CECS 329, Learning Outcome Assessment 5, March 2nd, Spring 2023, Dr. Ebert

NO NOTES, BOOKS, ELECTRONIC DEVICES, OR INTERPERSONAL COMMUNICATION ALLOWED. Submit solutions to at most 2 LO problems on separate sheets of paper.

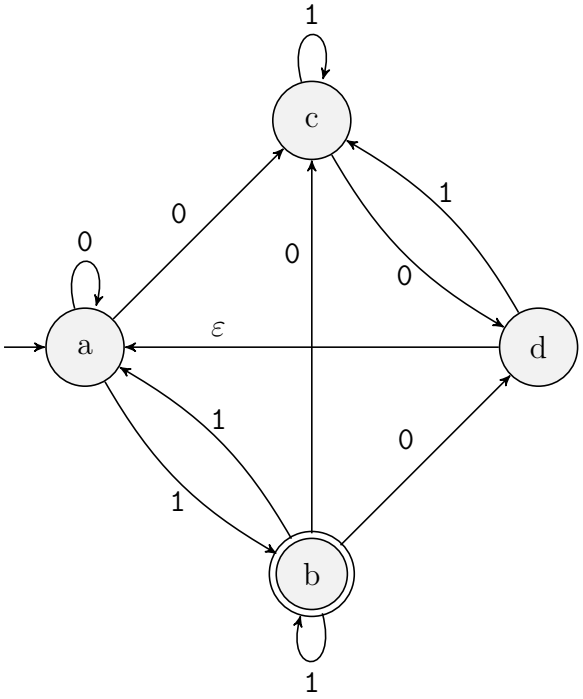
Problems

LO1. Do the following.

(a) Provide the state diagram for a DFA that accepts all binary words that have at *least* two 0s and at *most* one 1.

(b) Show the computation of M on input i) $w = 0100$ and ii) $w = 00110$.

LO2. Do the following for the NFA N whose state diagram is shown below.



(a) Provide a table that represents N's δ transition function.

(b) Use the table from part a to convert N to an equivalent DFA M using the method of subset states. Draw M's state diagram.

(c) Show the computation of M on input $w = 11001$.

LO3. Provide a regular expression that represents the set of binary words w that have at most one 0 and at least three 1's. Hint: there are more than two cases to consider.

LO4. Do the following.

(a) Provide a context free grammar $G = (V, \Sigma, R, S)$ for which $L(G)$ is the set of words from $\{a,b\}^*$ that are palindromes of odd length (i.e. words that read the same forwards as backwards). For example, aabaa is an odd-length palindrome, but abbab is not.

(b) Use G to provide a leftmost derivation of babab.

LO5. Let $\text{GTE}(x, y)$ be defined as

$$\text{GTE}(x, y) = \begin{cases} 1 & \text{if } x \geq y \\ 0 & \text{otherwise} \end{cases}$$

Provide a *recursive* definition for $\text{GTE}(x, y)$. In addition to the basic functions, the only other functions you may use in your definition are binary addition, subtraction, multiplication, $x - 1$, Sgn, and $\overline{\text{Sgn}}$. Hint: credit will not be awarded if your recursive case does not depend on the value of $\text{GTE}(x, y)$. For example, $f(x, y) = x + y + 0 \cdot \text{GTE}(x, y)$ is a function of x and y that does not depend on $\text{GTE}(x, y)$ even though $\text{GTE}(x, y)$ appears in its definition.