FLORIDA POLYTECHNIC UNIVERSITY

Course Syllabus

Course Information

- **Course Number and Title**: QMB 3200 Advanced Quantitative Methods
- **Credit Hours:** 3 credits
- **Current Academic Term**: Fall 2020

Instructor Information

- **Instructor**: Sravani Vadlamani, PhD
- **Office**: IST 2040
- **Office Hours**: Virtual through Microsoft Teams on W 1 – 2 PM, TR 2- 3 PM or by appointment
- **Office Phone**: 863-874-8806
- **E-mail**: svadlamani@floridapoly.edu
- **Class Meeting Day, Time & Location**: TR, 11:00 AM – 12:15 PM EST, IST 1067C and Microsoft Teams

Course Details

- **Class Delivery Mode**: The class will be delivered in a flex format where the students can choose to attend in person or remotely via Microsoft Teams.
- **Course Website**: https://floridapolytechnic.instructure.com/courses/4674
- **Official Catalog Course Description**: Advanced concepts in statistical analysis. Linear models and experimental design, multiple regression analysis, analysis of variance with multiple classification, analysis of covariance, repeated measures analysis of variance, multiple comparison techniques, and diagnostic procedures and transformations are discussed in this course.
- **Course Pre and/or Co-Requisites:** STA 2023 – Statistics I and COP 2271 – Introduction to Computation and Programming
- **Communication/Computation Skills Requirement (6A-10.030)**: No
- **Required Texts**:
    1. (OIS) OpenIntro Statistics (4th Edition) by David Diez, Mine Cetinkaya-Rundel & Christopher Barr ISBN 9781943450077. A free PDF version is available for this book.
    2. (IE) Introductory Econometrics: A Modern Approach by Jeffrey Wooldridge, ISBN-13:9781337558860, 7th Edition
- **Equipment and Materials**: Microsoft Excel, R and R Studio (freeware) and STATA. We will discuss this in detail in class and no previous knowledge of these programs is assumed. We will help you install them and run them on your machines.
- **Course Objectives**: The objective of this course is to provide a foundation in regression analysis and its extensions and generalizations, which subsume a vast array of methods, and their application to empirical analysis. This will enable you to pick up other techniques as needed. We will focus not just on estimating models, but also on specifying, evaluating, and refining them. We will begin with a concentrated review of probability and statistical inference.

- **Course Learning Outcomes**:

    1. Identify appropriate statistical methods for given problems.
    2. Apply and interpret statistical techniques including confidence intervals and hypothesis tests by demonstrating the appropriate use of test procedure.
    3. Evaluate applications of statistical techniques to data.
    4. Distinguish questions requiring causal inference from those requiring only prediction
    5. Use a statistical application software package to apply the statistical tools for the analysis of a dataset for an individual course project.

- **Alignment with Program Outcomes**:

	Course Learning Outcome				
Data Science Program Student Outcomes	1	2	3	4	5
(1) Apply current data science concepts, techniques, and practices to solve complex problems.	X	X	X	X	
(2) Analyze a given data science problem and formulate a solution in terms of the datasets needed, the techniques required or the technologies to be utilized.	X	X	X	X	X
(3) Communicate effectively insights, analysis, conclusions, or solutions to a diverse audience.		X	X		

	Course Learning Outcome				
Business Analytics Program Student Outcomes	1	2	3	4	5
(1) Apply current business analytics concepts, techniques, and practices to solve business problems.	X	X	X	X	
(2) Analyze a given business problem using appropriate analytics techniques to generate insights and solutions.	X	X	X	X	X
(3) Communicate effectively insights, analysis, conclusions, and solutions to a diverse audience.		X	X		

