FINAL EXAM STUDY GUIDE: ECE 7995, DETECTION AND ESTIMATION WINTER 2018

In preparation for the final, you should be able:

1. To identify and sketch probability mass functions or density functions for uniform, Gaussian, Bernoulli, categorical, exponential, and Laplace distributions.
2. To compute the likelihood ratio for a hypothesis testing problem.
3. To find the Bayes-optimum detector under arbitrary priors and cost assignments.
4. To compute the Bayes risk for the Bayes-optimum detector
5. To derive the Neyman-Pearson detector for a given size/false-alarm probability.
6. To derive the detection probability for the Neyman-Pearson detector of a given size.
7. To sketch the ROC curve for the Neyman-Pearson tests.
8. Compute the posterior given a likelihood function and prior for scalar estimation problems.
9. Compute the conditional expectation of a random variable X given Y=y.
10. Find the MMSE and MAP estimates for scalar estimation problems.
11. Find the MAP estimate using conjugate priors.
12. Compute a Bayes estimate of a **vector** parameter in the multivariate Gaussian setting.
13. Compute the bias and variance of a non-random estimator.
14. Identify a sufficient statistic via the Neyman-Pearson factorization theorem.
15. Compute the minimum-variance unbiased estimator from a complete sufficient statistic
16. Compute the Cramer-Rao bound on the variance (or co-variance) of an unbiased estimator.
17. Compute the time and measurement updates for the Kalman filter for a scalar system.

For the preceding problems, the likelihood functions will be restricted to the Gaussian, uniform distributions, and exponential families. Integrals will be easy to compute.