RV Educational Institutions
RV College of Engineering

Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi

Approved by AICTE, New Delhi

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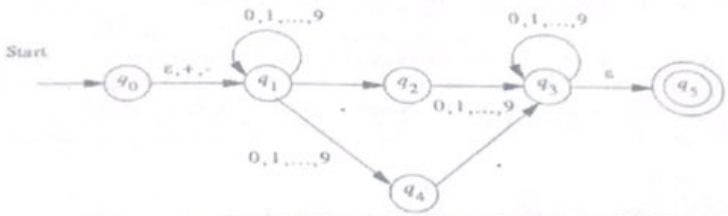
4G1 - V1 (1 - 24)

Academic year 2020-2021 (Even Sem)

DEPARTMENT OF

INFORMATION SCIENCE & ENGINEERING

Date	4th June 2021	Maximum Marks	50
Course Code	18IS46	Duration	120 Min
Sem	IV Semester	Closed Book Online Test-1	
THEORY OF COMPUTATION			

Sl. No.	Questions	M	BT	CO
1.a	Write NFA for the following: i) To recognize strings that start and end with same character for $\sum = \{a,b\}$. ii) The set of all strings containing exactly two occurrences of 10 over $\sum = \{0,1\}$.	04	L5	CO1
1.b	Obtain an ε-NFA for the following regular expressions: i) $((ab)^*b+ab^*)^*$ ii) $(a^*+b^*+c^*)$	06	L2	CO1
2.a	Find CFG's to generate the following languages: i) $\{a^ib^jc^k \mid i = j \text{ or } i = k\}$ ii) $\{a^ib^j \mid i < 2j\}$	04	L5	CO3
2.b	Obtain an equivalent DFA corresponding to the ϵ-NFA given below. 	06	L3	CO2
3.a	Given $\sum = \{0, 1\}$, Obtain an equivalent DFA corresponding to the NFA given below using subset construction method.	05	L3	CO2

δ	0	1
-> p	{p,q}	{p}
q	Φ	{r}
*r	{p,r}	{q}

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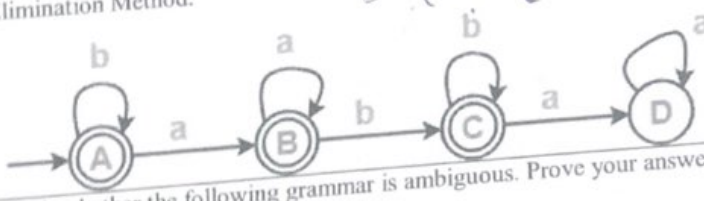
3.b	State Pumping Lemma for Regular Languages. By using P.L, Prove that $L = \{a^n b^n \mid n \geq 1\}$ is not regular.	05	L3	CO1
4.a	Write regular expressions for the following languages: $\Sigma = \{0,1\}$ i) The set of all strings that contain exactly three 1's. $0^*10^*10^*10^*$ ii) The set of even length strings $((a+b)(a+b))^*$ iii) The set of all strings of 0's and 1's not containing 101 as a substring. ~~$(0+1)^*101(0+1)^*$~~ $0^*(1^*000^*)^*1^*0^*$	06	L4	CO3
4.b	Obtain Regular Expression for the given Finite Automata using State Elimination Method. $b^*(aa^*(bb^*+\varepsilon)+\varepsilon)$ 	04	L3	CO1
5.a	Check whether the following grammar is ambiguous. Prove your answer. $S \rightarrow AB \mid C$ $A \rightarrow aAb \mid ab$ $B \rightarrow cBd \mid cd$ $C \rightarrow aCd \mid aDd$ $D \rightarrow bDc \mid bc$	04	L3	CO3
5.b	Show that class of regular languages is closed under Intersection and Complementation.	04	L2	CO2
5.c	What language over {a,b} does the CFG with productions → w contains even a's & even b's. S -> aaS | bbS | Saa | Sbb | abSab | abSba | baSba | baSab | ϵ generates?	02	L4	CO3

BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

Marks Distribution	Particulars		CO1	CO2	CO3	CO4	L1	L2	L3	L4	L5	L6
	Test	Max Marks	19	15	16	--	--	10	24	8	8	--