Academic Support Resources

- **Library**: Students can access the Florida Polytechnic University Library through the student portal Pulse and Canvas, on and off campus. Students may direct questions to the Success Desk in the Commons or by email, library@floridapoly.edu. The Florida Polytechnic University Library provides specialized resources and learning opportunities for students, faculty, and staff to successfully work with, interpret, and utilize information. The Library's core online collection features full-text journals as well as over 105,000 electronic books and other content covering all academic subject areas. As a member of the State University System of Florida, Florida Polytechnic University students can search and request materials from other state university libraries.
- **ASC**: The Academic Success Center provides essential services that directly support the student experience at Florida Polytechnic University. Located on the first floor of the Innovation, Science & Technology Building in room 1019 and at ASC East in Phase 2 Dorms, Academic Support Services is a hub that connects the community with the resources needed to succeed academically. The desk is staffed by success coaches who provide academic coaching on a

variety of topics, including time management, test preparation, and test-taking skills. Success coaches also provide academic guidance and help students manage their schedule and academic progress. Additionally, coaches lead career development initiatives on campus and are available to review resumes and conduct mock interviews. Students may direct questions to success@floridapoly.edu.

- **Writing Services:** Writing Services offers a full spectrum of writing support for Florida Poly students, including assistance with:
    - Understanding written assignment prompts
    - Researching writing genres and specific topics
    - Brainstorming
    - Organization
    - Revision Strategies
    - Citation and Formatting
    - Grammar and Punctuation
    - Preparing Presentations and Visual Aides

Course Policies:

- **Attendance:** Students are expected to attend all of their scheduled University classes and to satisfy all academic objectives as defined by the instructor." Attendance in this environment does not, of course, mean actual physical attendance in the classroom, although it may include that. Also see also University Policy.
- **Class Participation:** Asking and answering questions and solving problems in class is strongly encouraged.
- **In-Class Quizzes:** In-class pop quizzes will be given occasionally to assist students in practicing problem-solving and conceptual understanding. These will be graded and account for a portion of your final grade.
- **Grading Scale**: The following grading scale will be used for this class. See also University Grading Policy.

A	93% – 100%	B	83% – <86%	C	73% – <76%	D	63% – <66%
A–	90% – <93%	B–	80% – <83%	C–	70% – <73%	D–	60% – <63%
B+	86% – <90%	C+	76% – <80%	D+	66% – <70%	F	0% – <60%

- **Assignment/Evaluation Methods**:
    - Participation and In-class quizzes: There will be in class quizzes (pre-announced or pop) to ensure you study regularly rather than wait till the midterm, give an idea of what to expect on the exams and provide early feedback on your progress. Participation in all course activities is a very important element of this course and is a basic expectation. Course participation consists of active and respectful involvement in class discussions, peer feedback, postings, replies, projects, and other interactions. The participation grade takes into account quality, quantity, and timeliness of student participation.

    - Homework: There will be a number of homework assignments that are intended to engage you with challenging material to facilitate learning. You may work on the homework with other students but still need to submit your own work. The problems are to facilitate learning and not evaluate performance. If you work shows a reasonable attempt and is presented professionally and submitted on time, you will receive most of

the credit. Please follow the guidelines for homework submission listed at the end of this document. Sample homework questions are included at the end of this document.

- Midterm exam: This exam will cover the review of probability and inferential statistics and simple linear regression. The exam date listed on the schedule in later pages may change depending on the class progress and will be announced in class at least 2 weeks in advance. Sample midterm will be posted on canvas.
- Final Project: This is an individual project and each student will be provided a different dataset for estimating regression models. The project involves preparation of a professional report detailing your data, methods, and finds as though you were a consultant hired to perform the analysis. The final report is due on the last day of class (December 3, 2020). Detailed instructions along with sample reports will be posted on canvas after the midterm exam. The rubric for the final project report is included at the end of this document.
- Final Exam: The final exam will occur during the finals week December 7 – 11, 2020 at the assigned time (TBA). The final exam will be cumulative on all the concepts covered in class including the project.

