Data Science for Strategic Pricing

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Office Hours:	By Appointment
Teaching Assistant:	Lukas Hager, lghhager@uw.edu
Timing and Location:	Wednesdays 3:30-7:20pm, Thomson 125
Course Duration:	Sept 25th - Dec 4th; no class W prior to Thanksgiving
Final Exam:	Dec 4th during class.
Website:	http://www.jacoblariviere.com/DS_pricing_2024.html canvas.uw.edu
Code of Honor:	The University of Washington Code of Honor applies in full to this course. https://econ.washington.edu/policy-academic-conduct
Logistics:	Lectures will be offered live at the regularly scheduled class time. They will not be recorded but lecture slides will be available for viewing on the course website. Office hours will be held remotely through Teams. Assignments must be submitted remotely via Canvas. Exams will be given in-person. DRS accommodation is required for students to complete the class remotely.

Learning Objectives

This course is designed to rigorously cover the theory of industrial organization and strategic behavior of firms. We will cover both theoretical and empirical topics and focus on applications in the technology sector. We will develop both theoretical and empirical tools that will serve students in being competitive for quantitatively focused jobs in both tech and other sectors or be competitive graduate students in continuing your education. We will learn the R statistical computing language. At the end of the course you'll be able to perform supervised and unsupervised machine learning techniques in R with special attention paid to pricing and causal inference.

The course is structured to have both lecture and facilitated discussion. We anticipate lots of interaction and idea flows. It is going to be a fun, honest and stimulating classroom environment. This class should be thought of as a mechanism for your improvement as an economist, which increases your ability to think both critically and do interesting and important work that adds value to your endeavors. There will be guest lecturers by a few other economists working on strategic pricing and at the intersection of causal inference and machine learning at Microsoft.

Course Requirements & Grading

Homework	50%
Midterm	25%
Final	25%
Class Participation/Attendance	10% (+/-)

Homework assignments will be both theory and empirical with data sets being provided by the instructors. Homework assignments will have two main themes. The first will be to have students practice the mechanics of the concepts covered in class. The goal of this theme is to cement the comprehension of the material. The second theme of the homework assignments will be to foster creativity in thinking about the material. They will be grades on a full credit/partial credit/zero credit scale (e.g.: 100%, 50%, and 0%).

In some cases with empirical assignments, we may ask you to supplement the data sets on your own. You are encouraged to use R; any code that provided in solutions will be provided in R. The empirical assignments can span multiple weeks and steady progress is vital to not fall behind. These assignments will be similar to the types of problems you may face working with a firm like Microsoft, Amazon, Google, etc.

Exams will be of standard format: T/F, multiple choice, short answer, graphs and essays.

Since we are only meeting once a week, one can fall way behind by missing just one course. Accordingly, class attendance is mandatory, please email the instructors if you have a legitimate conflict so it does not hurt your participation score. Attendance combined with homework completion, and a thorough review of one's notes and homework assignments should adequately prepare a student for the exams. Note that there will be material on exams that is not covered in the book. IMPORTANT: If you will miss a midterm for a verifiable medical/legal/sports reason, notify us immediately to set up a make-up exam. Failure to do so will result in a zero grade for that exam. Unexcused absences for an exam will also result in a zero. If you have a condition that dictates special circumstances for exam taking, please notify us as early as possible.

Appropriate class participation is strongly encouraged. Grades can be increased or lowered by 10% based upon exceptional or unacceptable interaction in classroom, email, or office settings. The grading for this course will be curved. Do not be alarmed if the highest grade on a midterm is 80%; that 80% will earn an A and grades will be assigned from there.

ADVICE: You are strongly advised to actively engage in the course. You will find that in economics, a deep understanding of key concepts facilitates high grades. Deep understanding of concepts is most easily attained with class attendance and participation. Coming to class and not paying attention is virtually worthless; given the once a week format of this course, we strongly encourage you to prepare for class to minimize work catching up later on.

Textbook & Readings

An Introduction to Statistical Learning w/ Applications in R. James, G., Daniela, W., Hastie, T., Tibshirani, R. 7th Printing

Lectures on Pricing. McAfee, R. Preston. Available free and legally from:

http://www.mcafee.cc/Papers/Classes/BEM116/PDF/LectureNotes.pdf

We also may assign reading from selected academic journal articles and other sources, which will be announced on a rolling basis.

Course Outline

NOTE: This outline is subject to change at the discretion of the instructors.

** means required reading.*

Date	Topic	Optional Reading
Week 1	Core Pricing Concepts a. Deriving Demand b. Single good case and optimal price c. Elasticities and the Lerner formula d. Selling *n* goods e. Value-based pricing f. Unobservable type g. Introduction to R	McAfee Ch. 1, 2, 3 James et. al. 2.3 McMillan Ch. 1-3 (recommended) Varian's notes on price discrimination
Week 2	Value based pricing (price discrimination) a. Regression (OLS) b. Econometric methods c. Model Fit (MSE) d. Regression Interpretation e. Parametric/non-parametric f. Overfitting g. Empirics of demand modelling	Determinants of Store Level Price Elasticity
Week 3	Empirical methods for practical pricing a. Causality b. Bias c. Machine Learning (ML) d. Cross-Validation	Hastie Ch. 1 and 3.1-3.3 Measuring Customer's Reaction to Price
Week 4	Empirical methods for practical pricing II a. Cross-Validation cont… b. LASSO/Ridge c. Supervised/Unsupervised d. K-means clustering e. Prediction vs interpretation f. Logit g. Logit Demand	Lecture notes will be provided. Hal Varian "Causal Inference in the Social Sciences"
Week 5	Data science methods for pricing a. Regression Trees b. CART c. Bagging d. Gradient Boosting e. Causality versus prediction revisted	Lecture notes will be provided. NOTE: MIGHT DO FINAL THIS WEEK
Week 6	First half: midterm Second Half: a. Life Time Value b. Customer Inertia	Hastie 4.3, 8.1

	c. Fremium (quality differentiation) d. Purchase level data	
Week 7	Trees and Forests a. Gradient Boosting revisited b. Random Forest c. Heterogeneous Treatment Effects d. Conditional ATEs	Notes will be provided "Big Data: New Tricks for Econometrics"
Week 8	Intertemporal Substitution & Debiased ML a. Time as substitution b. Causality c. Omitted Variable Bias d. Double ML procedure Purchase Level Data a. ARPU versus LTV b. Rates and Flows	Notes will be provided
Week 9	Recap and Final	Notes will be provided