

DRAFT Syllabus Q4 2023

OIDD 6430 Analytics for Revenue Management

Students enrolling in OIDD 6430 in Q4 2022 must attend the first class session and take the in-class final quiz on Tuesday April 25th 1:45-3:15pm.

Class Schedule and Room

TR 1:45-3:15pm, Room TBA

Instructor

Noah Gans

Office Hours: TBA

Telephone: 3-7673

Email: gans@wharton.upenn.edu

Teaching Assistant

TBA

Course Overview

In the 1980's, Yield Management revolutionized the airline industry. Since then, the tactical use of forecasting and optimization tools to squeeze more revenue out of scarce operational capacity has spread widely. This approach – in what has come to be known as revenue management (RM) or pricing and revenue optimization (PRO) – is now actively used in a range of industries, including various forms of passenger and cargo transportation, media and communication services, hospitality, sports and performing arts, and retailing.

RM thrives in industries in which: 1) short-run operating capacities are fixed and perishable; and 2) for which there is some element of demand elasticity that can be estimated and used to extract more revenue out of that limited capacity. In some cases, demand elasticity comes from the identification of higher-paying segments of the general population for whom capacity can be reserved. The yield management models first developed by the airlines identified business customers as favored and reserved capacity for that group by requiring that low-cost fares include a weekend stay. In other cases, companies can use broader estimates of price elasticity of demand to dynamically change prices in response to changing forecasts of potential capacity-demand imbalances. This approach is the core of the dynamic markdown management tools used by fashion retailers.

This course introduces you to the essential concepts and techniques required to understand and implement RM. This approach, in part, represents the tactical implementation – day-by-day or even moment-by-moment – of classical demand estimation and capacity allocation models whose origins can be found in applied microeconomics and marketing. But the need for repeated, rapid cycles of estimation and optimization has driven the development of a set of analytical tools that are particularly well suited for RM, and in this course we will focus on those tools.

Prerequisites

Students who have already taken OIDD 6120 and STAT 6130 should be well equipped for the class. Other students should have a solid understanding of elementary probability, statistics, and constrained optimization.

DRAFT Syllabus Q4 2023

- Your background in probability and statistics should include an understanding of random variables, measures of central tendency and variation, sample statistics, and regression.
- Your background in constrained optimization should include an understanding of the algebraic formulation and spreadsheet implementation of simple linear and nonlinear programs (LPS and NLPs), as well as shadow (dual) prices.

For questions regarding the specifics of your background, please contact me.

Related Courses

The conceptual foundations for this course lie in Managerial Economics (MGEC 6110) and Marketing Management (MKTG 6110). These courses provide the basis for understanding core notions of customer segmentation and price discrimination. While the courses provide the background needed to understand the context for the tactical uses of the concepts, they are not needed to understand the specific tools that we will cover in the course.

Two other courses address topics that are central to this course but in a complementary fashion. Pricing Policies (MKTG 7540) considers topics – such as the estimation of willingness to pay and markdown policies – in a broader strategic context, rather than with the narrower tactical and computational focus that we'll take. Operations Strategy (OIDD 6150) highlights the connection between capacity reservation, overbooking decisions, and the newsvendor model that is central to much of operations management.

Two additional courses provide depth and sophistication to some of the estimation and forecasting issues that are touched on in the course. Applied Probability Models in Marketing (MKTG 7760) introduces students to complex structural models of consumer behavior, and Forecasting (STAT 7110) covers a wide range of models that can be of value when forecasting demand.

Course Materials

All course materials are either downloadable from study.net

STUDY.NET LINK HERE

and Canvas

CANVAS LINK HERE

or will be distributed in class.

For those who would like to have texts, I recommend:

- R. W. Phillips (2005). *Pricing and Revenue Optimization*, Stanford University Press.
- K. T. Talluri and G. J. van Ryzin (2004). *The Theory and Practice of Revenue Management*. Springer.

Course Requirements and Grading

Course grades will be based on class participation (15%), case write-ups (30%), homework questions (25%), and a final quiz (30%).

