This course is designed to provide doctoral students the theoretical foundations to perform analytical research in the inventory and supply chain management field. Rather than trying to cover an extensive set of models spanning the extensive literature on the subject, we will focus on the methodological foundations of inventory theory with a focus on deriving some of the fundamental results in the area. The focus of this course is on providing students with the analytical and computational tools to increase their effectiveness in formulating and carrying out inventory/supply chain management research projects. Enrollment is restricted to doctoral students; Master’s students can enroll in the course only with the consent of the instructor.

**Teaching Methodology.** The first part of the course will be presented by the instructor, and after each weekly section students will be asked to work a problem set. For the second part of the course we will review and discuss research papers. Each student will be required to study a set of research papers, and present and lead the discussion of at least one paper in the set.

**Grading.** There is no final exam; the course grade will be based on problem sets to be assigned weekly, class participation, and a term paper as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Sets</td>
<td>60%</td>
</tr>
<tr>
<td>Term Paper Presentation</td>
<td>10%</td>
</tr>
<tr>
<td>Term Paper</td>
<td>20%</td>
</tr>
<tr>
<td>Class Participation</td>
<td>10%</td>
</tr>
</tbody>
</table>

In the first class we will discuss the characteristics of the required term paper and the timeline of the intermediate deliverables.

**Teaching Materials.** We will use a textbook as indicated below; additional materials and papers will be supplied by the instructor.


**Reference Books.** In addition to the textbook above, we will use some parts of the following two books in the course. They will be on reserve in the library (PCL).

COURSE OUTLINE

Jan. 23

- Review of Preliminary Concepts
- Basic Inventory Models
- Recursive Approach to Optimization

Readings:
- Appendix A, and Chapters 1 and 2 of Porteus
- Chapter 2 of Bertsekas (Vol. 1)

Jan. 30

- Introduction to Finite Horizon Stochastic Dynamic Programming with Finite State and Action Spaces

Readings
- Chapters 3, 4 and 5 of Porteus

Feb. 6

- Solution Approaches to Stochastic Inventory Models

Readings:
- Chapters 6 and 7 of Porteus
- Myopic Solutions of Markov Decision Processes and Stochastic Games – M. Sobel (Section 1)

Feb. 13

- Lattice Programming and Total Positivity Applications in Operations Management Research

Readings:
- Chapters 8 and 9 of Porteus
- Minimizing a Sub-modular Function on a Lattice - D. Topkis
- Super-modularity and Complementarity – D. Topkis

Feb. 20

- Inventory Models with Imperfect State Information.
- Bayesian Inventory Models.

Readings:
- Chapter 5 in Bertsekas (Vol. 1)
- Chapter 10 in Porteus

Feb. 27

- Contraction Mappings and Fixed Points in Infinite Horizon Markov Decision Processes.

Readings:
- Chapter 11 and 12 of Porteus

Mar. 5.

- Policy Iteration and Linear Programming Approaches to the Solution of Infinite-Horizon Markov Decision Processes.

Readings:
- Chapter 13 of Porteus.
- Chapter 7 of Bertsekas (Vol. 1)
Mar 19
• Models with Average Cost per Period Optimization Objective.

Readings:
• Chapter 4 in Bertsekas (Vol. 2)

Mar 26
• Approaches for the Approximation of the Policy Space/Optimization of Finite and Infinite Horizon Dynamic Programs.

References:
• Chapter 6 of Bersekas (Vol. 1).
• Chapter 5 of Bertsekas and Tsitsiklis.

April 2
• Approaches for the Approximation of the Cost-to-Go Function of Finite and Infinite Horizon Dynamic Programs.

References:
• Chapter 6 of Bersekas (Vol. 1).
• Chapter 6 of Bertsekas and Tsitsiklis.

April 9 and 16
• Student Presentation and Discussion of Selected Seminal Papers and Recent Articles in Stochastic Multi-Echelon Inventory Theory.

April 23 and 30
• Presentation of Student Projects.