## Problem Session 5

1. *CLT and LLN.* Explain, in words, what CLT and LLN says when the underlying distribution is binomial.

2. *Random walk.* A particle moves on a line at integer sites. At each step it can move one step to the left, one step to the right, or stay at the same place, all with equal probability. After 10,000 steps what is the probability that the particle is 100 steps away from its starting point.

3. *Biased die.* A die is rolled one million times, and six is observed 180,000 times. Find an approximate 99.99% confidence interval for the probability that the die rolls six.

4. *Biased coin.* Estimate $p$ of the probability that a biased coin lends heads by tossing it repeatedly. $\hat{p}$ is the observed proportion of heads. How many times do you need to toss it so that $(\hat{p} - 0.1, \hat{p} + 0.1)$ is a 99% confidence interval? What about $(\hat{p} - 0.01, \hat{p} + 0.01)$?

5. *Two surveys.* Two companies make a 99% confidence intervals for the proportion of women in a certain population. One of them use 350 samples, the other use 1,000 samples. Which confidence interval will be shorter? By how much?