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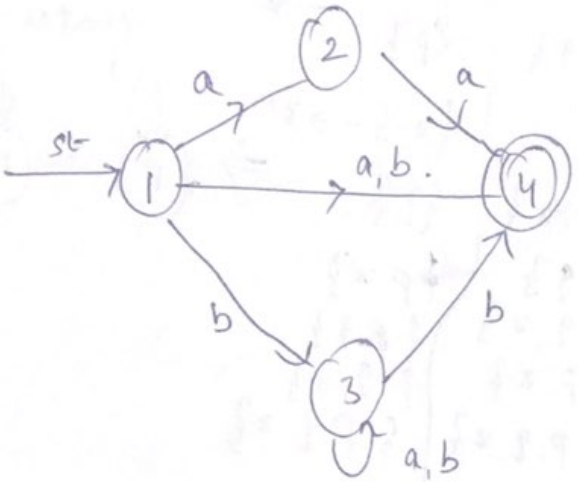
TOC CIE-1 Solution 04/06/2021

V-1

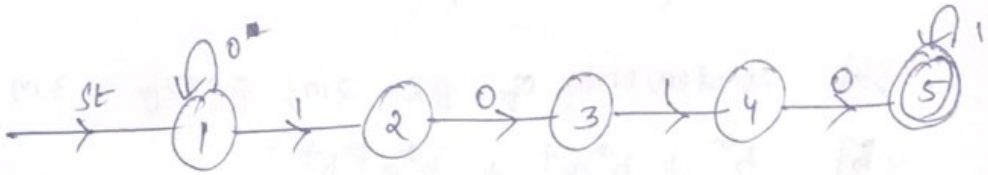
1a) i)



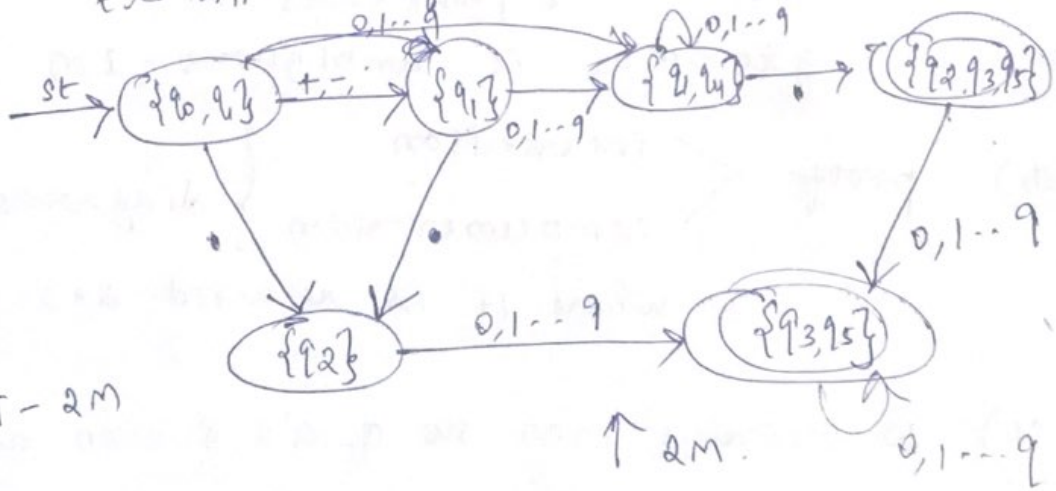
$\Sigma = \{a \times a, b \times b, a, b\}$

$2 * 2 = 4$ M

ii)



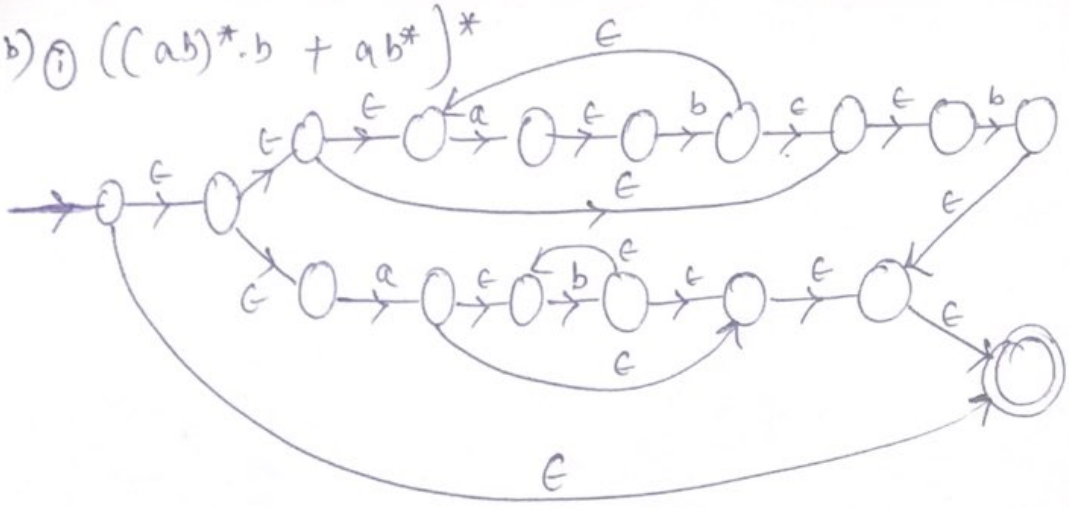
2b] Steps to identify start state, Σ, states, transition & final states of DFA - 2M.



