CS4104 Spring 2007 Homework Assignment 10
Due at 11:00pm on Tuesday, April 3
50 Points

1. [15 points] Your brilliant but erratic friend has found an algorithm that can solve an arbitrary homework exercise for this course in ten minutes. Unfortunately, her incomprehensible algorithm only works one time in a hundered; if it doesn't work in 10 minutes, it never will. Fortunately, her algorithm can be repeated on the same exercise as many times as you like, and each time it has a one in a hundred chance of solving the exercise. If the average exercise takes you an hour to solve using your normal algorithm (if you manage to solve it), and if you only solve one exercise in five using it, is it worthwhile to switch to your friend's algorithm exclusively? Note that if you are unable to solve a given exercise in one hour with your regular algorithm, you will never be able to solve that exercise.

Now suppose that you work in a team of ten and everyone in the team currently uses your algorithm to solve exercises (and each person has an independent probability of one in five to solve the exercise). Is it worthwhile for all of you to switch to your friend's algorithm? Is it worthwhile for any of you to switch to your friend's algorithm?

2. [15 points] Recall that when a hash table gets to be more than about one half full, its performance quickly degrades. One solution to this problem is to reinsert all elements of the hash table into a new hash table that is twice as large. Assuming that the (expected) average case cost to insert into a hash table is $\Theta(1)$, prove that the average cost to insert is still $\Theta(1)$ when this reinsertion policy is used.

3. [20 points] n theorists want to swap gossip. If every phone call is between two theorists, and if when two theorists talk they swap all the gossip they each know, what is the least number of calls necessary for everyone to know everything? You answer should be better than $2n - 3$ for $n > 3$.