CS 181 Homework Week 5
Due *Friday May 4 by 12:00noon*
Online submission *strongly* preferred

1. [5 points] Let $\Sigma = \{ a, b \}$. Consider the following language:

   $$L = \{ ww \mid w \in \Sigma^* \}$$

   Determine whether the *complement* $\bar{L} = (\Sigma^* - L)$ of this language is a Finite State Language. To prove whether $\bar{L}$ is finite state or not, you may use any approach or combination of approaches we have discussed in class. (If this exact fact is stated in the text, you cannot simply reference the statement in the text.) There are several ways to do this. After you have solved it "your way", you might want to see how many other ways you can think of for extra practice.

2. [2 points] Is the following grammar is ambiguous?

   $$G = (V, \Sigma, R, E), V = \{ E \}, \Sigma = \{ \text{atom}, +, \text{x}, (,) \} \text{ and}$$
   $$R = \{ E \rightarrow \text{atom} \mid E + E \mid E \times E \mid (E) \}$$

   Briefly justify your answer.

3. [5 points] Show a CFG for the language L_{ists} over the alphabet
   $\Sigma = \{ \textbf{atom}, \textbf{(,)} \}$, consisting of all strings over Σ of
   the following forms:

   atom

   list: where a list is any sequence between a matched pair of
   parentheses of any number ($\geq$ zero) of **atom**'s or lists.

   E.g., L_{ists} contains:
   atom , () , (atom) , (atom atom) , (atom ()) , ((atom) ()) , etc.
   E.g., L_{ists} does not contain:
)(, atom) , (( ) , ε **, atom) atom , (atom) atom** , etc.

Total: 12 points
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