# Homework 7

Math 167 / CS 142: Complexity Theory

1. Problem 11.5.17 of the text.

> Let $0 < \epsilon < 1$ be a rational number. We say that $L \in \mathbf{PP}_\epsilon$ if there is a nondeterministic Turing machine $M$ such that $x \in L$ if and only if at least an $\epsilon$ fraction of the computations are accepting. Show that $\mathbf{PP}_\epsilon = \mathbf{PP}$.

2. Problem 11.5.18 of the text.

> Show that, if $\mathbf{NP} \subseteq \mathbf{BPP}$, then $\mathbf{RP} = \mathbf{NP}$. (That is, if $\textsc{sat}$ can be solved by randomized machines, then it can be solved by randomized machines with no false positvies, presumably by computing a satisfying truth assignment as in Example 10.3.)

3. Problem 11.5.25 of the text.

> We know that most languages do not have polynomial circuits (Theorem 4.3), but that certain undecidable ones do (Proposition 11.2). We suspect that $\mathbf{NP}$-complete languages have no polynomial circuits (Conjecture B in Section 11.4). How high do we have to go in complexity to find languages that *provably* do not have polynomial circuits?