CSE 208A Homework 1
Randomized algorithms
Due Thursday, May 24

For each of the algorithm problems, design as asymptotically efficient an algorithm as possible. Give a correctness argument (explanation, if it is relatively simple, or proof if not) and time analysis. You may use any well-known algorithm or data structure, or algorithm from the text or from class, as a sub-routine without needing to provide details.

Vazirani, Ex. 1.1, page 7

Vazirani, Ex. 2.2, page 23

Vazirani, Ex. 2.15, page 25

The independent set problem, is: given an undirected graph, find the largest independent set S of vertices, i.e., a set so that no adjacent vertices x, y are both in S. A. Give a linear programming relaxation for the independent set problem. (2 points) B. Give a poly-time algorithm that, given a graph G with n vertices, either finds an independent set of size at least $n/3$ or certifies that no independent set in G has size greater than $2n/3$. (It may involve using an algorithm for linear programming.) (6 points) C. Consider the special case of graphs of at most degree 3. Find $\alpha > 1/3$ and a poly-time algorithm that either finds an independent set of size αn or certifies that no independent set has size $(1-\alpha)n$. (2 points + 2 extra credit if you beat my α.)