Math 50 Stat Inf: Homework 2

due Wed Jan 18

Problems from LM3 unless indicated [with LM4 ref given or typed out].

3.2: 1 [LM4 3.3.1a].

3.3: 18 (more historical anecdotes. Hint: it's easier to write the probability of the event *not* happening) [LM4 3.2.17].

LM4 3.3.7: "Suppose a particle moves along the x-axis beginning at 0. It moves one integer step to the left or right with equal probability. What is the pdf of its position after 4 steps?" (This is called a *random walk*; compare LM3 3.3.20).

3.4: 1:

"Graph the cdf corresponding to the random variable whose pdf is $p_X(k) = 1/3$, $k = 1, 2, 3$."

8 [LM4 3.4.8], 10 [LM4 3.4.10 - bingo!] Also use the cdf to state the *median* of the distribution.

3.10: 3 [LM4 3.5.4], 8 [LM4 3.5.12], 16 [LM4 3.5.17].

3.11: 8 [LM4 3.5.30].

3.12: 1 [LM4 3.6.1], 2 [LM4 3.6.2].

A. Calculate $\mathrm{Var}(X)$ if $f_X(x) = (1/\lambda)e^{-x/\lambda}$ for $x > 0$. [Hint: you'll need integration by parts to remove all powers of x].

B. Use the computer to simulate the distribution of X, the number of heads in 100 tosses of a biased coin with $\alpha = p(H) = 0.7$, as follows.

1. Generate a list of $N = 1000$ samples k from X. To help you, I'll dissect some bits of the useful commands I gave you in HW1. `rand(100,10000)` fills a rectangular array 100 down by 10000 across with random numbers in $[0, 1]$. The logic operation `>0.5` converts this to an array of 1 or 0 based on whether each element exceeded 0.5. Given a rectangular array, the operation `sum` sums down each column to leave you a row vector. You can get help on any command using *e.g.* `help sum`.
2. Plot, then print, a histogram of these samples. Use a bin width of 1. [Hint: see HW1].
3. Estimate $E(X)$ by taking the average value of your list. By *roughly* how much does your estimate deviate from the true $E(X)$? You may want to repeat the process to get a better idea of the deviation. (We will learn why when we get to *estimators*).

3.5: 3 [LM4 3.7.3], 4 [LM4 3.7.4], 10 [LM4 3.7.11],

3.6: 5 [LM4 3.7.43].