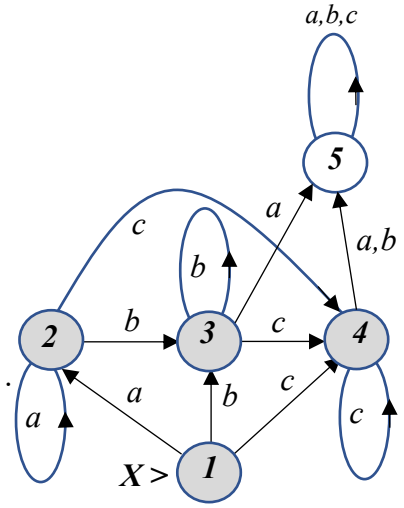
SABANCI UNIVERSITY

Faculty of Engineering and Natural Sciences
CS 302 Automata Theory
Fall 2020

Remote Midterm Answers

Answer 1 (*50* points)

(a) *(15 pts)* A *DFA* ***X*** that accepts L_1 is given below ; hence L_1 is *regular*.



(b) *(15 pts)* L_2 is *not regular*. Choose $w = a^{2n}\, c^n$ which is in L_2 and has length $3n > n$. By the pumping lemma $w = xyz$ where $|xy| \leq n$ and $|y| > 0$; hence $xyz = a^{2n}\, c^n$ implies that $xy = a^p$ and $y = a^q$ with $p \leq n$ and $q > 0$. Hence $x = a^{p-q}$, $y = a^q$ and $z = a^{2n-p}\, c^n$ therefore $xy^j z$ for $j=0$ is : $xz = a^{p-q}\, a^{2n-p} c^n = a^{2n-q}\, c^n$ and since $q>0$ occurence of ***a'***s are less than twice that of ***c'***s and thus xz is not in L_2 as demanded by the pumping lemma and so L_2 is NOT regular.

(c) *(20 pts)* $G = (\{S,B\},\{a,b,c\},R,S)$ where the production set R is given by

R : $S \rightarrow aaSc \mid B \mid e$; $B \rightarrow bB \mid e$

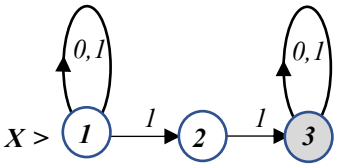
Answer 2 (*50* points)

(a) *(25 pts)* ***E = (0+1)*1.1.(0+1)* .***

E

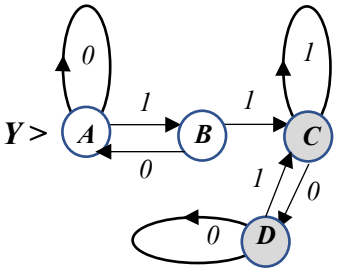
→ E*E → (E)*E → (E+E)*E → (0+E)*E → (0+1)*E → (0+1)*E.E → (0+1)*1.E → (0+1)*1.E.E → (0+1)*1.1.E → (0+1)*1.1.E* → (0+1)*1.1.(E)* → (0+1)*1.1.(E+E)* → (0+1)*1.1.(0+E)* → (0+1)*1.1.(0+1)*

(b) *(25 pts) NFA* for ***E*** is given below

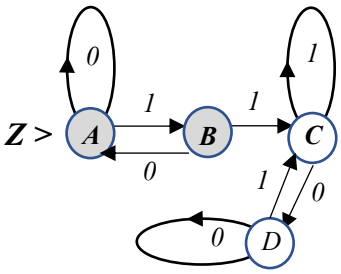


This is converted to a DFA ***Y*** using the table below

state	*input*	*next*
>1=A	*0*	*1*
1	*1*	*1,2*
1,2=B	*0*	*1*
1,2	*1*	*1,2,3*
*1,2,3=C**	*0*	*1,3*
1,2,3	*1*	*1,2,3*
*1,3=D**	*0*	*1,3*
1,3	*1*	*1,2,3*



The complement language corresponds to a DFA where final and non-final states of ***Y*** are interchanged yielding the DFA ***Z*** below



To find the minimal state DFA we use the table filling algorithm as below

C	D	A	B
	Eq	0	0
		0	0
			1

Hence ***D*** and ***C*** are equivalent states and a minimal state *DFA* ***W*** is :