HW 4 CMSC 452. Morally DUE Sep 30 (YES, the same day as HW 3)

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

2. (30 points) Write a Regular Expression for the languages A, B, C below. The alphabet is $\{a, b\}$.

   (a) $A = \{w \mid abab \text{ is a suffix of } w\}$

   (b) $B = \{w \mid$ the third to the last symbol of w is a b$\}$
   (Examples: *aaabaa*, *abaaaaabab*.)

3. (30 points) Consider the following alternative proof that if L is accepted by a DFA then L has a regular expression.

   L is accepted by DFA $(Q, \Sigma, \delta, s, F)$.

   Let $S(i, j, k)$ be the set of all string w such that $\delta(i, w) = j$ via a route that uses AT MOST k STATES AS INTERMEDIARIES

   (a) What is $S(i, j, 0)$.

   (b) Write $S(i, j, k)$ in terms of $S(i', j', k-1)$ in such a way that this can used to prove that if all $S(i', j', k-1)$ can be expressed as a regular expression then so can $S(i, j, k)$.

4. (40 points)

   (a) Write an NDFA for the language

   $$L_3 = \{w \mid \text{ the third to the last symbol of } w \text{ is a b}\}$$

   (b) Use the NDFA to DFA converstion to write a DFA for L_3. How many states does it have.

   (c) Let $n \in \mathsf{N}$. Write an NDFA for the language

   $$L_n = \{w \mid \text{ the } n\text{-to the last symbol of } w \text{ is a b}\}$$

   You may use DOT-DOT-DOT notation.

   (d) If you were to do the NDFA to DFA converstion for the DFA for L_n then how many states would it have when minimized? Argue why this is true informally.