

ECE 597: Probability, Random Processes, and Estimation
Spring 2016

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Grading: Homework 20%, Computer Assignments 20%, Three exams @ 20% each.

Notes

1. You are expected to do your own homework since your friends (or those who pretend to be your friends) will not generally be available for discussions during the exams.
2. You are expected to spend an average of about 8-10 hours per week outside of class on your homework.
3. Do not wait for the last minute to do the homeworks. There are not likely to be many of the 'plug and chug' variety. You (and I) will be better off if you try them a little bit each night, and come and see me if you are having problems.
4. Some of the homework problems will be extensions of the material covered in class, and you are responsible for this material on the exams also. A lot of what we are doing is applicable to *many* fields.
5. Last time this course was taught, some students complained that a lot of the material was NOT in the text. Yeah, well, grow up!! You will do much better if you show up for all of the classes.
6. Unless told otherwise on specific problems, you cannot use MAPLE or turn in MAPLE code for a problem (you can check your answers with MAPLE if you want.)
7. The computer assignments should be neat and well labeled with a cover sheet. However, you are generally not expected to spend much time writing anything up. The reason for these projects is generally to get a feel for some of the concepts in the class and how you might use them.
8. LATE HOMEWORKS WILL NOT BE ACCEPTED WITHOUT PRIOR APPROVAL.

Tentative Outline

1. Review of Probability and Random Variables (4 classes)
2. Vector Random Variables (5 classes)
 - Joint distributions and densities
 - Expectations of random vectors and covariance matrices
 - Properties of covariance matrices
 - Multidimensional Gaussian
3. Estimation and Decision Theory I (8 classes)
 - Parameter estimation
 - Estimation of vector means and covariances
 - Maximum likelihood estimation
 - Optimal linear estimators
 - Bayesian approach to decision theory (likelihood ratios)
4. Random Sequences (5 classes)
 - Independent Increments
 - Autocorrelation, autocovariance
 - Stationary, wide sense stationary
 - Random sequences and linear systems
 - Convergence of random sequences
 - Power Spectral Density
5. Estimation Theory II (5 classes)
 - Principle of orthogonality
 - Discrete Weiner Filtering
 - Innovation sequences and prediction
 - Discrete Kalman filter
6. Random Processes (3 classes)
 - Definitions
 - Poisson, Weiner, Markov random processes
 - Linear systems with random inputs
 - Classification of random processes
7. Stationary Processes and Sequences (8 classes)
 - Power spectral density
 - White and colored noise
 - Stationary processes and linear systems
 - WSS random processes
 - Estimation of power spectral densities