Assignment	Percentage
Participation & In-class Quizzes	15%
Assignments	20%
Data Analysis Project	20%
Midterm	20%
Comprehensive Final Exam	25%
Total	100%

- **Late Work/Make-up work**: All class assignments will have due dates communicated at the time of assignment. **It is the student's responsibility to know the deadlines and turn work in ON TIME.** The make-up policy applies only to missed exams (midterm and final). If you miss an exam with an excused absence, you must meet with your professor as soon as possible to deal with the issue. In most cases your final score will be calculated with that exam, you missed, so it is in your best interest to not miss any exams. In-class quizzes and the Final exam cannot be made up. If you have a schedule conflict for the final let your professor know as soon as possible.
- **Lecture Expectations:** Lecture meets for seventy-five minutes, twice per week and you have the option to attend in person or remotely. The intent of lecture time is for you to develop your conceptual understanding and practice problem-solving. The lecture will be interactive - you are expected, at appropriate times, to work with your neighbor, express your thoughts, ask and answer questions, discuss ideas, patiently listen to and respect other's ideas.
- **CANVAS Policy:** Assignments, announcements, and information will be posted on CANVAS. **Students are responsible for checking CANVAS regularly to be aware of their assignments** and other class information. Please see the end of this document for guidelines for submission of assignments.
- **Email Policy:** All students are required to use **studentuserID@floridapoly.edu** email system

(most preferable) OR the CANVAS e-mail system to communicate with the instructor. On occasion, email may be used to disseminate important class-related assignments, announcements and information. Students are responsible for any information or assignments given in e-mail.

University Policies

- **Academic Integrity**: All students must commit to the highest ethical standards in completion of all academic pursuits and endeavors: Academic Integrity. "Behaviors of academic dishonesty in violation of this policy are listed below and are not intended to be all inclusive. Violations may result in the imposition of academic sanctions under this regulation and/or disciplinary sanctions under the Student Code of Conduct.
    - Intentionally using or attempting to use unauthorized materials, information, or study aids in any type of academic exercise.
    - Intentionally or knowingly representing the words or ideas of another as one's own in any academic exercise.
    - Intentional and unauthorized falsification or invention of any information or citation in an academic exercise.
    - Multiple Submission. Submission of the same or substantially the same work for credit in two or more courses. Multiple submissions shall not include those situations where the instructor gives the student prior written approval to use such prior academic work or endeavor.
    - Facilitating Academic Dishonesty. Intentionally or knowingly assisting or attempting to assist another in violating any provision of this regulation.
    - Misconduct in Research and Creative Endeavors. Serious deviation from the accepted professional practices within a discipline or from the policies of the University in carrying out, reporting, or exhibiting the results of research or in publishing, exhibiting, or performing creative endeavors. This does not include honest error or honest disagreement about the interpretation of data.
    - Misuse of Intellectual Property. Illegal use of copyright materials, trademarks, trade secrets, or intellectual properties."

- **Reasonable Accommodations**: Florida Polytechnic University is committed to assisting students with disabilities and offering reasonable accommodations to those with documented eligibility. The Office of Disability Services (ODS) coordinates accommodations for students with disabilities in accordance with the ADA Amendments Act of 2008 (ADAAA), the Americans with Disabilities Act of 1990 (ADA), and Section 504 of the Rehabilitation Act of 1973. Reasonable accommodations are determined on an individual basis through an interactive process between you, ODS, and your instructor(s). If you have already registered with ODS, please ensure that you have requested an accommodation letter for this course and communicate with your instructor about your approved accommodations at your earliest convenience. If you are not registered with ODS but believe you have a temporary health condition or permanent disability requiring an accommodation, please contact ODS as soon as possible at DisabilityServices@floridapoly.edu or (863)874-8770 or ASC East building or ODS website: www.floridapoly.edu > Student Affairs > Health Wellness > Disability Services

- **Accommodations for Religious Observances, Practices and Beliefs:** The University will reasonably accommodate the religious observances, practices, and beliefs of individuals in regard to admissions, class attendance, and the scheduling of examinations and work

assignments. See the Florida Poly policy on Reasonable Accommodations for Religious Observances, Practices and Beliefs for more details.

- **Title IX**: Florida Polytechnic University is committed to ensuring a safe, productive learning environment on our campus that prohibits sexual misconduct, including discrimination based on sex or gender, harassment, stalking, sexual assault, sexual exploitation, or intimate partner violence. If you or someone you know needs assistance, you may speak to any university employee; however, they have an obligation to report the incident to the Title IX Coordinator, who will keep that information private to the greatest extent possible. If you want to speak to someone permitted to keep your disclosure confidential, seek assistance from the Florida Polytechnic University Ombudsman, BayCare's Student Assistance Program, 1-800-878-5470 and locally within the community at Peace River Center, 863-412-2700 (24-hour hotline) or 863-412-2708 to schedule an appointment. If you or someone you know feels unsafe or may be in imminent danger, please call the Florida Polytechnic University Police Department 863-874-8472 or the local Police Department 911 immediately. For more information about policy, reporting options and resources at Florida Polytechnic University and the community, please visit the Title IX Website.

