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 $\lambda$. Argue that there exists a right-linear grammar for $L$, whose productions are restricted to the forms:

   $$A \rightarrow aB, \text{ and}$$
   $$A \rightarrow a$$

   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, $\lambda$-productions and useless productions from the the grammar $G = \langle V, T, P, S \rangle$, with productions $P$ defined by:

   $$S \rightarrow aA \mid aBB$$
   $$A \rightarrow aaA \mid \lambda$$
   $$B \rightarrow bbC$$
   $$C \rightarrow B$$