose and correct for violations of those assumptions. My expectation is that at the end of the semester you will be savvy readers of published research and tasteful users of linear models. Labs, problem sets, and exams will teach students to apply concepts from class toward programming skills in R, LaTeX and GitHub, which are standard practices in academics and industry. We will cover such topics as:

- Examining and transforming data
- Linear regression
- Dummy variable regression
- Diagnostics of unusual and influential data
- Non-constant variance, non-normality & collinearity
- Model selection

Office Hours:

I will hold office hours for individual 15-min meetings, please sign up! If you cannot attend regular office hours, please contact me via email.

Class Materials:

All materials will be presented in class, and the readings used to prepare for this course, will be made available on the course website.

Class Structure:

I want our class to thrive no matter how we meet or your individual methods of participating in class. I cannot guarantee an identical experience of each student. But, my goal is that all students receive a high-quality experience to the extent possible, and that all students are treated equitably and consistently.

To ensure this, communication is important. I commit to responding to emails within 48 hours of receipt, and my intention is to respond faster than that most of the time. I will likely be slower on weekends. Likewise, if your situation changes regarding health, housing, or in any other aspect with regard to your ability to participate in class, please contact me and the appropriate student support organisation as soon as feasible. It is easier for me to address your needs if I know about them. This does not mean I can successfully respond to every request, but I want to emphasise that I aim for you to succeed in life, not just this course.

This semester some students might be sick, and if you are sick, understand that I will be flexible. Please make sure to email me so that we can discuss your individual circumstances. Otherwise, it is expected that you prepare for class and participate in office hours. Attendance directly and indirectly impacts your final grade. If you do attend meetings, please arrive on time; we will start promptly.

The lectures will provide you with core concepts and theoretical foundations of regression analysis in the social sciences. Lectures will be supported by a PowerPoint style presentation. I will post a handout of the shortened, student version of the lecture on the course website, under the "Slides" tab. You may want to use this brief outline to follow the lecture and take additional notes.

If class is moved online for an unexpected reason, all class sessions on Zoom will be recorded for students in the course to refer back. The content presented through video conferencing will be posted on the course website for the sole purpose of educating the students enrolled in the course. The release of such information (including but not limited to directly sharing, screen capturing or recording content) is strictly prohibited, unless the instructor states otherwise. Doing so without the permission of the instructor will be considered an Honor Code violation.

Students who participate with their camera engaged or utilise a profile image are agreeing to have their video or image recorded. If you are unwilling to conset to have your profile or video image recorded be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. Please read the Rules of Zoom Engagement for further advice on participating in our Zoom class sessions.

Absences, Late Work and Appeals:
Late work will not be accepted without prior permission, and students who miss assignments will receive a score of 0 absent extraordinary circumstances. With that said, please consult me as soon as possible of there is an event that hinders your ability to participate in the class.

Appeals made on the validity of grading or assignment questions have to be made within five working days after publication of the results. The appeal has to be submitted with the original assignment. The appeal must explain in detail why an error has been made, and provide supporting evidence. If an assignment is re-graded due to a successful appeal, this may result in a better grade, lower grade, or no grade change. Insufficient grounds for an appeal include: a student missed a lecture that covered relevant material, a student does not feel well but decided to complete the assignment anyway, a student did not understand the material, a student says that she/he wanted to give the correct answer but made a typographical error, a student would like additional consideration to receive a better letter grade.

Academic Integrity:
Cheating and plagiarism will not be tolerated. I strongly encourage you to review the College's policies regarding academic honesty. In general, if you have any questions, please feel free to ask me.

Students with Disabilities:
Students with disabilities enrolled in this course who may need disability-related classroom accommodations are encouraged to make an appointment to speak with me within the first week of the semester. All conversations remain confidential. If you have a disability-related need for reasonable academic adjustments in this course, you are required to provide the instruction with an accommodation notification letter from the Office of Disability Services. If you need immediate accommodations or physical access, please arrange to meet with me as soon as your accommodations have been finalised.

Religious Observances:
Some students may wish to take part in religious observances that occur during this semester. If you have a religious observance that conflicts with your participation in the course, please talk to me within the first week of the semester to discuss accommodations.

