ISYE 3232 STOCHASTIC MANUFACTURING AND SERVICE SYSTEMS

Required for BSIE

Credit: 3-0-3

Prepared Prof. Steimle, Ayhan, Maguluri, Tovey

Prerequisite(s): ISYE 2027 or MATH 3215 or MATH 3225

Catalog Description:
Methods for describing stochastic movements of material in manufacturing facilities, supply chain, and equipment maintenance networks. Includes analysis of congestion, delays, and inventory ordering policies.

Texts:
1. Goldratt, E, *The Goal: Process On Ongoing Improvement*, North River, 3rd Ed., 2003.
2. *Littlefield Technology Access Case*, Responsive L, 2007.

References
1. Feldman, R.M., and Valdez-Flores, C., *Applied Probability and Stochastic Processes* (custom printing), Thomson, 2004.

Course Description
Manufacturing & service systems typically have random components to their behavior such as the demand for products and services. We will learn quantitative methods which are useful in analyzing, designing, and operating stochastic systems particularly manufacturing and service systems. Much of our attention will be focused on understanding, managing, and reducing variability for inventory, production and service systems.

Topical Outline

Topics	Weeks
Introduction, News Vendor problem	3
Queuing Theory overview, Kingman's Approximation, Little's Law, Bottleneck	1.5
Discrete and Continuous-Time Markov Chains: Markov Property, Transition Probabilities, State Classifications	4
Poisson Process, Poisson Random Variable and random variables for Poisson Processes, Time-inhomogenous Poisson Process, Thining Poisson Process, Merging Poisson Process, Examples of continuous Markov Chain	2
Continuous Markov Chains, Generation Matrix, M/M/1/b queue, M/M/∞, M/M/k Queues.	2.5
Summary	1
	14

Current:

Course Learning Outcomes and its relationship to BSIE program learning outcomes

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

1. Model a system when randomness is significant
2. Describe how variability affects a system's behavior and performance
3. Apply Markov Chains
4. Apply basic inventory models
5. Define key concepts in production flow such as bottlenecks, line balancing, and Little's Law
6. Use open and closed Jackson networks
7. Maintain throughput in a closed Jackson network and compute corresponding WIP levels

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Course Goals and Learning Outcomes

The goal of this course is to provide an overview of methods and modeling techniques used to design, analyze, and manage a manufacturing or service system with uncertainty.

1. Describe the role of uncertainty in manufacturing and service systems
2. Analyze and manage uncertainty in systems dealing with perishable items
3. Quantify the waiting time, length of the queue, and utilization in queueing systems
4. Analyze and manage uncertainty in systems using predictions of potential future outcomes
5. Effectively work as a member of a team to analyze the role of uncertainty in a system and communicate the findings

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.	H						
2. Describe how	H						

variability affects a system's behavior and performance.							
3. Apply Markov Chains	H						
4. Apply basic inventory models	H						
5. Define key concepts in production flow such as bottlenecks, line balancing and Little's Law	H						
6. Use open and closed Jackson networks							
7. Maintain throughput in a closed Jackson network and compute WIP levels							

Evaluation of the important outcomes

The outcomes 1, 2, 3, 4 and 5 will be assessed via direct complex verbal questions in an engineering context on final exam.