



Assignment 8, Complexity Theory, SoSe 15

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Due: June 24, 2015, 11:00

Exercise 8.1 Show that a language L is in ZPP if and only if L is accepted by a probabilistic Turing machine with error probability zero and expected polynomial running time. Here the expectation is taken over all possible random strings on the random tape.

Exercise 8.2 Let PP be the class of all languages L such that there is a polynomial time probabilistic Turing machine M that accepts all $x \in L$ with probability $\geq 1/2$ and accepts all $x \notin L$ with probability $< 1/2$. Show that $\text{NP} \subseteq \text{PP}$.

Exercise 8.3 Show that NP is closed under positive polynomial time Turing reductions.

Exercise 8.4 Show that if $\text{P} \neq \text{BPP}$, then $\text{EXP} \neq \text{EXPSPACE}$.

Hint:

- a) First show that if there is a unary language in $\text{PSPACE} \setminus \text{P}$, then $\text{EXP} \neq \text{EXPSPACE}$.
- b) Now take a language $L \in \text{BPP} \setminus \text{P}$. Using L , and Adleman's theorem, construct a unary language in $\text{PSPACE} \setminus \text{P}$.