DRAFT Syllabus Q4 2023

Class Participation

On-time attendance is mandatory, and 10 of the 15 class participation points will reflect this basic measure of participation. Each student gets one “free” absence that does not affect their attendance score, but each additional absence is scored more negatively:

< 2 absences	10/10 attendance points
2 absences	9/10 attendance points
3 absences	7/10 attendance points
4 absences	3/10 attendance points
> 4 absences	fail the course

The last 5 of the 15 class participation points reflect my qualitative judgment concerning your effective contribution to class discussions and dynamics. You should be attentive to the class discussion. Your comments should respond to and “push forward” what is happening in class.

Policy on Electronics in the Classroom

The course is structured for lecture and discussion, and it moves more quickly (and covers more material) than a “flipped” classroom in which students work on spreadsheets during class. To that end, unless I approve a student request to use a tablet or laptop in response to a specific extenuating circumstance, these devices are not to be used in class. Phones should not be used in class. **Unauthorized use** of electronics in class will be **marked as an absence** for that day. Please see the section on Class Participation, above.

Short Homework Exercises

There will be five relatively short homework exercises that, in some cases, prepare you for an upcoming class and, in others, review material we’ve just covered. You will be able to download these from Canvas / Files after class on the day the homework is assigned and should **enter your answers into a Canvas Quiz by 12pm on the day the homework is due**. You may discuss the assignments with others, but your answers to the quizzes must be your own. **Late submissions will be penalized.**

Case Write-Ups

There are three longer homework exercises associated with cases we’ll cover in class. I will count the best 2 scores toward your final grade.

For each case, I will post on Canvas a set of questions to be answered. You may answer the questions one at a time. While there is no need to write up the case as a memo, your answers to case questions should be crisp and complete. I will judge your answers based on the depth, clarity, and care with which you present them.

You should do these cases with a partner, and I have set up Case HW groups on Canvas where you and your Case HW partner can form a group. The first Short Homework asks you to sign up and report who your partner is. You and your partner should hand in one write-up for the two of you. **You should upload your write-up, along with any associated Excel (or other) files with analysis, to Canvas by 12pm on the day the homework is due. Late submissions will be penalized.**

DRAFT Syllabus Q4 2023

Self-Study Exercises

The course also includes ungraded self-study exercises that are designed to for you to practice using the course's analytical models to solve problems. I will post sample solutions for the exercises on Canvas.

I suggest you work in pairs on the self-study exercises. Having a partner will help to ensure that you do the work on a timely basis. You are also likely to find that discussing the problem with another person helps you in the learning process.

Final Quiz

On **Tuesday April 25th 1:45-3:15pm**, an in-class, open-book quiz will cover the tools and concepts developed in class. No electronics will be allowed during the exam, but you will be able to bring your own written notes, as well as printouts of whatever is posted on Canvas and Study.Net this quarter.

Homework and self-study problems will give you a good idea of the kind of questions you can expect on the quiz. In the last week of class, I'll also hand out a sample quiz which you can also use to practice for the final quiz.

While you may prepare in groups for the quiz, the notes you use during the quiz must be your own. Similarly, the work performed on the quiz itself must be your own.

Class Schedule

Below is a summary listing of class topics and the due dates for case write-ups. To prepare for a given session, you should go to Canvas

CANVAS LINK HERE

and follow the appropriate link for instructions for the given class.

		Topic	Video Review	Short HW	Case HW
1	3/14	Intro + Customer Valuation Game			
2	3/16	Optimization for Statistical Estimation	#1	#1	
3	3/21	Demand-Curve Estimation, Pricing for NYHC			#1
4	3/22	Estimating with Censored Data		#2	
5	3/28	Segmentation and Peak-Load Pricing for NYHC			
6	3/30	Dynamic Pricing Using Dynamic Programming		#3	
7	4/04	Retailer: Dynamic Demand Estimation, Pricing			#2
8	4/06	Capacity Allocation and Control	#2		
9	TBA	Guest Speaker		#4	
10	4/13	No-Shows and Overbooking			
11	4/18	Large Networks, Real-Time Control		#5	
12	4/20	Capacity Allocation at Harrah's + Wrap-up			#3