COSC 545, Spring 2012: Problem Set #1

Due: Wed., 2/1, at the beginning of class (hand in hard copy).
Covers: Lectures 1 to 4.
Collaboration: You may collaborate with classmates. Every student must write up his or her own answers and list collaborators. No sources outside of the assigned textbook may be consulted.

Pre-Assignment: Review the class web site for rules on formatting your problem set, collaboration, late submissions, and academic integrity.

Problems

1. Provide a high-level argument that regular languages are closed under intersection \( (A \cap B = \{w | w \in \ A \land w \in B \}) \) and complement \( (\overline{A} = \{w | w \notin A \}) \). Arguing in words is fine. You do not need to provide formal automata definitions.

2. 1.31, from Sipser.

3. 1.32, from Sipser. To receive full credit, provide a formal definition of the automaton; i.e., define the elements of the 5-tuple, \((Q, \Sigma, \delta, q_0, F)\), for any automaton used by your proof.

4. 1.38, from Sipser.

5. Prove that language \( A = \{w\#y | w, y \in \{a, b\}^*, w \neq y \} \) is not regular. (Hint: For the solution I have in mind, you will find it useful to use what you proved in problem 1 about intersection and complement.)

6. Give a CFG generating the language of binary strings with twice as many 0’s as 1’s.

7. 2.44, from Sipser. You do not have to provide a formal automaton definition.