## Assigned: 17/19 January 2017

## Project #2 – Samples and statistics

EE 511: Spring 2017

Due: (1 week) at the start of lecture. Late penalty: 15% per day.

- 1. Simulate sampling uniformly (how many?) on the interval [-3,2].
  - a. Generate a histogram of the outcomes.
  - b. Compute the sample mean and sample variance for your samples. How do these values compare to the theoretical values? If you repeat the experiment will you compute a different sample mean or sample variance?
  - c. Compute the bootstrap confidence interval (what width?) for the sample mean and sample standard deviation.
- 2. Produce a sequence X by drawing samples from a standard uniform random variable.
  - a. Compute  $Cov[X_k, X_{k+1}]$ . Are  $X_k$  and  $X_{k+1}$  uncorrelated? What can you conclude about the independence of  $X_k$  and  $X_{k+1}$ ?
  - b. Compute a new sequence Y where:  $Y[k] = X[k] 2 \cdot X[k-1] + 0.5 \cdot X[k-2] X[k-3]$ . Assume X[k] = 0 for  $k \le 0$ . Compute  $Cov[X_k, Y_k]$ . Are  $X_k$  and  $Y_k$  uncorrelated?
- 3. Let M = 10. Simulate (uniform) sampling with replacement from the outcomes 0, 1, 2, 3, ..., M-1.
  - a. Generate a histogram of the outcomes.
  - b. Perform a statistical goodness-of-fit test to conclude at the 95% confidence level if your data fits samples from a discrete uniform distribution 0, 1, 2, ..., 9.
  - c. Repeat (b) to see if your data (the same data from b) instead fit an alternate uniform distribution 1, 2, 3, ..., 10.