CE6965: Stochastic Processes
Department of Computer Engineering
Sharif University of Technology
Fall 2014: Saturdays & Mondays: 13:30-15:00

Instructor:

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Course Website:

`http://ce.sharif.edu/courses/93-94/1/ce695-1`

Prerequisites:

Engineering Probability and Statistics (40-181)

Course Objectives:

To make the graduate students acquainted with the fundamental concepts of stochastic processes and their applications in Electrical & Computer Engineering.

Course Textbooks & References:

1. A. Papoulis and S. Pillai, Probability, Random Variables and Stochastic Processes, 4th Edition, McGraw Hill, 2002.
2. S. Ross, Probability Models for Computer Science, Harcourt Academic Press, 2002.
3. G. Casella and R. L. Berger, Statistical Inference, Wadsworth Press, 1990 (reference for Estimation Theory part of the course).
4. Christopher M. Bishop, Pattern Recognition and machine learning, Springer, 2006
5. Carl E. Rasmussen, Christopher K. I. Williams, Gaussian Processes for Machine Learning, the MIT Press, 2006
6. Instructor Handouts.

Grading:

Based on your performance on Homework, Quizzes, Mid-Terms and Final Exams. The grade will be determined by:

- Homework: 20%
- Quiz: 10%
- Mid-Term Exams I & II: 20% each
- Final Exam: 30% (Comprehensive)

Course Description:

The course includes fundamental concepts of Probability Theory, Stochastic Processes, Stochastic Linear Systems, Stationary and Ergodic Processes, Power Spectral Density, Estimation Theory, Spectral Estimation, Markov processes, Markov Chains, Random Walks, and Selected Advanced Topics.

Week	Topic	Readings	HW/Quiz
1 06/29, 07/31	Course overview Review of Probability Theory	Ch. 1-7 & Handout Ch. 1-7 & Handout	 Quiz #1
2 07/05, 07/07	Stochastic Processes I Stochastic Processes II	Ch. 9 & Handout Ch. 9 & Handout	 Quiz #2
3 07/12, 07/14	Stationary Stochastic Processes Stochastic Processes III	Ch. 9 & Handout Ch. 9 & Handout	HW #1 Due Quiz #3
4 07/19, 07/26	Stochastic Processes IV Stochastic Linear Systems	Ch. 9 & Handout Ch. 9 & Handout	HW #2 Due
5 07/28, 08/03	Stationarity & Ergodicity Power Spectral Density	Ch. 9 & Handout Ch. 9 & Handout	 Quiz #4
6 08/05, 08/10	Random Walks Random Walks	Ch. 10 & Handout Ch. 10 & Handout	HW #3 Due Quiz #5
7 08/17, 08/19	Random Walks Estimation Theory - Motivation	Ch. 10 & Handout Handout	**Midterm Exam I** **Upto end of Ch. 9**
8 08/24, 08/26	Estimation Theory Basics Estimation Theory I	Ch. 8, CB: Ch 6,7 & Handout	 Quiz #6
9 09/01, 09/03	Estimation Theory II Estimation Theory III	Ch. 8, CB: Ch 6,7 & Handout	HW #4 Due Quiz #7
10 09/08, 09/10	Estimation Theory IV Estimation Theory V	Ch. 8, CB: Ch 6,7 & Handout	 Quiz #8
11 09/15, 09/17	Prediction Theory Filtering & Prediction	Ch. 13 & Handout Ch. 13 & Handout	HW #5 Due Quiz #9
12 09/24, 09/29	Filtering & Prediction Graphical Models - Motivation	Ch. 13 & Handout Bishop Ch. 8 & Handout	**Midterm Exam II** **Upto end of estimation**
13 10/01, 10/06	Graphical Models - Bayesian Net Graphical Models - MRF	Bishop Ch. 8 & Handout Bishop Ch. 8 & Handout	HW #6 Due Quiz #10
14 10/08, 10/13	Graphical Models - Markov Chains Graphical Models - HMM I	Bishop Ch. 13 & Handout Bishop Ch. 13 & Handout	 Quiz #11
15 10/15	Graphical Models - HMM II Applications of Stochastic Processes	Bishop Ch. 13 & Handout Handout	 Quiz #12
93/10/29	**Final Exam**	**Comprehensive**	**09:00**

Course Regulations

Homework Problems:
Homework problems will be handed out on their designated dates and will be due two weeks later, before the beginning of lectures. The problems will also cover the following week's materials so do not expect to cover the whole problem set right after its release. There might be some simple programming projects using MATLAB. If needed there will be learning materials and classes on how to use MATLAB for problem solving. Course policy for late submission is mentioned below:

- 10% of the whole point for everyday delay until a week
- Do not even think of submission after more than one week delay!

Homework Submission:
Answers to theoretical sections: Hand in your answers at the start of your class session. Email your answers for practical sections to SPFall14@gmail.com , with the following format:
Subject for answers to practical sections: HW[HW#]-[std#]-PA (For example HW3-93100011-PA)
Emails with any other format will be discarded automatically.

Quizzes & Exams:
Each Monday there will be a quiz, at the beginning of the lectures. Each quiz will cover the facts discussed in the previous week, so use your Fridays to study! If Monday falls on a holiday, next quiz will cover the facts of last two weeks.

Problem Solving Classes:
As a fundamental course, Stochastic Processes needs practice through problem solving; Therefore, Problem solving classes are mandatory. Do not be disappointed, as it is an obligatory help!

Statement on Collaboration, Academic Honesty, and Plagiarism:
We encourage working together whenever possible on homework, working problems in tutorials, and discussing and interpreting reading assignments. Talking about the course material is a great way to learn. Regarding homework, the following is a fruitful (and acceptable) form of collaboration; discuss with your classmates possible approaches to solving the problems, and then have each one fill in the details and write her/his own solution *independently*. An unacceptable form of dealing with homework is to copy a solution that someone else has written. We discourage, but do not forbid, use of materials from prior terms that students may have access to. Furthermore, at the time that you are actually writing up your solutions, these materials must be set aside; copy-editing from others work is not acceptable. At the top of each homework you turn in, we expect you to briefly list all sources of information you used, except known course materials like Text Book, Lectures, etc. A brief note such as Did homework with ABC and ABD in study group or Looked at old solution for Problem 4 would be sufficient. Besides the morality issues, it will help TAs on grading your hand outs. There will be a zero tolerance policy for Cheating/Copying HWs. The first time you are caught, you will receive a zero for the task at hand. If you are caught for a second time, you will fail the course. In general, we expect students to adhere to basic, common sense concepts of academic honesty. Presenting other's work as if it was your own, or cheating in exams will not be tolerated.

Acknowledgements

We would like to thank MIT OCW (ocw.mit.edu), and Dr. Kharrazi of Sharif CE. for their contributions in preparation of Course Regulations.

We would also like to thank all previous TAs of this course, most of all Dr. Rohban, for their generous contributions to this course, which has made possible a learning experience that is unique in Sharif CE.

Enjoy the course & Good luck!