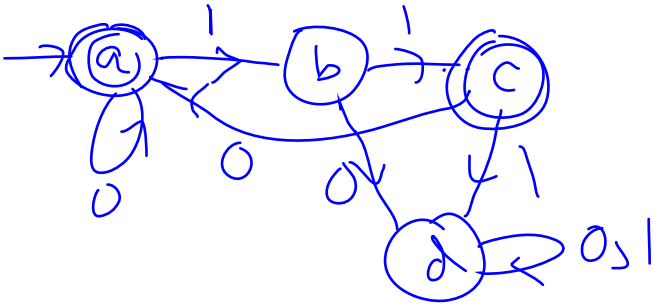
CECS 329, Learning Outcome Assessment 4, Feb. 23rd, Spring 2023, Dr. Ebert

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

Solution to LO1



Problems

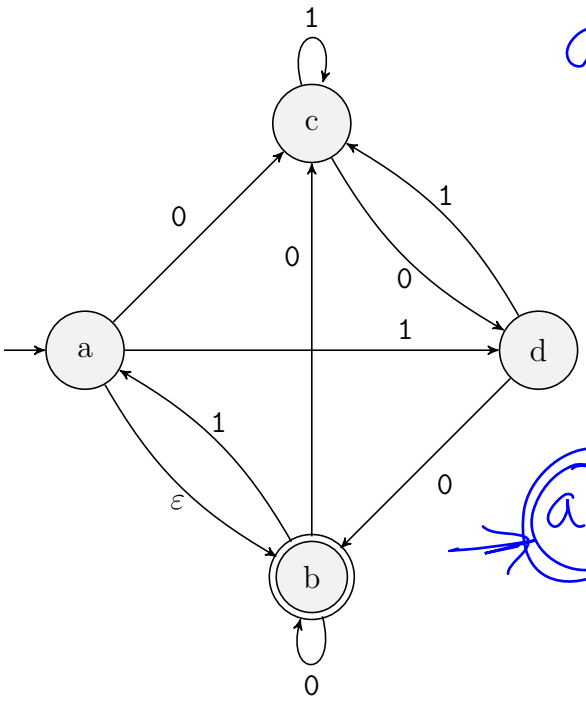
LO1. Do the following.

(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) $w = 011010$.

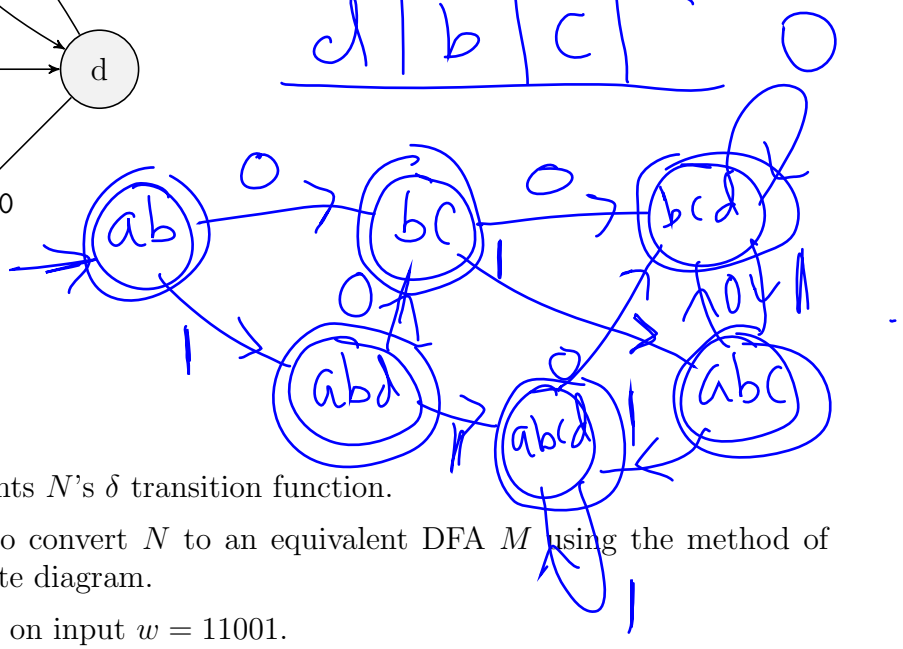
0 1 1 0 1 1
a a b c a b
c ⇒ accept

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



a)

	0	1
a	c	d
b	b,c	a,b
c	d	c
d	b	c



(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 $w = 11001$.

1 ab 1 abd 0 bc 0 bcd 1 bcd
abc ⇒ accept

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.

$\{00, 10, 000, 100, 110\} \cup \{0,1\}^3\{0,1\}^*0$

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.

$S \to SaSbSbS \mid SbSaSbS \mid SbSbSaS \mid \varepsilon$

$S \to SbSabS \to bSabS \to babS \to$
$babSaSbSbS \to babaSbSbS$
$\to bababSbS \to bababbS$
$\to$ bababb