

CS5000: Assignment 1  
Due: September 5, 2008 by 11:20am

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**Problem 1: 1 point**

Let  $S$  be a non-empty set. Let  $P_{\bar{\emptyset}}(S)$  be the set of non-empty proper subsets of  $S$ . Derive and prove by induction the formula for the number of elements in  $P_{\bar{\emptyset}}(S)$  as a function of the number of elements in  $S$ .

**Problem 2: 1 point**

Let  $x \in \{0,1\}^*$  and  $i_v(x)$  be the integer value of  $x$ . Let  $m|n$  denote the relationship of divisibility, i.e.  $n$  divides  $m$ . Show that  $\{x|i_v(x)|4\}$  is regular.

**Problem 3: 2 points**

1. Give a  $O(n)$  algorithm that takes a DFA  $M$  and determines if  $L(M) = \emptyset$ .
2. Give a  $O(n)$  algorithm that takes a DFA  $M$  and finds the shortest string in  $L(M)$ . Ties are broken arbitrarily.