1. (0 points) What is your name? Write it clearly. What day is the midterm? Staple your HW.

2. (40 points)
   
   (a) (10 points) Write a DFA for \( \{a, b\}^* \). How many states does it have?
   
   (b) (10 points) Write a DFA for \( \{a, b\}^3 \). How many states does it have?
   
   (c) (10 points) Write a NDFA for \( \{a, b\}^* \{a, b\}^3 \) by using the procedure to take two DFA’s and produce an NFA for the concat of the two languages. How many states does it have?
   
   (d) (10 points) Write a DFA for \( \{a, b\}^* \{a, b\}^3 \). Use the powerset construction. How many states does it have?

3. (30 points) If \( x \) is a string then \( x^R \) is that string reversed. For example \((aaab)^R = baaa\).

   If \( L \) is a language then

   \[
   L^R = \{w^R : w \in L\}
   \]

   (a) Show that if \( L \) is regular than \( L^R \) is regular.
   
   (b) Find a function \( f \) such that the following is true:
   
   (c) If \( L \) is regular via DFA \( M \) of size \( n \) then there exists a DFA for \( L^R \) with \( \leq O(f(n)) \) states.

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4. (30 points) Let $L$ be the following set of infinite strings of 0’s and 1’s:

$$L = \{ w : w \text{ has an infinite number of 1’s } \}.$$ 

Write a DFA $M$ such that:
If $w \in L$ then if you run $M$ on $w$ you will hit an accept state infinitely often.
If $w \notin L$ then if you run $M$ on $w$ you will hit an accept state finitely often (possibly zero).