Group Work, Chapter 9
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Part I. For this group work, let $\Sigma = \{a, b\}$, let EVEN-EVEN be defined as in your text, and let $\mathcal{R}$ be the set of regular languages over Σ. If A is a set, let A' denote the complement of A. Of course, to figure out what that means, you need to know what the universal set is. If A happens to be a language over Σ, assume that the universe if Σ^*. For each of the statements below, decide whether it is true or false or whether it doesn't make sense (because an adjective is being used with the wrong type of noun, for example). Provide justification in all cases.

1. EVEN-EVEN is a set of words.
2. $\mathcal{R}$ is a set of words.
3. EVEN-EVEN is an element of $\mathcal{R}$.
4. *abba* is an element of $\mathcal{R}$.
5. All elements of $\mathcal{R}$ are languages over Σ.
6. All languages over Σ are elements of $\mathcal{R}$.
7. EVEN-EVEN is closed under union.
8. $\mathcal{R}$ is closed under union.
9. EVEN-EVEN is closed under concatenation.
10. $\mathcal{R}$ is closed under concatenation.
11. What is the complement of EVEN-EVEN?
12. $\mathcal{R}$ is closed under complement.
13. EVEN-EVEN is closed under complement.
14. If L_1 and L_2 are languages, then $L_1 \cap L_2 = (L_1' \cup L_2')'$.
15. $\mathcal{R}$ is closed under intersection. (How is the previous question related to this one?)
16. EVEN-EVEN is closed under intersection.
17. EVEN-EVEN is closed under the reverse operation.
18. $\mathcal{R}$ is closed under the reverse operation.

Part II.

1. In class you learned an algorithm for constructing a finite automaton that accepts $L_1 \cup L_2$ given finite automata that accept L_1 and L_2. How could you modify this algorithm (ever so slightly) to construct a finite automaton that accepts $L_1 \cap L_2$?

2. Let L_1 be the language given by the regular expression $(a+b)^*a$. Let L_2 be the language given by the regular expression $b(a+b)^*$. Describe these languages in English.

3. Construct simple automata that accept L_1 and L_2. (I suggest you use your creativity rather than relying on the algorithms we learned in class here.)

4. Use your algorithm from question 1 above to construct an automaton that accepts $L_1 \cap L_2$.

5. Make sure you got question 15 from Part I right.