HW 3 CMSC 452. Morally DUE Feb 21
THIS HOMEWORK IS TWO PAGES

1. (0 points) What is your name? Write it clearly. When is the midterm? Write that clearly too. Staple your HW. WHAT IS THE DAY/TIME OF THE MIDTERM? (HINT: The Midterm is March 30 IN CLASS at 11:00.)

2. (30 points) Write an NDFA for the following language:

$$L = \{w : \text{ the third to last symbol of } w \text{ is } a \}$$

(For example *bbbabb* $\in L$.)

   (a) (10 points) Write an NDFA for L How many states are in this NDFA?

   (b) (10 points) Use the construction in class to make an DFA for L. How many states are in this DFA?

   (c) (10 points) Fix k. Write an NDFA for the following language:

$$L_k = \{w : \text{ the } k\text{th to last symbol of } w \text{ is } a \}$$

   Roughly how many states does it have?

   (d) (0 points) Speculate on how many states the DFA for L_k would take.

3. (30 points) In this problem we will complement a Regular Expression Language by first converting it to an NDFA, then to a DFA, then complement the DFA (to complete this I would then have you turn the DFA into a Reg Expression, but thats just so long and hard I won't make you do that).

Let

$$L = (a \cup b)^* ab$$

(a) Use the construction in class for converting regular expressions to NDFAs to find an NDFA for L.

(b) Use the construction in class for converting NDFAs to DFAs to find a DFA for L.

(c) Find a DFA for $\overline{L}$.

4. (a) (0 points) Draw a NDFA for the set $\{(X, x) \mid x \in X\}$. (YES this is the one I did in class, but wait for the next few.) How many states does it have?

(b) (5 points) Draw a NDFA for the set $\{(X, x) \mid x + 1 \in X]\}$ How many states does it have?

(c) (5 points) Draw a NDFA for the set $\{(X, x) \mid x + 2 \in X]\}$ How many states does it have?

(d) (30 points) Fix $k \in \mathsf{N}$. Draw a NDFA for the set $\{(X, x) \mid x + k \in X]\}$ You may use ... notation and will have to; however, make it so clear that anyone looking at your answer will be able to, given k, How many states does it have?