RUTGERS - THE STATE UNIVERSITY OF NEW JERSEY

**Stochastic Dynamic Models and their Applications
in Supply Chains and Marketing**
Spring 2009
Preliminary Syllabus by M. Katehakis

- **Texts**
    1. C Derman. *Finite State Markovian Decision Processes,* 1970 - Academic Press, Inc.
    2. EA Feinberg, A Shwartz. *Handbook of Markov Decision Processes: Methods and Applications,* 2002 – Springer.

    Additional Reading Material:
    1. Bayesian Statistics and Marketing (Wiley Series in Probability and Statistics) by Peter E. Rossi, Greg M. Allenby, Rob McCulloch.
    2. A lot of reading material from top conferences/journals will be made available online or in class as required.

Description

This course provides an introduction to Stochastic Dynamic Optimization and its Applications in Supply Chains and Marketing. Stochastic Dynamic Optimization is also known under several other names including Markov Decision Processes, discrete-time stochastic control, sequential stochastic optimization and sequential optimization of discrete time stochastic systems. The main theory studies the optimization over time of a discrete-time stochastic system whose transition mechanism can be controlled. Each control policy (i.e., sequence of decisions in time) defines a stochastic process and values of objective functions associated with this process. The objective of the controller is to select optiml or "good" control policies. In Supply Chains and Marketing, decisions that humans or systems make often have impact not only on costs/revenues, time, or other resources, but in addition they have an impact on the future, by influencing the dynamics of the system. Thus often decisions with the largest immediate payoff (myopic) may not be optimal over a time interval because of future events. The theory of Stochastic Dynamic Optimization (SDO) provides a foundation for such problems and it supplies results on the existence, structure and computation of optimal policies. This theory is important both from the methodology and the applied points of view since it provides tools for the solution of important practical problems in many areas of supply chains, marketing as well as in many other areas of business applications.

The course will be organized in a seminar format. Students will be required to do a data collection design and implementation study and submit a detailed project report. There will be one final examination at the end of the course.

Tentative Syllabus.

1. Finite Time Problems.

2. Infinite Horizon Discount Rewards

3. Optimal Stopping

4. Average Rewards.

5. Problems with Constraints.

6. Partial Information, the Goal of Inference and Bayes' Theorem.

7. Prediction and Bayes.

8. Conditioning and the Likelihood Principle.

9. Risk, and the Sampling Properties of Bayes Estimators.

10. Identification and Bayesian Inference.

11. Inventory control methods for a single product and a single location.

12. Inventory control methods for a multi locations.

13 Survey Sampling and applications in Marketing.

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Grading

Attendance (including in-class work)	10%
Assignments	20%
Project/Presentation/Paper	30%
Final Examination	20%