CMPE 350 - Summer 2014
PS#5

11.08.14

Chapter 4

4.9 $\text{INFINITE}_{\text{DFA}} = \{\langle A \rangle |$ is a DFA and $L(A)$ is an infinite language$\}$. Show that $\text{INFINITE}_{\text{DFA}}$ is decidable.

4.18 Let A and B be two disjoint languages. Say that language C separates A and B if $A \subseteq C$ and $B \subseteq \bar{C}$. Show that any two disjoint co-Turing-recognizable languages are separable by some decidable language.

4.27 Let $C_{\text{CFG}} = \{\langle G, k \rangle | L(G)$ contains exactly k strings where $k > 0$ or $k = \infty\}$. Show that C_{CFG} is decidable.

4.28 Let A be a Turing-recognizable language consisting of descriptions of Turing machines, $\{\langle M_1 \rangle, M_2 \rangle, \ldots\}$, where every M_i is a decider. Prove that some decidable language D is not decided by any decider M_i whose description appears in A. (Hint: You may find it helpful to consider an enumerator for A.)

- Show that the language $\{< M, w, q > | M\}$ is a Turing Machine that visits state q during its execution when started with input string $w\}$ is undecidable.

- If a language L is a Turing recognizable but not decidable, then any TM which recognizes L must fail to halt for infinitely many input strings.

- Given an example of a language L such that L is co-Turing recognizable but its complement is not.

- Let L be the language of all Turing machine descriptions $\langle M \rangle$ such that there exists some input on which M makes at least 5 moves. Show that L is decidable.