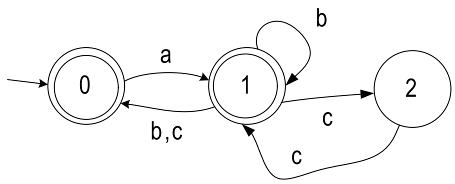
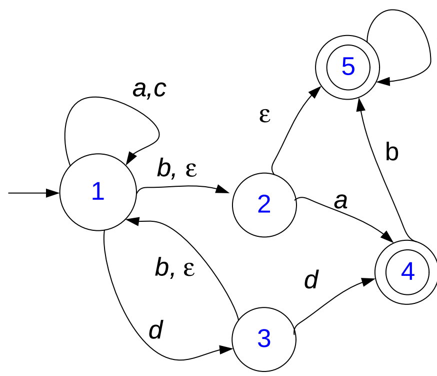
ECS 120: Theory of Computation — ps3
UC Davis — Phillip Rogaway — April 10, 2015

Problem Set 3 – Due Friday, April 17, 2015

Problem 1. Using the procedure shown in class, convert the following NFA into a DFA for the same language. Show all work.



Problem 2. Using the procedure shown in class, eliminate all ε-arrows from the following NFA.



Problem 3. Let $L_1, L_2, L_3 \subseteq \Sigma^*$ be languages and let $\mathit{Most}(L_1, L_2, L_3)$ be the set of all $x \in \Sigma^*$ that are in at least two of L_1, L_2, L_3. Prove: if L_1, L_2, and L_3 are DFA-acceptable then so is $\mathit{Most}(L_1, L_2, L_3)$.

Problem 4 Let $\mathit{Stutter}(L) = \{a_1a_1\ a_2a_2\ \cdots\ a_na_n \in \Sigma^* : a_1a_2\cdots a_n \in L\}$. **(A)** Prove that the DFA-acceptable languages are closed under *Stutter*. **(B)** Then, having proved it once, give another, entirely different proof.

Problem 5. How many states are in the smallest possible DFA for $\{0,1\}^*\{1^{10}\}$? Prove your result.

Problem 6 Let L_n (for $n \geq 1$) be $\{0,1\}^*\{1\}\{0,1\}^n$. Prove that there is an NFA for L_n having $n+2$ states, but that there is no DFA for L_n having $2^n - 1$ or fewer states. In a well written English sentence or two, give a high-level interpretation of your result.