

EECS 395-23 – Assignment 2

1. Let L be a language accepted by a deterministic RAM machine in time $t(n)$. Show there is a k such that L is accepted by a multi-tape Turing machine in time $t^k(n)$.
2. Show that for any space-constructible $s_1(n)$ and $s_2(n)$ such that $s_1(n) = o(s_2(n))$, $\text{NSPACE}(s_1(n)) \subsetneq \text{NSPACE}(s_2(n))$. Hint: Use the fact that nondeterministic space is closed under complement.
3. Let $\text{NTISP}(t(n), s(n))$ be the set of problems solvable by a nondeterministic Turing machine using $t(n)$ time and $s(n)$ space. Show $\text{NTISP}(t(n), s(n)) \subseteq \text{DSPACE}(s(n) \log t(n))$.
4. Show that for some real $a > 1$, the function $s(n) = n^a$ is not space-constructible.
5. Show that for all reals a and b with $1 \leq a < b$, $\text{DSPACE}(n^a) \subsetneq \text{DSPACE}(n^b)$.