PHY 227 Problem Set 1 (Due 6pm 1/31/14 PHY227)

1. Flipping coins

(a) If you flip 1000 coins, what is the probability of getting exactly 500 heads and 500 tails?

(b) If you flip 1000 coins, what is the probability of getting exactly 600 heads and 400 tails?

(c) If you flip 10^6 coins, would you be surprised to get 501,000 heads and 499,000 tails? Justify your answer.

(d) If you flip 10^6 coins, would you be surprised to get 510,000 heads and 490,000 tails? Justify your answer.

2. Consider a two-state paramagnet composed of 10^{23} individual dipoles, with net dipole energy equal to zero in a magnetic field.

(a) The system as described is said to be in one "macrostate." How many microstates are accessible for this macrostate?

(b) Suppose that the microstate of the system changes 1 billion times per second. How many micro states will it explore in the 14 billion years? (approximately the age of the universe)?

(c) From the results of parts (a) and (b), explain whether it is correct/incorrect to say that the system will explore most of its accessible microstates over the age of the universe.

3. Book Problem 2.1

4. Book Problem 2.2

5. Book Problem 2.3

6. Book Problem 2.4

7. Book Problem 2.5