Course Specifications

General Information

Course name	Performance Modeling
Course number	ITCS4343
Faculty	
Department	
Course type	Major Needs
Course level	4
Credit hours (theoretical)	3
Credit hours (practical)	0
Course Prerequisites	

Course Objectives

1 - Apply queueing based models to characterize computer (communication) systems

2 - Use appropriate analytical and/or numerical tools to compute performance measures of interest (i.e., thruput, response time, etc) for a given queueing system

3 - Select the system characateristics (e.g., memory capacity) to achieve a given level of performance

4 - Compare the relative merits of alternative system designs

Intended Learning Outcomes

Knowledge and Understanding	* a1 Modeling of stochastic service systems
	* a2 Elementary queuing theory
	* a3 Simulation techniques and simulation tools
	* a4 Application to communication and computer systems
	* a5 System resource management
	* a6 Network and system planning
Intellectual Skills	* b1 Evaluate the relative merits of alternative system design solutions
	* b2 Engage in research in the field of performance analysis and evaluation
Professional Skills	* c1 Apply simulation techniques to develop models of computer and communication systems
	* c2 Appy queueing-based models to characterize computer and communication systems
	* c3 Use appropriate analytic tools to compute performance measure of interest (e.g., response time and throughput) for a given queueing system
	* c4 Select the system characteristics (e.g., storage capacity) to achieve a given level of performance
General Skill	* d1 The ability to quantify and compare collections measured performance data, understanding basic statistical methods
	* d2 An understanding of how simulators and simulation systems are developed; the proper use of those systems including termination, repeated measurements, sampling and transient removal
	* d3 The ability to apply operational laws to computer analysis problems
	* d4 The ability to analyze simple queue networks and understand the limitations and benefits of those networks
	* d5 The ability to analyze simple mean-value analysis networks and understand the limitations and benefits of those networks
	* d6 The ability to display and convey performance measurement data in a meaningful manner that reveals the data in a method best understood by humans

Course Contents

1 - Introduction
2 - Generation of random numbers and stochastic variates
3 - Simulation designs
4 - Estimation techniques for analyzing endogenously created data
5 - Validation
6 - Sochastic processes and Markov processes
7 - Poisson process
8 - Birth-death processes
9 - The M/M/1 queue and variants
10 - Erlang and Coxian distributions as models of service time
11 - The M/G/1 queue
12 - Priority queueing and conservation laws

Teaching and Learning Methods

1 - Lecture Notes
2 - Seminars
3 - Projects

Students Assessment

Assessment Method	TIME	MARKS
Midterm Examination	Week 8	30
Project Implementation and Presentation	During the Semester	20
Final Examination	Week 16	50

Books and References

Essential books	L. Kleinrock, Queueing Systems, vol. 1: Theory, Wiley. ISBN: 0-471-49110-1
Recommended books	L. Kleinrock, Queueing Systems, vol. 2: Computer Applications, Wiley
	W. Drake, Fundamentals of Applied Probability Theory, McGraw-Hiil (or any other book on probability theory and transforms)

Knowledge and Skills Matrix

Main Course Contents	Study Week	Knowledge and Understanding	Intellectual Skills	Professional Skills	General Skill
Introduction	1	a1		c1	
Generation of random numbers and stochastic variates	2	a2			
Generation of random numbers and stochastic variates (Cont.) + Simulation designs	3	a2			
Simulation designs (Cont.)	4	a2,a3		c2	d1
Estimation techniques for analyzing endogenously created data	5	a4	b1	c1-c3	d1-d2
Validation	6	a5	b1	c4	d3
Sochastic processes and Markov processes	7	a6	b2	c4	d3
Sochastic processes and Markov processes (Cont.) + Poisson process	8	a5	b2	c4	d4
Poisson process (Cont.)	9	a6	b2	c2	d5
Birth-death processes	10	a2	b1	c3	d5
The M/M/1 queue and variants	11	a3	b2	c1	d2,d5
Erlang and Coxian distributions as models of service time	12	a1,a3	b1	c2	d1-d4
Erlang and Coxian distributions as models of service time (Cont.) + The M/G/1 queue	13	a1,a3	b1	c2	d1-d4
The M/G/1 queue (Cont.)	14	a3		c2	d6
Priority queueing and conservation laws	15	a5	b2	c4	d2-d6