STAT 612 (2006)

Stochastic Processes for CS

Dr. Muhammad Al-Hashimi

Credits 3

Homepage www.hashimi.ws/stat612

Email stat612@hashimi.org

Phone 640–0000 ✆ Ext. 6–4231

Office Faculty of Science • Room 577

Prerequisite STAT211, MATH102, and CS background.

This is a practical course emphasizing concepts and their application to Computer Science. Examples will be drawn from algorithms, networks, operating systems, fault tolerance, reliability, and computer architecture. We will use Maple, a symbolic math package, so that we can focus on probabilistic modeling. Although STAT 211 is a formal prerequisite, only rudimentary probability background will be assumed. However, students will be expected to have CS background to be able to follow the examples and do the projects.

Topics Material designed for 14 weeks. Check homepage for the latest teaching schedule.

- **Preliminary** Sets concept and notation, random experiments, probability spaces, conditional probability, independence, Bayes rule, Bernoulli trials.
- **Probability Theory** Random variables, distribution functions, functions of random variables, joint-distribution, moments, generating functions, expectation, limit theorems, conditional distribution and expectation.
- **Random Processes** Classification, Bernoulli process, Poisson process, renewal processes, Markov chains, embedded [=subordinated] Markov chains, Markov-modulated Bernoulli process.
- **Discrete-time Markov Chains** Time homogeneous DTMC, n-step transitions, state classification, irreducibility, periodicity, limiting behavior, time between states, discrete-time birth-death, and finite DTMC.

Assessment One exam on probability fundamentals ([TRI 2002] Chapters 1–4) will be given sometime in (teaching) weeks 10–11. The exact date will be arranged. The exam will be open-book.

15% Project 1
25% Project 2
35% Project 3
25% Exam

Projects Three projects requiring about 2–3 weeks of work each. The projects are intended to build research skills focusing on probabilistic reasoning, simulation study, and technical presentation.

Learning Resources Check the homepage for the latest lecture schedules and slides, supporting web links, software tools, online tutorials, and textbook resources.

Textbooks

[TRI 2002] Probability and Statistics with Reliability, Queuing and Computer Science Applications, Kishor S. Trivedi, 2nd edition, Wiley-Interscience, 2002. ISBN: 0471333417

[HSU 1997] Schaum's Outline of Theory and Problems of *Probability, Random Variables & Random Processes*, Hwei P. Hsu, McGraw-Hill, 1997. ISBN: 0070306443

Other References

1. Maple Essentials, Mike Pepe, free online tutorial (login required) from Maplesoft.com, 2003.
2. Chapter 2 of Schaum's Outline of *Probability*, Seymour Lipschutz, 2nd edition, McGraw-Hill, 2000. ISBN: 0071352031
3. A Guide to Maple, Ernic Kamerich, Springer, 1999. ISBN: 0387941169
4. Probability and Random Processes: A First Course with Applications, A. Bruce Clarke and Ralph L. Disney, 2nd edition, John Wiley & Sons, 1985. ISBN: 0471085359
5. The Essence of Discrete Mathematics, Neville Dean, Prentice-Hall (www.pearsoneduc.com), 1997. ISBN 0133459438

Tentative Teaching Schedule The lecture topics, readings, and slides will be published before the lecture in the course calendar on the homepage.

Topics	*Sections* [TRI 2002]	*Weeks*
Preliminary	1.1–1.12	2
Probability theory	2.1–2.5, 2.7–2.9	5
	3.1–3.2, 3.4–3.8	
	4.1–4.4, 4.5 (results), 4.6–4.7	2
	(select) 5.1, 5.3	
Random processes	6.1–6.5, 6.8	2
Markov chains	7.1–7.5, 7.6 (select) 7.8–7.9	3