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 $k \leq 0$. 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.