Assignment 1

Due September 18, 9:00 a.m. Please remember that consulting course bibles or other outside or online materials for help with this assignment is a breach of academic integrity, which will be reported to the Academic Panel.

Problem 1

Prove by induction that $|uv| = |u| + |v|$. (Hint: use a recursive definition of the length of a string.)

Problem 2

Give state diagrams of deterministic finite automata (DFAs) recognizing the following languages over $\Sigma = \{a, b\}$.

a. $\{w \mid w$ begins with an $a$ and ends with a $b\}$.
b. $\{w \mid w$ contains an even number of $a$s, or exactly two $b$s $\}$. 
c. $\{w \mid w$ has length at least 3 and its third symbol is an $a$\}.

Problem 3

Let $L = \{w \mid w$ contains an equal number of occurrences of the substrings $ab$ and $ba\}$. This means that $bab \in L$ because $bab$ contains a single occurrence of $ab$ and a single occurrence of $ba$. On the other hand, $baba \notin L$ as it has two $bas$ and one $ab$. Construct a nondeterministic finite automaton (NFA) recognizing $L$.

Problem 4

Convert the following NFA to an equivalent DFA, using the method outlined in class and the book. Be sure to show all of your steps.

![Diagram](image-url)