

**ORF 411**  
*Operations and Information Engineering*

**Syllabus**  
**Fall, 2014**

**Course description:** We look at the world from the perspective of designing and controlling complex stochastic resource allocation problems. We take a fundamental approach, where we identify six fundamental classes of resources. We then develop a modeling framework that emphasizes capturing the organization and flow of information and decisions. This framework breaks down problems into five core dimensions, one of which is the design of policies for making decisions. At all times, emphasis will be placed on modeling real-world problems that arise in business, finance, energy, health and other complex problems.

The course will progress through a series of successively more complex resource allocation problems in the first half of the course. The second half will focus primarily on the organization and flow of information in complex systems.

Students are exposed to all issues in the second half of the course through an intensive, controlled competition called the Orange Juice Game. Students are formed into teams which then compete to see who can operate a company that makes and distributes orange juice products. The game involves acquiring raw materials, purchasing futures, creating a manufacturing and distribution network, and deciding on a pricing strategy.

**Instructor:** Hugo P. Simão ([hpsimao@princeton.edu](mailto:hpsimao@princeton.edu)) – Sherrerd Hall Room 112  
Office hours: By appointment (please send request via email).

**Teaching assistants:** Daniel Jiang <[drjiang@princeton.edu](mailto:drjiang@princeton.edu)>  
Genna Gliner <[genna@princeton.edu](mailto:genna@princeton.edu)>  
Zhaoran Wang <[zhaoran@princeton.edu](mailto:zhaoran@princeton.edu)>

**Web site:** The lectures will be available on Blackboard at the *end* of each week. Problem sets and other handouts can also be downloaded from Blackboard. Problem sets (1<sup>st</sup> half of the course) and OJ game runs (2<sup>nd</sup> half) will be due on Tuesdays by 5pm.

**Prerequisites:** Students are expected to have a background in statistics (ORF 245 or ECO 300 or ECO 303), probability and stochastic processes (ORF 309) and optimization (such as ORF 307 or ELE 382).

**Requirements:**

Problem sets (including attendance):	20 %
Midterm:	30 %
Game day performance:	20 %
Project write-up:	15 %
Team performance evaluation:	15 %

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Course outline  
2014

**Part I – Overview**

Sept 11 – Course themes and focus

Sept 16 – What is a resource?

**Part II – Operations engineering**

*Here we provide an overview of a series of fundamental resource allocation problems that arise in physical and financial applications.*

Sept 18 – The budgeting problem

Sept 23 – The deterministic inventory problem

Sept 25 – The newsvendor problem

Sept 30 – Modeling uncertainty and dynamic information

Oct 2 – How do we make decisions? Designing policies

Oct 7-9 – A sequence of “storage” problems

Oct 14 – Substitutable resources - I

Oct 16 – Substitutable resources – II

Oct 21 – Demand management

Oct 23 – *OJ Game* overview and Review

----- Fall break -----

Nov 4 – Midterm Exam

### **Part III – Information engineering**

*At the heart of most resource management problems is information. In this section of the course, we start from the fundamental question of defining information, and proceed to studying the flow of information and how people use it in the context of resource management problems.*

Nov 6 – What is information?

Nov 10, Mon – *OJ Game* first test run, due by 5pm

Nov 11 – Efficient collection of information – I

Nov 13 – Efficient collection of information – II

Nov 18 – An exercise in communication: The Beer game. Attendance is required.

Nov 20 – Beer game review

Nov 25 – Information exchange and the two-agent newsvendor problem - I

Nov 27 – Thanksgiving

Dec 2 – Information exchange and the two-agent newsvendor problem - II

Dec 4 – Guest speaker: Jim Liu '99

Dec 9 – IPO pricing and the science of lying

Dec 11 – The final challenge: real-time decisions

Dec 11, Thu – *OJ Game Write-Up Part I – Modeling*, due by 11:59pm

----- Winter break -----

### **Part IV – OJ Game Final Steps**

Jan 9, Fri – *OJ Game Write-Up Part II – Individual Work*, due by 11:59pm

Jan 12, Mon – The Orange Bowl, 1pm – 5pm (lunch served starting at noon).  
**Attendance is required at the Orange Bowl.**

Jan 13, Tue – *OJ Game Team Evaluation*, due by 5pm.