

ISYE 4232 ADVANCE STOCHASTIC SYSTEMS

Credit:

3-0-3

Prepared

Prof. Hayriye Ayhan, Fall 2013

Prerequisite(s):

ISYE 3232

Catalog Description:

The course will cover Jackson Networks and Markov Decision Processes with applications to production/inventory systems, customer contact centers, revenue management, and health care.

Texts:

No required texts. The class will be based on lecture notes, reference papers and text.

Objective

The objective of this course is to develop models for sequential decision making in production and service systems where the outcomes are uncertain.

Topical Outline

1. Open and Closed Jackson Networks
2. Markov Decision Processes
 - Finite Horizon Models, Infinite Horizon Models, Long-Run Average Reward Models
3. Sequential Decision Making Under Uncertainty: Some Applications
 - Multi-Period Inventory Systems, Production Systems, Telecommunication Systems, Call Centers and Other Service Systems

Outcomes

At the end of this course, students will be able to:

- Model a system when randomness is significant
- Apply Continuous Time Markov Chains
- Use open and closed Jackson networks
- Use Markov Decision Processes
- Develop models for sequential decision making under uncertainty

Course outcome \ Program Outcomes	a. apply math	b. Design, conduct experiment, analyze interpret data	c. Design system	d. team	e. problem solving	f. prof/ and ethical responsibilities	g. communication	h. global, eco, envi and soc context	i. Life-long learning	j. Contemporary issues	k. use tools for eng. practice
Model a system when randomness is significant	High		Med		Med				Low		High
Apply Continuous Time Markov Chains	High				Low						
Use open and closed Jackson networks	High		High								
Use Markov Decision Processes	High		Med		High				Low		High
Develop models for sequential decision making under uncertainty	High		High		High						High

Evaluation of the important outcomes

The students should be able to demonstrate the following on two midterm exams, a final exam, and a project:

1. The students should be able to apply Continuous Time Markov Chains to various kinds of problems.
2. The students should be able to use open and closed Jackson networks
3. The students should be able to use Markov Decision Processes
4. The students should be able to develop models for decision making in systems with uncertainty

ISyE ABET Student Outcomes a - k

- a) an ability to apply knowledge of mathematics, science, and engineering
- b) an ability to design and conduct experiments, as well as to analyze and interpret data
- c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- d) an ability to function on multidisciplinary teams
- e) an ability to identify, formulate, and solve engineering problems
- f) an understanding of professional and ethical responsibility
- g) an ability to communicate effectively
- h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- i) a recognition of the need for, and an ability to engage in life-long learning
- j) a knowledge of contemporary issues
- k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.