- **Statement of Academic Continuity**: In the event of an emergency (such as a hurricane), it may be necessary for Florida Poly to suspend normal operations. During this time, Florida Poly may opt to continue delivery of instruction through methods that include but are not limited to: the Learning Management System (Canvas), online conferencing, email messaging, and/or an alternate schedule. It is the responsibility of the student to monitor the Learning Management System for each class for course-specific communication, and the Florida Poly website and emails for important general information. For additional guidance on emergency protective actions and hazards that affect the University please visit Safety and Security at Florida Poly.

- **Covid-19 Syllabus Statement**

  Regardless of the mode of course delivery, all Florida Poly students are asked to make a Campus Commitment demonstrating respect and consideration for themselves or others, and for the people they care about. This Campus Commitment includes monitoring one's health and seeking medical care when appropriate; wearing face-coverings and respecting social-distancing, especially in the classroom and in gatherings; washing one's hands frequently (and when not possible using hand-sanitizer); following medical guidance; and participating in keeping shared spaces clean. If you are experiencing any symptom(s) of COVID-19 outlined by the CDC, you must stay home or in your residence hall room and immediately contact the associate director of campus wellness management at 863-874-8599 or email care@floridapoly.edu.

  Basic rules for in the classroom, IST, and Campus:

  1. You MUST have a face-covering.
  2. Leave the furniture on its correct floor markings, or if it is moved, please return it to those markings.
  3. Whenever possible, clean your space with a sanitizing wipe before you start and when you are finished with class.
  4. Do not remove sanitizing wipes or hand sanitizers from their set locations—they are put there for everyone.
  5. Follow directional signs throughout the buildings and respect appropriate social distancing.
  6. Study hard and engage with all of your courses!

Course Schedule

Date	Topic	Suggested Reading
August 20	Introduction to the Course, Pre-class Quiz	
August 25	Introduction to Statistics, Measurement Levels, Sampling, Descriptive Statistics	OIS 1
August 27	Data Collection, Qualitative vs Quantitative Data, Measures of Central Tendency, Describing Distributions, Measures of Variability	OIS 2
September 1	Probability Review, Marginal, Joint and Conditional Probability, Independence, Bayes theorem,	OIS 3
September 3	Random Variables, Expected Value and Variance, Linear Combinations, Covariance and Correlation	OIS 3
September 8	Probability Distributions – Bernoulli, Binomial, Geometric, Poisson, Normal, Chi-Squared, t and F	OIS 4
September 10	Foundations for Inference – Sampling Distribution, Central Limit Theorem, Type 1 and Type 2 Errors	OIS 5
September 15	Steps of Hypothesis Testing	OIS 5
September 17	Hypothesis Testing with Z-scores, T-test, Statistical Power, Inferences for proportions	OIS 7
September 22	Inferences for Proportions	OIS 6
September 24	Simple Regression – prediction vs causal modeling and population regression function, transformations and linearity in parameters	OIS 8 & IE 2
September 29	Simple Regression – Assumptions, minimizing SSE, Normal Equations and interpretation of coefficients	OIS 8 & IE 2
October 1	Simple Regression – Expected value and variance of coefficients, Precision and Inference, Goodness of fit	OIS 8 & IE 2
October 6	Simple Regression – Heteroskedasticity and robust standard errors, Measurement error	OIS 8 & IE 2
October 8	Simple Regression – Practice and Midterm Review	
October 13	Midterm	
October 15	Multiple Regression – Notation, interpretation and control variables	IE 3, 4, 5, 6
October 20	Multiple Regression – Minimization of SSE, Normal equations and interpretation	IE 3, 4, 5, 6
October 22	Multiple Regression – Matrix formulation and Assumptions	IE 3, 4, 5, 6

