HW 4 CMSC 452. Morally DUE Feb 27
THIS HOMEWORK IS TWO PAGES
SOLUTIONS

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?

   SOLUTION TO PROBLEM 2

   (Hard to draw in LaTeX so I'll describe.)

   a) One State. DFA for $\{0, 1\}^*$ is just one state that is start and final and all transitions go to it.

   b) FIVE States State START NOT a final state.

   on a or b START to ONE, NOT a final state

   on a or b ONE to TWO, NOT a final state

   on a or b TWO to THREE. THREE is a final state

   on a or b THREE to DUMP. DUMP is not a final state.

   on a or b DUMP goes to DUMP.

   c) Connect the final state from the DFA in (1) to the start states in (2). SIX states.

   d) will do in class

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 $\le O(f(n))$ states.

SOLUTION TO PROBLEM 3

a) Take the DFA M for L

Make the start state a final state

Create a new start state and have an e-transition from it to all of the final states

REVERSE all of the arrows.

b) If L has a DFA with n states then the by the above there is an NFA with $n+1$ states. Convert to a DFA of size 2^{n+1}. Okay to have $f(n) = 2^n$.

END OF SOLUTION TO PROBLEM THREE

THERE IS ONE MORE PAGE

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).

SOLUTION TO PROBLEM FOUR

Two states s and ONE.

s is a start state.

ONE is a final state

$\delta(s, 0) = s$

$\delta(s, 1) = ONE$

$\delta(ONE, 0) = s$

$\delta(ONE, 1) = ONE$

END OF SOLUTION TO PROBLEM FOUR