Predictive analytics and decision modeling are two key components of business analytics. They provide business entities and policy makers with the fundamental rationality in evaluating performance, making decisions, designing strategies, and managing risk. In ORF360, we will focus on decision modeling of business analytics and operations management.

The course will emphasize both popular decision models arising from real applications, as well as mathematical decision-making tools and concepts. The first half of the course introduces the basic decision models in revenue management, pricing, and inventory control. The second half of the course consists of a series of business themes, such as finance, energy, health care, and games.

**Teaching Assistants**
Jing Ye (jingy@princeton.edu)  Zhaoran Wang (zhaoranwang@gmail.com)

**Assignments**
Six weekly problem sets (problem solving and/or Matlab programming)

**Midterm**
In-class midterm on March 24

**Final Project (TBD)**

**Grading**
Assignments 35%; Midterm 35%; Final 30%
ORF 350 - Decision Modeling in Business Analytics

February 3 – Introduction

February 5 – Basics of Revenue Management
  • Overview of revenue management
  • Case study: Airline pricing
  • Demand functions

February 10 – Basic Pricing Model I
  • Solving the basic pricing model, pricing model with capacity constraints
  • Consumer segmentation, consumer surplus, consumer welfare

February 12 – Basic Pricing Model II
  • Two-class pricing model, multiple-class pricing model

February 17 – Exploiting Price Discrimination Against Time
  • Understanding airline fare classes
  • Single resource capacity control problem

February 19 – An Important Tool: Dynamic Programming
  • Dynamic arrival model for customers
  • Introduction to Dynamic Programming

February 24 – Dynamic Pricing Models I
  • Understanding the price trajectory
  • Mark up/down
  • Solving dynamic pricing using dynamic programming

February 26 – Dynamic Pricing Models II

March 3 – Network planning in Airline Management
  • Network capacity control
  • Airline scheduling, smart flight cancellation

March 5 – Network Capacity Control
  • Connection between DP and LP
  • Approximate DP via linear parametric model

March 10 – Consumer Choice Models
  • Effects of reference price

March 12 – Consumer Choice Models and Midterm Review
  • Types of consumers
  • Network effect
--------- Spring Break ---------

March 24 – Midterm

March 26 – Demand Learning
  • Parametric vs. Nonparametric

March 31 – Workforce Analytics (Guest Lecture by Kush Varshney@IBM)

April 2 – Demand Learning and Energy Applications

April 7 – Energy Applications
  • Nuclear Power Planning by DOE
  • Risk-averse dynamic programming

April 9 – Finance Applications: Automated Trading
  • Learning from the order book
  • Markov Chain Estimation

  Finance Applications: Credit Card and Micro-Loans
  • Predicting the default rate
  • Decision with risk concern

April 14 – Health Analytics (Christian Nicherson @Cedar Gate Technologies)

April 16 – Internet Applications
  • Google ads problem
  • Amazon recommendations

April 21 – Hotel Booking Analytics (Guest Lecture by YieldPlanet)

April 23 – Mathematics in Games
  • Nash equilibrium, optimal bluffing frequency in poker
  • Player analytics and exploitive play
  • Pokerbots via approximate DP
  • Risk-free market making in sports betting
  • Sport modeling

April 28 – Misc Topics

April 30 – Final Presentations and Summary