Automata Theory - Homework II

K. Subramani
LCSEE,
West Virginia University,
Morgantown, WV
{ksmani@csee.wvu.edu}

1 Instructions

1. The homework is due on October 26, in class.
2. Each question is worth 3 points.
3. Attempt as many problems as you can. You will be given partial credit, as per the policy discussed in class.

2 Problems

1. Let L be a regular language not containing λ. Argue that there exists a right-linear grammar for L, whose productions are restricted to the forms:

$$\begin{array}{rcl} A & \rightarrow & aB, \text{ and} \\ A & \rightarrow & a \end{array}$$

   where A and B are generic variables and a is a generic terminal.

2. Consider the language $L = \{a^n : n \text{ is not a perfect square}\}$. Prove that L is not regular, *by using the Pumping Lemma.* You may not use complement properties of regular languages.

3. Consider the grammar $G = \langle V, T, S, P\rangle$, with productions defined by:

$$S \rightarrow aSbS \mid bSaS \mid \lambda$$

   Is G ambiguous? Is $L(G)$ ambiguous?

4. Show that the language $L = \{w \cdot w^R : w \in \{a, b\}^*\}$ is not inherently ambiguous.
   Hint: Prove that L has an unambiguous grammar.

5. Remove all unit productions, λ-productions and useless productions from the the grammar $G = \langle V, T, P, S\rangle$, with productions P defined by:

$$\begin{array}{rcl} S & \rightarrow & aA \mid aBB \\ A & \rightarrow & aaA \mid \lambda \\ B & \rightarrow & bB \mid bbC \\ C & \rightarrow & B \end{array}$$