**CECS 329, Learning Outcome Assessment 4, Feb. 23rd, 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**.

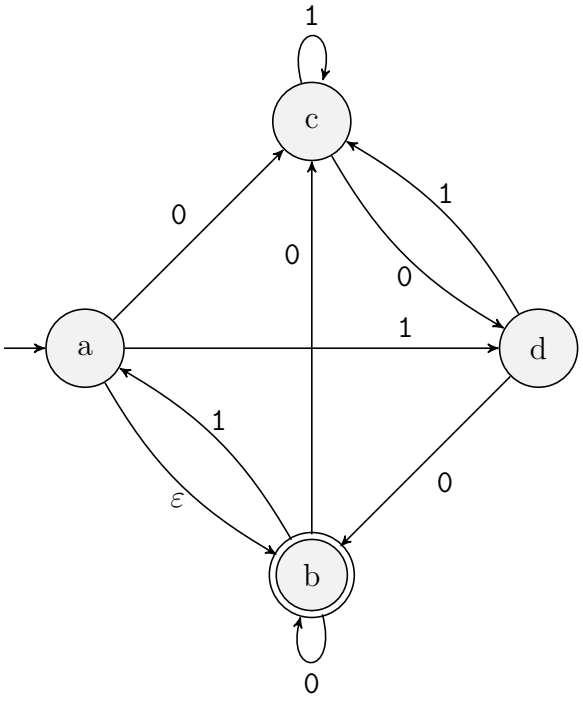
# Problems

LO1. Do the following.

(a) Provide the state diagram for a DFA that accepts the binary language $L$ described as follows. Binary word $w \in L$ iff either i) $w$ is empty, ii) $w$ consists of all 0's, or iii) each 1 bit in $w$ is next to exactly one other 1 bit. For example, 01100011 and 000 are words in $L$, while 0100110 and 01101110 are *not* words in $L$.

(b) Show the computation of $M$ on input i) $w = 011011$ and ii) $w = 011010$.

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




(a) Provide a table that represents $N$'s $\delta$ 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 a length of at least two and end with a 0, but not including the word 010. In other words, 010 is the only word of length two or more that ends with a 0 and is *not* in the set.

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 $\{a,b\}^*$ for which there are twice as many b's as a's.

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