# CS599 (Spring 2010) - Homework 6

## Due in class on Thursday, 04/29 — no late submissions

**(1)** Exercise 29.2 from the textbook.

**(2)** Exercise 29.6 from the textbook.

**(3)** Exercise 29.10 from the textbook.

**(4)** In class, we saw that the greedy algorithm for maximizing a submodular, monotone, non-negative function $f$ gives a $1 - 1/e$ approximation. Sometimes, just evaluating $f(S)$ for a given set $S$ is not so easy. In class, we assumed that we had an oracle that gives us the correct value of $f(S)$ given a set $S$.

Suppose that instead, we had an "imprecise" oracle. When we give it a set $S$, it gives us a value $g(S)$, such that $(1 - \epsilon)f(S) \leq g(S) \leq (1 + \epsilon)f(S)$, for some $\epsilon \geq 0$. So it gives us good enough approximations to $f$, but not the precise value. We can still use the greedy algorithm with this imprecise oracle, but its performance will be a little worse now.

Prove that with an imprecise oracle, the greedy algorithm is a $1 - 1/e + h(\epsilon)$ approximation, where $h$ is some function such that $h(x) \to 0$ as $x \to 0$. (In other words, as your oracle gets more accurate, you get approximations arbitrarily close to $1 - 1/e$.)