Write every problem on a separate sheet of paper, write legibly, and write your name, your student ID, this Homework # and the problem # on top of each page.

The description of your proofs should be as clear as possible (which does not mean long – in fact, typically, good clear explanations are also short.)

Make sure you are familiar with the collaboration policy, and read the overview in the class homepage theory.cs.stanford.edu/~trevisan/cs154.

Recall that our late policy is that late homework is not accepted (however the lowest homework grade is dropped).

Refer to the class home page for instructions on how to submit the homework.

**Homework 8**

*Due on Thursday, March 15, 2012, 9:30am*

1. (3 points) Prove that the Acceptance problem for NFA ($A_{\text{NFA}}$) is $\text{NL}$-complete.

2. We discussed the CLIQUE problem in class, where $(G, k) \in \text{CLIQUE}$ if and only if $G$ contains a $k$-clique.

   Let $\text{MAX-CLIQUE}$ be the set of pairs $(G, k)$ such that the largest clique in $G$ has exactly $k$ nodes in it.

   Let $\#\text{MAX-CLIQUE}$ be the set of $(G, \ell)$ such that $\ell$ is the number of largest cliques in $G$ (that is, $\ell$ is the number of sets $S$ of vertices such that $S$ is a clique in $G$ and there is no clique in $G$ of size $> |S|$).

   (a) (2 points) Show that $\text{MAX-CLIQUE}$ and $\#\text{MAX-CLIQUE}$ are in $\text{PSPACE}$.

   (b) (1 points) Explain why the following argument fails to show that $\text{MAX-CLIQUE} \in \text{coNP}$: To show that $(G, k) \not\in \text{MAX-CLIQUE}$, it suffices to demonstrate the existence of a larger clique in $G$ of size greater than $k$, so the $\text{NP}$ algorithm for $\text{MAX-CLIQUE}$ just guesses the larger clique.

3. (optional) Ask any questions on Piazza that you might have leading up to the final. Good luck studying for this and the rest of your classes!