MIDTERM STUDY GUIDE: ECE 7995, DETECTION AND ESTIMATION

WINTER 2018

In preparation for the midterm, you should be able to:

1. Identify and sketch the probability mass function and probability density function for the uniform, Gaussian, Bernoulli, categorical, exponential, and Laplacian distributions.
2. Compute the probability of an event by integrating (or summing) over the probability density function (or probability mass function).
3. Compute the expectation and variance of a random variable.
4. Use the fundamental theorem of expectation to compute the expectation of a function of a random variable.
5. Identify whether two random variables are independent depending on whether the joint distribution factorizes into the product of marginal
6. Compute the conditional distribution p(y|x) using Bayes rule
7. Given a multivariate Gaussian random vector with known mean and covariance matrix, find the mean and covariance of a linear function of the random vector.
8. Given a pair of likelihood functions p(y|H0), p(y|H1), set up the Neyman-Pearson hypothesis test for a given threshold. You should be able to do this for a variety of distributions, including uniform, Gaussian, exponential, Laplace, and categorical distributions.
9. Given likelihood functions and prior probabilities pi_0 and pi_1, set up the Bayesian hypothesis test, for the same distributions and stated above.
10. Given likelihoods, prior probabilities, and cost functions C_ij, set up the hypothesis test that minimizes the Bayes risk.
11. Given M likelihood functions and (if appropriate) prior probabilities, find the maximum-likelihood or MAP detector.
12. After solving for an optimum detector, carry out the hypothesis test on a given test point.