CS321 - Homework 1

October 8, 2013

Problems from 1.2

6 Let L be any language on a non-empty alphabet. Show that L and $\overline{L}$ cannot both be finite.

7 Are there language for which $\overline{L^*} = (\overline{L})^*$?

Additional Problems

For the additional problems, describe via an English sentence each of the languages from the following Exercises in Section 1.2.

14(b) Let $\Sigma = \{a, b\}$. For each of the following languages, find a grammar that generates it.

$L_2 = \{a^n b^{2n} : n \geq 0\}$.

15(a) Find grammars for the following languages on $\Sigma = \{a\}$.

$L = \{w : |w| \bmod 3 = 0\}$.

18(b,d) Using the notation from Example 1.13:

$$\begin{aligned} S &\to aA, \\ A &\to bS, \\ S &\to \lambda \end{aligned}$$

find grammars for the languages below. Assume $\Sigma = \{a, b\}$.

(b) $L = \{w : n_a(w) = n_b(w) + 1\}$.

(d) $L = \{w \in \{a, b\}^* : |n_a(w) - n_b(w)| = 1\}$.

Problems from 2.1

2(d) For $\Sigma = \{a, b\}$. construct dfa's that accept the sets containing of all strings with at least one a and exactly two b's.

7(c) Find dfa's for the following languages on $\Sigma = a, b$.

$L = \{w : |w| \bmod 3 > 1\}$.

9(c) Consider the set of strings on $\{0, 1\}$ defined by the requirements below. For each, construct an accepting dfa.

The leftmost symbol differs from the rightmost one.

12 Show that $L = \{a^n : n \geq 4\}$ is regular.

17 Show that if L is regular, so is $L - \{\lambda\}$.
Hint: We know that L is regular. Thus there is a DFA M such that $L = L(M)$. To solve this problem you need to describe how to form a new DFA M' from M such that $L(M') = L - \{\lambda\}$. You can construct such an M' by adding a single state to M with the appropriate arcs. You need to provide an informal argument as to why your construction is correct.