

Homework 3

December 8, 2004

Due date: December 22, 2004

1. (15%) [Sipser 4.3] Let $ALL_{DFA} = \{ \langle A \rangle \mid A \text{ is a DFA that recognizes } \Sigma^* \}$. Show that ALL_{DFA} is decidable.
2. (15%) [Sipser 4.5] Let $INFINITE_{DFA} = \{ \langle A \rangle \mid A \text{ is a DFA and } L(A) \text{ is an infinite language} \}$. Show that $INFINITE_{DFA}$ is decidable.
3. (15%) [Sipser 5.4] If $A \leq_m B$ and B is a regular language, does that imply that A is a regular language? Why or why not?
4. (15%) [Sipser 5.6] Show that \leq_m is a transitive relation.
5. (10%) [Sipser 7.1] Answer each part TRUE or FALSE.
 - a. $2n = O(n)$.
 - b. $n^2 = O(n)$.
 - c. $n^2 = O(n \log^2 n)$.
 - d. $n \log n = O(n^2)$.
 - e. $3^n = 2^{O(n)}$.
6. (15%) [Sipser 7.6] Show that P is closed under union, concatenation and complement.
7. (15%) [Sipser 7.11] Call graphs G and H **isomorphic** if the nodes of G may be reordered so that it is identical to H . Let $ISO = \{ \langle G, H \rangle \mid G \text{ and } H \text{ are isomorphic graphs} \}$. Show that $ISO \in NP$.