# HW 3 CMSC 452. Morally DUE Feb 18

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

2. (30 points) READ the handout on CLOSURE on the course website. Let $L_1$ be regular via DFA $M_1 = (Q_1, \Sigma, \delta_1, s_1, F_1)$. Let $L_2$ be regular via DFA $M_2 = (Q_2, \Sigma, \delta_2, s_2, F_2)$. Write down the NDFA for $L_1 \cdot L_2$ (the concatenation of $L_1$ and $L_2$). The NDFA you write down will use $Q_1, \Sigma, \delta_1, s_1, F_2, Q_2, \delta_2, s_2, F_2)$.

3. (30 points) We define a new kind of DFA called a Bill-DFA. A Bill-DFA is a tuple $(Q, \Sigma, \delta, s, A, R, S)$ where (1) $Q, \Sigma, \delta, s$ are as usual, (2) $A$, $R$, $S$ are all disjoint, (3) $Q = A \cup R \cup S$. Our intention is that if a string $x$ ends up $A$ then its ACCEPTED, if it ends up in $R$ then its REJECTED (but with dignity), and if it ends up in $S$ then its just STUPID- of the wrong form.

   Let $L_1$ be regular via Bill-DFA $M_1 = (Q_1, \Sigma, \delta_1, s_1, A_1, R_1, S_1)$. Let $L_2$ be regular via Bill-DFA $M_2 = (Q_2, \Sigma, \delta_2, s_2, A_2, F_2, S_2)$.

   Write a Bill-DFA for $L_1 \cap L_2$. Note that if EITHER machine thinks a string is stupid then the new DFA should also think its stupid.

4. (40 points)

   (a) Write an algorithm for the following problem: Given an NDFA and two states $p, q$ (which could be the same) determine if THERE EXISTS a non-empty string $x \in \Sigma^*$ such that if the machine starts in state $p$ and $x$ is fed into it, then the machine ends up in state $q$.

   (b) Write an algorithm for the following: Given an NDFA $M$ which we interpret as a $B$-NDFA, does there exist $x \in \Sigma^\omega$ (an infinite string) that is accepted. This part should use part a. (NOTE- see the slides on line to remind yourself what it means for an $B$-NDFA to accept an infinite string.