CS 310, Assignment 1

Due on 26 January in class

1. Let $\Sigma = \{a, b\}$ and consider languages $A = \{b, aa, ba\}$ and $B = \{\varepsilon, a, bb\}$.
   (a) Write down all strings in Σ^* that have length at most two.
   (b) How many strings are in $A \cdot B$? Write down all of them.
   (c) How many strings are in $B \cdot A$? Write down all of them.
2. Let $R = (ba^*b + aba^*ba)^*$ and $S = (a^*ba^*ba^*)^*$, both over $\Sigma = \{a, b\}$.
   (a) Give an example of a string z that is both in R and in S (that is, $z \in R \cap S$).
   (b) Is it possible to find a string x that is in R and is not in S (that is, $x \in R \cap \overline{S}$)? If yes, write it down; if not explain briefly why.
   (c) Is it possible to find a string y that is in S and is not in R (that is, $y \in S \cap \overline{R}$)? If yes, write it down; if not explain briefly why.
3. Give regular expressions for each of the following languages over $\Sigma = \{0, 1\}$.
   (a) All strings that begin with 1 *and* end with 00.
   (b) All strings that have both 00 and 01 as substrings. Note that the substrings can occur in either order and possibly overlap.
4. Describe the language L over $\Sigma = \{0, 1\}$ defined by each of the following equations. Justify your answers as fully as you can.
   (a) $L = 0 + 1L$
   (b) $L = L + 1 + L$

Make sure you review the submission guidelines posted on the course's Web site before submitting.