BDPEMS – Management Science I Part 2

Sequential Decision Making Under Uncertainty

With Applications to Operations and Management Sciences

*DRAFT – Depending on the pace of the class, this syllabus might be subject to change.*

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Thursdays
8:45am – 11:45am

Location
ESMT Room 00.21 (the session on Nov 21 will take place in the ‘Bookshop’)

See http://www.esmt.org/eng/about-esmt/how-to-get-there/

COURSE DESCRIPTION

This course is concerned with situations in which decisions are made sequentially. The fundamental tradeoff at stake consists in balancing immediate reward with unpredictable future rewards. These situations can be found in a wide variety of areas ranging from marketing (e.g. dynamic pricing) to the environment (e.g. water management). In this course, we will primarily focus on applications in the field of management science.

The approach is based on Markov decision processes and more generally (stochastic) Dynamic Programming (referred to as DP in the following), which provides a set of general methods for making sequential decisions under uncertainty.

Objectives of the courses

- Learn to formulate and solve dynamic programming problems
- Develop modeling skills to tackle issues in Operations and Management Science
- Gain knowledge on conducting research in Operations and Management Science
COURSE MATERIALS AND BOOKS:

Course material will be distributed in class (problem sets, articles etc.). However, we will extensively use the following textbook:


I will also sometimes refer to and summarize results from the following books that are not required:

Other books

“Foundations of Stochastic Inventory Theory”, Porteous, 2002
“Supermodularity and Complementarity”, Topkis, 1998

COURSE REQUIREMENTS

Final Exam (40%): There will be a 3h final exam in the last session (Jan 16, 2014).

Papers Presentation (40%): You will be asked to do in-class presentations of research articles (in Sessions 5). Papers will be assigned in class. Alternatively, you can suggest your own articles.

Class participation (20%): Graded for each class. I am evaluating to which extent you come prepared to class as well as the quality and frequency of your interventions in class.
TENTATIVE SCHEDULE (subject to change)

I will try to follow the following outline but will adjust the content depending on the class needs and learning rate.

PART I – Theory and Foundation

This part constitutes the technical part of the course and focuses on the theoretical foundations of Dynamic Programming and Stochastic Optimization. The core classes are probably Sessions 2 and 3, in which some of the most important concepts and technique will be introduced.

1. Introduction - Principle of optimality and DP Algorithm
   
   Read:
   Explore: Vol. I, Chapters 1.1, 1.2, 1.5

   
   Read:
   Previous session (going deeper): Vol. I, Chapter 1
   Explore: Vol. I, Chapters 4.2, 4.3

3. Infinite Horizon – Discounted Problems, Continuous Time Problems
   
   Read:
   Previous session (going deeper): Vol. I, Chapter 4
   Explore Vol. I, Chapter 7

PART II – Applications

In this part we will learn how the previous approaches and techniques are used to conduct research in the fields of Operations and Management Science. The main methodology consists in modeling real situations and gaining insights into the problem by analyzing the structure of the corresponding policy. Depending on time and availability, we may also broaden the focus of the class and learn about empirical research in the field of Management Science with guest speakers.

4. Examples, Extensions and Other Approaches to Operations Management

5. Applications - Supply Chains, Dynamic Pricing, Nonprofits
   
   Read:

6. Final Exam

### SUMMARY

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