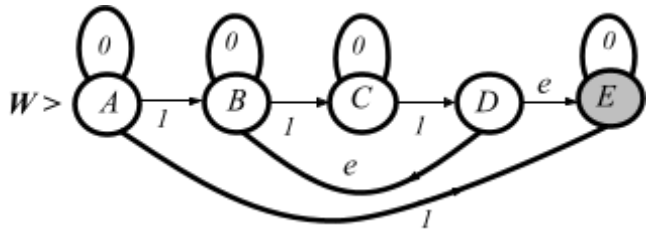
SABANCI UNIVERSITY, CS 302 Automata Theory, Fall 2023

Answers for the Midterm Examination

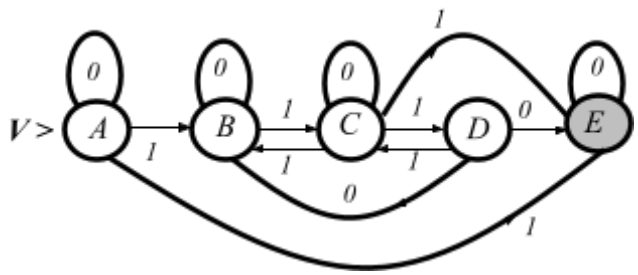
ANSWER 1

(a) *(10 pts) See the relevant slides.*

(b) *(15 pts) First sketch the* $\varepsilon-$ *NFA* ***W*** *for* ***E*** *as below :*



The corresponding NFA ***V*** *without* ε*-transitions are*



(c) *(25 pts) Let* ***N*** *be given in PL and choose* $\mathbf{w = 0^N\ 1^N\ 0^N}$ *then* $\mathbf{w=w^R}$ *hence it is in* ***L*** *and* $\mathbf{|w| =3N > N}$ *as required by the PL . Now by the PL* $\mathbf{w =x.y.z}$ *and so* $\mathbf{x.y= 0^p}$; $\mathbf{p\leq N}$ *and* $\mathbf{y = 0^q}$ *with* $\mathbf{q > 0}$ *. So* $\mathbf{z = 0^{N-p}.\ 1^N.0^N}$ *and* $\mathbf{x.z = 0^{p-q}\ 0^{N-p}.\ 1^N.0^N = 0^{N-q}.\ 1^N.0^N}$ *which is* ***not*** *a palindrome and not in* ***L*** *since* $\mathbf{q > 0}$ *so it violates the PL and* ***L*** *is not regular.*

ANSWER 2

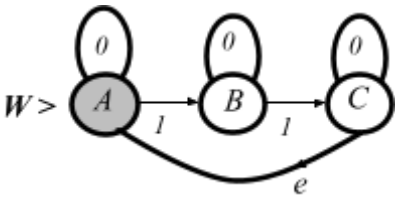
(a)&(b) *(50 pts) First note that* $L_2 = L_1^c$ *and also* $L_1 = L_2^c$ *so it is enough to find regular expressions for* L_1 *and* L_2 **.**

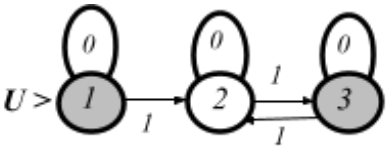
E_1 **= (0*. 1. 0*. 1. 0*)* -->** *even number of 1's*

E_2 **= 0*. 1. (0*. 1. 0*. 1. 0*)*. 0*-->** *odd number of* **1's**

We shall find a minimal state DFA **X** *for* E_1 *and through its complement* **Y** *for* E_2 *and the entire problem shall be solved .*

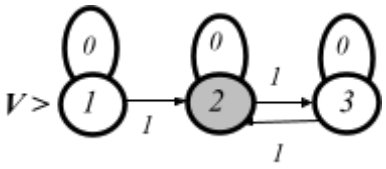
The epsilon-NFA **W** *for* E_1 *and its equivalent DFA* **U** *are given as below :*





State	Input	Next State
> A=1*	0	A
A	1	B
B=2	0	B
B	1	AC
AC=3*	0	AC
AC	1	B

The DFA for E_2 **,** *namely* **V** **,** *is the complement of* **U** *as given below.*



2 1 3

2

	0	0	1
			3

The table above is the result of the *table filling algorithm* both for ***U*** and ***V*** and for both cases states ***1*** and ***3*** are equivalent . And so the ***minimal state*** automata ***X*** and ***Y*** for E_1 and E_2 respectively are given below.