

CMSC 28100 Spring 2017  
Homework 8

1. Show that a  $k$ -tape nondeterministic Turing machine running in a nondeterministic time  $T(n)$  can be simulated by a 2-tape nondeterministic Turing machine running in nondeterministic time  $O(T(n))$ . Note that, unlike the case of deterministic time, there is no additional  $\log(T(n))$  factor. Only state the essential ideas (i.e. why don't we need  $\log(T(n))$  factor) in plain English like an algorithm.
2. Show that if  $\text{DSPACE}(n) \subseteq \text{P}$ , then  $\text{PSPACE} = \text{P}$ . Recall that  $\text{PSPACE} = \bigcup_{k \geq 1} \text{DSPACE}(n^k)$ . *Hint:* padding from HW7 and PSPACE-completeness.
3. Show that  $\text{DSPACE}(n) \neq \text{P}$ . *Hint:* you may find the statement of the previous problem useful. Even if you were unable to complete Problem 2, you may use its statement in this question.
4. Show that  $\text{NSPACE}(n) \neq \text{P}$ . As before, you may use the statement of Problem 2 in this problem.