October 27	Multiple Regression – Expected value and variance of coefficients, Multicollinearity, Heteroskedasticity	IE 3, 4, 5, 6
October 29	Multiple Regression – variance decomposition and model comparisons, omitted variable bias and causal inference	IE 3, 4, 5, 6
November 3	Count Models – Estimation, Maximum Likelihood, Rate formulation	IE 7
November 5	Count Models – First order conditions, coefficient interpretation and marginal effects, violations and robust standard errors	IE 7
November 10	Logistic Regression – Latent variable formulation, problems with linear probability model	IE 17, OIS 9
November 12	Logistic Regression – Likelihood function, Logit model, Probit Model	IE 17, OIS 9
November 17	Logistic Regression – Marginal effects, Generalization to multiple outcomes	IE 17, OIS 9
November 19	Internal validity and research design, external validity and sample design	
November 24	Construct validity and instrument design	
December 1 and 3	Final project and Exam Review – Remote Instruction	

This is a tentative schedule and I reserve the right to modify this schedule as required by the progression of the class.

Guidelines for Homework Submission

When submitting any work, your objective is to communicate information to the reader (in this case, your instructor or TA) in a Clear, Concise, Complete, Careful, and Courteous manner (5 C's of good writing). If your work does not possess the "5C" qualities and/or does not adhere to the guidelines specified below, you will definitely lose A LOT OF credit even though you may have the correct answer(s).

1. All assignments are electronically due on CANVAS in pdf format. You may choose to type your work in Microsoft Word and convert it to word. If you prefer to handwrite your assignments and scan them, please write only on ONE side of the paper. If you are using engineering paper, you must use the "lighter" side only. Paper torn out of notebooks (with ragged edges) will not be accepted. Also, for handwritten assignments, if using a pencil, make sure it is sharpened and writes dark. If they are not done on computer, all graphs and figures must be drawn in PENCIL using a ruler/straightedge. Graphs must be labeled appropriately to convey information effectively (e.g., label axes, units, scales, important points on curve, etc.).
2. Write or type your FULL name on your work (as it appears on the class roster). No nicknames or short abbreviations will be accepted. If you are not sure how your name appears on the class roster, check with the instructor.
3. Maintain minimum margins (on both handwritten or typed assignments) as follows: Left -1"; Right, Top, and Bottom -3/4".
4. You must show ALL steps in your work to receive partial or full credit. At each step, symbols

must be clearly defined, formulas written out, and substitutions and calculations shown clearly. Above all, write LEGIBLY and provide UNITS where appropriate. Also, make sure that you report answers to the correct and appropriate number of significant digits.

5. If you have any questions regarding submission of work, play it safe: CHECK WITH YOUR INSTRUCTOR. The primary aim in specifying these guidelines is to ensure that your work reflects the professional nature of the career path you have chosen. Finally, guidelines may be modified, deleted, or added at the discretion of the instructor!

Rubric for Project Report

Objective	Category	Below Expectations	Weak	Average	Good	Excellent
	Score	1	2	3	4	5
Students can write professional quality documents	Introduction	Opening is off-topic and inappropriate to the purpose, not concise and no clarity	Opening is somewhat related to the topic and appropriate to the purpose but is not concise and clear	Opening is related to the topic and appropriate to the purpose. Somewhat clear and concise	Opening is related to the topic and appropriate to the purpose. Clear and concise	Strong opening that is clear and concise
	Quality of Report	Very poor quality. Not enough or too much colors, fonts and animations that detract from project objective	Poor quality. Not enough or too much colors, fonts and animations that detract from project objective	Fonts, colors and animations barely support the presentation objective	Fonts, colors and animations support the presentation objective	Fonts, colors and animations support, clarify and reinforce the presentation objective
	Organization (weighted twice)	Disorganized; incorrect format; unclear direction	Somewhat organized; incorrect format; unclear direction	Organized; correct format; unclear direction	Organized; correct format; clear direction	Correct formatting, strong clarity and organization in the development of main points
	Analysis (weighted thrice)	Incorrect, Irrelevant, no supporting evidence	Correct, irrelevant, no supporting evidence	Correct, relevant, no supporting evidence	Relevant and correct with supporting evidence	Relevant, correct, complete, incorporates innovative insights
	Conclusion	Missing or content does not support conclusion	Conclusion irrelevant to the findings	Conclusion somewhat relevant to the findings	Conclusion relevant to the findings	Strong conclusion that is clear, complete and compelling
	Grammar & Spelling (weighted twice)	Uses language that often impedes meaning due to errors	Uses language that often sometimes meaning due to errors	Uses language that generally conveys meaning to readers with clarity, although writing includes some errors	Uses straightforward language that conveys meaning to readers. Language has few errors	Uses graceful language that communicates meaning to readers with clarity and fluency and is virtually error free
Total points for Report = 50						

