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

Student Outcome Assessment Plan

Course outcome \ Program Outcomes	1. identify, formulate solve engg prob by engg, sci & Math	2. produce solutions consider public health, safety, welfare, global, cultural, social, environ & economic	3 communicate with a range of audience	4 recognize ethical & professional responsibilities, make informed judgement consider resolutions in global, economic, environ and societal context.	5. effective on a team provide leadership, collaborative and inclusive envirn, plan tasks & meet objectives	6. develop and conduct experiment, analyze and interpret data & use engineering judgement to draw conclusions.	7. acquire and apply new knowledge using appropriate learning strategies
1. Model a system when randomness is significant	M						
2. Apply Continuous Time Markov Chains	M						
3. Use open and closed Jackson networks	M						
4. Use Markov Decision Processes	M						
5. Develop models for sequential decision making under uncertainty	M						

Evaluation of the important course outcomes

The approximate relationship from prior ABET a – k to new ABET 1 – 7.

OLD Criterion 3. Student Outcomes The program must have documented student outcomes that prepare graduates to attain the program educational objectives. Student outcomes are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program.	NEW Criterion 3: Student Outcomes The program must have documented student outcomes that support the program educational objectives. Attainment of these outcomes prepares graduates to enter the professional practice of engineering. Student outcomes are outcomes (1) through (7), plus any additional outcomes that may be articulated by the program.
(a) an ability to apply knowledge of mathematics, science, & engineering (e) an ability to identify, formulate, and solve engineering problems	(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	(6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
(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 & safety, manufacturable, & sustainable	(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration for public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
(d) an ability to function on multidisciplinary teams	(5) An ability to function effectively on a team whose members together provide leadership, create a collaborative & inclusive environment, establish goals, plan tasks, and meet objectives.
(f) an understanding of professional and ethical responsibility (h) the broad education necessary to understand the impact of engg solutions in a global, economic, environmental, & societal context (j) a knowledge of contemporary issues	(4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
(g) An ability to communicate effectively.	(3) An ability to communicate effectively with a range of audiences.
(i) a recognition of the need for, and an ability to engage in life-long learning	(7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	Implied in 1, 2 and 6