
Complexity Theory

Due date: June 4, 2013 before class!

Problem 1 (10 Points)

Show that there is a language $B \in \mathbf{EXP}$ such that $\mathcal{NP}^B \neq \mathcal{P}^B$.

Problem 2 (10 Points)

Show that $\mathbf{SPACE}(n) \neq \mathcal{NP}$. (Note that it is unknown if either class is contained in the other.)

Problem 3 (10 Points)

Give an example of a non-regular language that is in $\mathbf{SPACE}(\log \log)$.

Problem 4 (10 Points)

Consider the problem of checking a boolean formula's syntactical correctness. Show that this problem can be decided in log-space, even if we have no precedence relation between the boolean operators and force precedence behavior with parentheses, e.g. $(x \wedge y) \vee (\bar{z} \wedge x) \vee \bar{y} \vee z$ is a valid formula, as is $(x \wedge (y \vee \bar{z}) \wedge x) \vee \bar{y} \vee z$, while $x \wedge y \vee \bar{z} \wedge x \vee \bar{y} \vee z$ is not.