Approximation Algorithms | **Homework 2**
Date: February 3, 2010 | **Due:** February 16, 2010

1. (10 points) Obtain an approximation scheme for the problem. Given n positive integers, $a_1 < \ldots < a_n$, find two disjoint non-empty subsets $S_1, S_2 \subseteq \{1, \ldots, n\}$ with $\sum_{i \in S_1} a_i \geq \sum_{i \in S_2} a_i$ such that the ratio,
$$\frac{\sum_{i \in S_1} a_i}{\sum_{i \in S_2} a_i}$$
is minimized. Is your approximation scheme a PTAS or FPTAS?

2. (10 points) Consider the k-cover problem discussed earlier in the class. We are a given a set E and a family of subsets $\S = \{S_1, \ldots, S_m\}$ of E. We are also given a positive integer k. The task is to find a set of indices $I \subset \{1, \ldots, m\}$ with $|I| = k$ such that $|\cup_{i \in I} S_i|$ is maximized. We showed that the greedy algorithm gave a $(1 - \frac{1}{e})$-approximation algorithm for the problem. Here we will give another algorithm based on linear programming rounding.
   (a) Given an integer linear programming formulation for the k-cover problem.
   (b) Given a randomized rounding algorithm using the optimal linear programming solution.
   (c) Prove the best possible performance guarantee for your algorithm.

3. (10 points) Problem 5.1, page 127.

4. (10 points) Problem 5.3, page 128.

5. (10 points) Problem 5.4, page 128.

6. (10 points) Derandomize one of the $\frac{3}{4}$-approximation algorithm for the MAX-SAT problem.