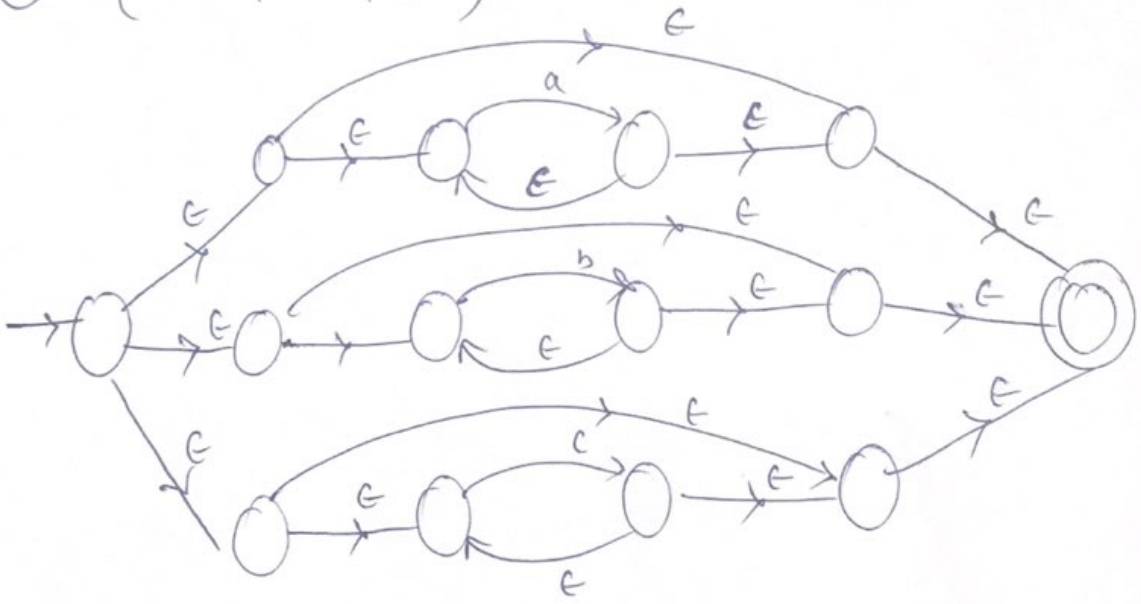
TT - 2M

↑ 2M.

1b) (i) $((ab)^*.b + ab^*)^*$



(ii) $(a^* + b^* + c^*)$ $3 * 2 = 6M$



2a) i) $S \rightarrow AC \mid B$

$A \rightarrow aAb \mid \epsilon$

$C \rightarrow cC \mid \epsilon$

$B \rightarrow aBc \mid \epsilon$

$B \rightarrow bB \mid \epsilon$

ii) $S \rightarrow aaSb \mid aSb \mid Sb \mid ab$

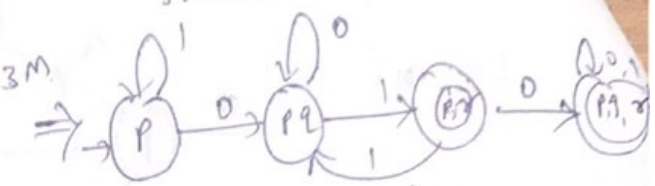
$2 * 2 = 4M$

3a]

δ	0	1
ϕ	ϕ	ϕ
→ {p}	{p,q}	{p}
{q}	ϕ	{r}
{r}	{p,r}	{q}
{p,q}	{p,q}	{p,r}
* {p,r}	{p,q,r}	{p,q}
{q,r}	{p,r}	{q,r}
* {p,q,r}	{p,q,r}	{p,q,r}

* identify start & final states - 1M

→ 3M



↳ 1M.

3b] statement of pL - 2m, proof - 3m.

4a]. $b^* + b^*a^+ + b^*a^+b^+$

4b] Each step carries marks. — 4M

Reduced R.E is $(b^*(aa^*(bb^*+\varepsilon)+\varepsilon)$

5a] any string { 2 LMD's, 2 RMD's, 2 parse trees } 1.5*2 = 3M

grammar is ambiguous - 1M

5b) proof { intersection, complementation } diagrams

where it is required - 2*2 = 4M

5c) w contains even no of a's & even no of b's.