15-453 Formal Languages, Automata, and Computation

Review Problems 1

Friday, April 07

Problem 1

Show that if $L \subseteq \Sigma^*$ is regular, then $L \in TIME(n)$.

Problem 2

Fill out the table described in the polynomial time algorithm for context-free language recognition from Theorem 7.14 for string $w = baba$ and CFG G:

$$\begin{aligned} S &\rightarrow RT \\ R &\rightarrow TR \mid a \\ T &\rightarrow TR \mid b \end{aligned}$$

[This is problem 7.4 from the textbook]

Problem 3

Show that UN-PRIM $= \{1^p \mid p$ - prime$\}$ is in $\mathcal{P}$. [This is problem 7.8 from the textbook]

Problem 4

Show that the following languages are in $\mathcal{P}$.

(a) $\{\langle M \rangle \mid M$ is a finite automaton and $L(M) = \emptyset\}$

(b) $\{\langle M \rangle \mid M$ is a finite automaton and $L(M)$ is infinite$\}$

Problem 5

Call graphs G and H *isomorphic* if the nodes of G may be reordered so that it is identical to H. Let $ISO = \{\langle G, H \rangle \mid G$ and H are isomorphic graphs$\}$. Show that $ISO \in \mathcal{NP}$. [This is problem 7.11 from the textbook]