Sample Homework

Few problems from your assigned homework are shown here for reference. You will have around 10 -11 assignments throughout the semester consisting of at least 5 problems in each. The assignments will involve manually solving the problems as well as analyzing a dataset using R or Stata.

Homework 1

Problem 1: You have data on 100 defendants who have been on trial twice, and the verdict in each trial. Of those: 20 were never convicted, 40 were convicted both times, 10 were convicted the first

time but not the second, and 30 were convicted the second time but not the first. What is the probability a defendant randomly selected from among those convicted in their first trial was convicted in their second trial? Is the outcome of the second trial independent of the outcome of the first? Explain.

Problem 2: Suppose someone develops a screening for a particular learning problem. A school district proposes conducting the screening on their entire first grade population, since interventions to correct the problem are more effective when delivered earlier. The screening produces a false negative in 1 in 25 with the condition and a false positive in 1 in 50 without the condition. One in 200 students has the condition. What is the probability a student with a negative result has the condition? What is the probability a student with a positive result has the condition? Based on these two answers, do you see any problem? If so, can you think of a reasonable solution? If so, what? After implementing your solution, what is the probability you will have incorrectly concluded a student has the problem when they in fact do not?

Homework 2

You will need to download the file "supplement.csv" to work with in Stata. The file contains data for a (fictional) block randomized trial aimed at testing the effectiveness of a dietary supplement in reducing the incidence and severity of colds. Thirty male and 30 female were randomly assigned to take the supplement or a placebo for 2 months. The data records whether each subject experienced a cold and for how may days they experienced symptoms.
Variable Definitions
Subject: Individual subject identifier.
Female: 1 if the subject is female, 0 otherwise.
Supplement: 1 of the subject was given the supplement, 0 otherwise.
Cold: 1 if the subject experienced a cold over the trial, 0 otherwise.
Days: Number of days the subject experienced cold symptoms over the trial.
Weight: Subject's weight in pounds.

1. Calculate summary statistics for the proportion that caught a cold and for the number of days with a cold among those that caught a cold. Do this overall, separately by supplement use, separately by gender, and then separately by gender and supplement use.
2. Using the command prtest, test the association between getting a cold and both taking the supplement and gender.
    a. Test whether the proportion that get a cold is influenced by the supplement.
    b. Test whether the proportion that get a cold is influenced by the supplement for males and females separately.
    c. Test whether the proportion that get a cold is influenced by gender.
    d. Test whether the proportion that get a cold is influenced by gender for those taking the supplement and those not taking it separately.
3. Prepare a brief write up summarizing, interpreting and analyzing your results from 1-Don't write more than 3 pages of text.

Important Dates

August 20	Th	First Day of Classes
August 20-26	Th-W	Drop/Add Week
August 26	W	Withdrawal Deadline - No Academic or Fee Liability
Sept. 7	M	Labor Day Holiday - No Classes

Nov. 11	W	Veteran's Day Holiday – No Classes
Nov. 18	W	Withdrawal without Academic Penalty Deadline (W assigned)
Nov. 25-27	W-F	Thanksgiving Holiday Break – No Classes
Dec. 1 & Dec. 3	T&Th	Classes will only be remote only
Dec. 3	TH	Last Day of Classes
Dec. 4-5	F-S	Reading Days - No Classes
Dec. 7-11	M-F	Final Exams
Dec. 16	W	Final Grades Available Online