2016 Spring ORF360 Final Project Guidelines

Hi all! Great job in the past eleven weeks! We are really close to the summer vacation. Now comes the final project. Don’t panic. Just treat it as a big assignment (but you can pick your own problems).

ORF360 focuses on decision modeling and covers a wide scope of models/applications. You are expected to model a decision-making problem that comes from a practical application. There are two types of project: model-driven project, and data-Driven Project. You can choose either one. If you choose to work on a model-driven project, you want to study a specific decision model (and its variants), and use simulation to compute optimal policies and do decision analysis. If you choose to work on a data-driven project, you need to identify a data set and build a predictive/prescriptive model based on the data, compute the optimal policies and conduct analysis. You can also do a combination of both.

Deliverables:

• Presentation (12 min per person; Date: 10:30am – 1pm, May 6\textsuperscript{th}; Friend 003)

You will present your project to the class (imagine that you are making a pitch to investors). Your presentation needs to have the following components: application background, your mathematical decision model, real data or simulation of your model, the optimal decision computed for your model, and your analysis and insights.

• Technical Report (5-8 pages)

This is a short summary of what you have done. Try to provide all the technical details including your code. No need for a lengthy paper. It is due on the same day, May 6\textsuperscript{th}.

Grading of Final Project:

50% peer grading (at the end of all presentations);

50% instructor grading (after reading your report).

Sample Project Topics

Here are several project topics. They are quite open, so you are free to develop your own models. You are also welcome to come up with your own topics.

• Airfare network management:

Build an airfare network management model to find the optimal pricing strategy under seat capacity constraint. You can make your own assumptions on the consumer arrival process, flight routes, main hubs, and flight capacity constraints. One interesting goal can be to recover the “hidden-city
phenomenon” from your model.

- **Dynamic Pricing and Consumer Behavior Models**

Dynamic pricing is able to exploit certain aspects of consumer behaviors, such as myopicity and impatience. This project aims to model a specific consumer behavior and study the corresponding optimal pricing strategy. For example, you can study the case where consumers have different memory lengths or the case where some consumers are myopic while others are not. You want to build your own model, formulate the pricing problem using dynamic programming, and compute the optimal strategy using simulation. Show us why your model is a good approximation of reality and what does your optimal strategy implies.

- **Micro-Loan Risk Management:**

Suppose that you have micro-loan payback history from a bank. The question is whether to approve/reject one’s loan application based on one’s attributes. The bank wishes to make the most money but also has risk concerns. You want to build a predictive-prescriptive model in order to make the best loan decisions. **Data available upon request.**

- **Tactics-Driven Trading**

Suppose that you are given two daily trading signals, based on which you want to long/short S&P 500. The problem is to find the optimal trading strategy. You want to model this into an optimization problem, in which you can inject some risk consideration. It can be as simple as an unconstrained single-stage optimization problem, and as hard as a multi-stage portfolio management problem. Please formulate your own problem, simplify it such that it is solvable, find the optimal trading strategy, and demonstrate its performance (empirical return, risk, max drawdown). Data available upon request.

- **Pricing of Exotic Options**

Suppose that you have historical price of some equity, and you want to price an option with unusual structure. You may compare two approaches. The first one is to fit a time-series model and solve the pricing problem using the fitted price model (via dynamic programming). The second one is to apply data-driven dynamic programming. Show us your option model, how you simulated the price data, how you calculate the price function, and some comparative analysis.

- **Learning the Consumer Segmentation and Optimal Pricing**

Suppose that consumers have two attributes, and the anticipated price is a function of the two attributes (feel free to build your own model here). Say that third-degree consumer segmentation is possible if you classify consumers into two disjoint groups according to their attributes. Now you want to learn the best segmentation and best pricing scheme in each segment via offline (or online) demand learning. In this project, you can use either real data or simulated data. (If you want to study online learning and the regret, you would have to use simulated data.)

- **Learning Problem of Uber Driver**