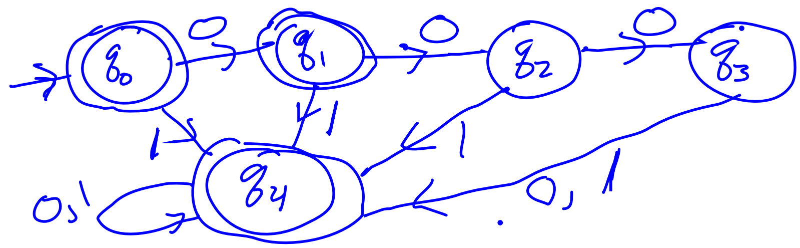
CECS 329, Learning Outcome Assessment 3, Feb 9th, Spring 2023, Dr. Ebert

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

LO1a:



Problems

LO1. Do the following.

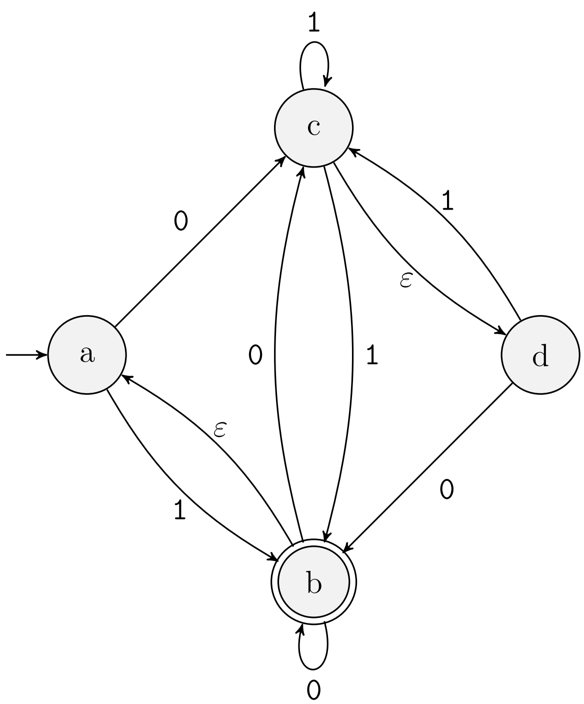
(a) Provide the state diagram of a DFA M that accepts all binary words except for 00 and 000.

(b) Show the computation of M on input i) $w = 1101$ and ii) $w = 1110$.

LO1b: 1 1 0 1

q_0 q_4 q_4 q_4 q_4 accept

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



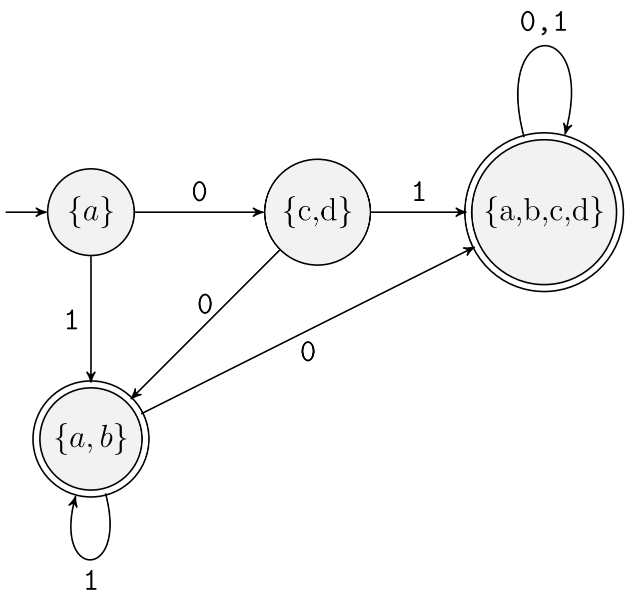
(a) Provide a table that represents N's δ transition function.

Solution.

$Q\backslash\Sigma$	0	1
a	{c,d}	{a,b}
b	{a,b,c,d}	∅
c	∅	{a,b,c,d}
d	{a,b}	{c,d}

(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.

Solution.



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

Solution.

Input Symbol Read	Current State
1	{a}
1	{a,b}
0	{a,b}
0	{a,b,c,d}
1	{a,b,c,d}
Accepting State:	{a,b,c,d}

LO3. Do the following.

(a) Provide a regular expression that represents the set of binary words w for which either i) w has at most one 1 bit or ii) between any two 1 bits of w there is exactly an odd number of 0 bits.

Solution.

$$0^* \cup 0^*1(0(00)^*1)^*0^*.$$

001 0001 000001 000

(b) Consider the CFG

$$G = \{V = \{S\}, \Sigma = \{a, b\}, R = \{S \to SS, S \to aSb, S \to \varepsilon\}, S\},$$

Provide a derivation of aaabbababb.

Solution.

$$S \Rightarrow aSb \Rightarrow aSSb \Rightarrow aaSbSb \Rightarrow aaaSbbSb \Rightarrow aaabbSb \Rightarrow aaabbSSb \Rightarrow aaabbaSbSb.$$

$$\Rightarrow aaabbabSb \Rightarrow aaabbabaSbb \Rightarrow aaabbababb.$$