Due: beginning of class on Wed., Feb 2, 2000

Please PRINT your name clearly at the beginning of each problem. If you have not already done so, read collaboration policy from the course web page: http://www-cse.ucsd.edu/classes/wi00/cse105

In this homework set, we always use the alphabet \( \Sigma = \{a, b\} \).

**Problem 1**

Use the construction shown in class (or other equivalent construction) to convert the following NFA \( N \) to DFA. Give your answer as a state transition diagram. (You do not need to include in your answer the states that cannot be reached from the start state).

![NFA diagram](image)

Figure 1: A nondeterministic finite automaton \( N \)

**Problem 2**

Use the method discussed in class (or equivalent method) to find NFAs that accept the the languages corresponding to the following regular expressions. Show intermediate steps in the construction. (You can omit a few of the minor steps.)

a. \((aaa)^* \cup b(ab)^*\)

b. \((ab \cup ba)^*\)
Problem 3

Use the method discussed in class (or the method from the book) to find a regular expression that describes the language accepted by the NFA from problem 1. Show the intermediate steps of the computation. (You can simplify the intermediate expressions as well as the final answer using simple identities like $\epsilon \cdot a = a$ and $a^* \cup a = a^*$.)

Problem 4

Prove that for every regular expression $R$ there exists another regular expression $R'$ such that the language recognized by $R'$ is the complement of the language recognized by $R$, i.e., $L(R') = \Sigma^* - L(R)$. (You can use the results proved in class and in the first problem set to solve this problem.)

Give regular expressions corresponding to the complement of the following regular expressions:

a. $(a \cup ab)^*$

b. $(aa)^* \cup b^*$