CS 271 (Spring 2013) — Assignment 9
Due: 04/23/2013

(1) Read Chapter 7.

(2) Reread the class policies on accessing online solutions to homework problems. It is not acceptable when about 20% of a class are caught cheating. Cases we have caught up to now will be reported as a first offense. If anything else comes up on this or subsequent homeworks and you have been caught cheating on earlier homeworks, then you will have two cases in front of Student Judicial Affairs. The consequences likely wouldn't be pretty.

(3) Solve the following exercises from the textbook

(a) Section 7.1, Exercises 12, 18, 30, 36, 38

(b) Section 7.2, Exercises 10, 16, 24, 30

(c) Section 7.3, Exercises 8, 16, 22

(d) Section 7.4, Exercises 12, 16, 18, 22

(4) In class, we discussed two non-uniform physical sources of randomness (whereas a coin flip or a die roll are typically uniformly random). The two we discussed were throwing a thumbtack, and observing if it landed on the flat side or on the tip, and throwing a (fairly short) needle on a grid-ruled sheet of paper, and observing if it crossed any lines.

Think of another example of physical *non-uniform* randomness, and conduct experiments (say, at least 30 trials) to get a reasonably accurate estimate of the probabilities of the different outcomes. Report the result of your experiments. Your example should be such that at least two outcomes have probabilities of 10% each. (So no "I throw a nail, and it lands sideways 30 out of 30 times, though there's a theoretical possibility that it might land on the flat side.")

(5) [0 points]
Chocolate Problem (2 chocolate bars): Suppose that you generate a "random graph" as follows: For each pair of vertices of the graph (u, v), with probability p, you create an undirected edge (u, v), whereas with probability $1 - p$, you do not create the edge. The decisions for different edges are independent.

Assume that $p = \frac{c \log(n)}{n}$, for some constant c. Feel free to make c any constant (independent of n), as large as you'd like. Probably, $c = 4$ is enough, but if you want, feel free to make $c = 100$ to help your proof. Prove that the resulting random graph is connected with probability at least $1 - 1/n^2$. (Actually, the probability is quite a bit higher, but this bound is good enough for now.)

[Hint: Use that a graph is connected if and only if for every subset S of nodes, there is at least one edge between S and $\overline{S}$.]