Physical Health:
Though we are all minimizing our contact with others, at the very first sign of not feeling well, stay at home and reach out for a health consultation. Please consult the campus FAQ for how to get a health consultation.

Mental Health:
Completing a MSc degree in can be a difficult time. Please reach out to me with any concern, and know that Mental Health Services' professional staff members work with students to resolve personal and interpersonal difficulties, many of which can affect the academic experience. These include conflicts with or worry about friends or family, concerns about eating or drinking patterns, and feelings of anxiety and depression. Your health is a critical part of your success in life, not just your coursework.

Assessment

Aside from the baseline requirements – class attendance, punctuality, and reading ahead in preparation for class – you are required to work on 4 problem sets. The average of your top 3 problem sets accounts for 50% of your course grade. We will distribute problem sets nearly every month, and will expect to receive electronic copies of your assignment by the week after.

Our midterm exam is scheduled for Week 6 of instruction, and the exam at the end of the semester is on Week 12 of instruction. Each of these counts for 25% of your grade.

Late assignments will not be accepted. Assignments should be turned in at regularly scheduled dates, and given that the midterm and final exams also have a date fixed known well in advance, I will not allow incompletes in this class.

Recommended Reading List

This is a list of interesting and pertinent books that will be used during the course. You need to consult them occasionally, but you do not ned to purchase them. I will provide the assigned readings in PDF format on the course website:

- Angresti, Alan and Barbara Finlay (2009). Statistical Methods for the Social Sciences. Fourth Edition.
- Chatterjee, Samprit and Ali S. Hadi (2012). Regression Analysis by Example. 5th edition.
- Cunningham, Scott (2020). Casual Inference: The Mixtape. 1st Edition.
- Fox, John (2015). Applied Regression Analysis and Generalized Linear Models. 3rd Edition.
- Hosmer, David W., Stanley Lemeshow, and Rodney X. Sturdivant (2013). Applied Logistic Regression. 3rd Edition.
- Imai, Kosuke (2017). Quantitative Social Science: Introduction. 1st Edition.
- James, Gareth., Daniela Witten, Trevor Hastie, and Robert Tibshirani (2013). An Introduction to Statistical Learning with Applications in R. 1st Edition.
- Kmenta, Jan (1986). Elements of Econometrics. University of Michigan.

Reading and Exam Schedule:
The following is an anticipated schedule of course topics. The plan is to cover a new topic each week, but we will go as fast as needed to make sure that everyone is understanding the material. Check the course website to see what we will be covering in the upcoming lecture. We also have a Google Calendar that is posted on the course website with up-to-date information on problem sets, office hours, lectures, and exams.

Week	Topic	Readings	Assignments
1	Introduction & basics	Gill 2021	PS 1 handed out
	Statistical inference review • Sampling & measurement • Descriptive statistics • Probability distributions • Confidence intervals	AF 1-6; CH 1	
2	Hypothesis testing	AF 7; Imai 1	
	Experiments, Difference in Means	AF 8, 10	
3	Contingency tables & bivariate regression: Correlation, assumptions	AF 9.1-9.4, 9.6; CH 2.1-2.5	
4	Bivariate regression: Inference and prediction	AF 9.5; CH 2.6-2.11; JWHT 3.1	PS 1 due; PS 2 handed out
5	Review: Hypothesis testing, correlation, bivariate regression		
6	Exam		PS 2 due
7	Reading week		
8	Multiple linear regression: Interpretation, centering & scaling, multiple correlation coefficient	AF 10; CH 3.1-3.8; JWHT 3.2	PS 3 handed out
9	Multiple linear regression: Inference for individual parameters and groups of parameters	AF 11; CH 3.9-3.12	
10	Dummy variable regression	AF 12; Fox 7-8	PS 3 due; PS 4 handed out
	Dummy variable regression: Interactions	AF 13	
11	Regression diagnosis: Variance decomposition, goodness of fit, leverage, influence, and outliers	AF 9.6, 14.1-14.3; CH 4.1-4.9	PS 4 due

Week	Topic	Readings	Assignments
	Non-normal disturbances, data transformation		
12	Exam		