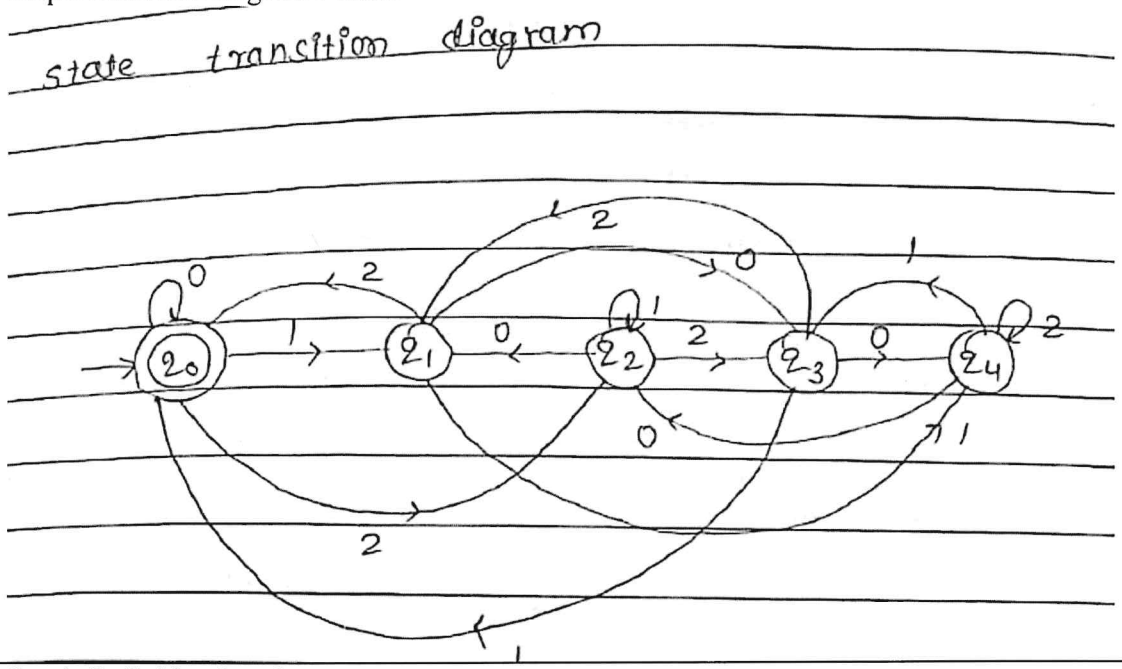
Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

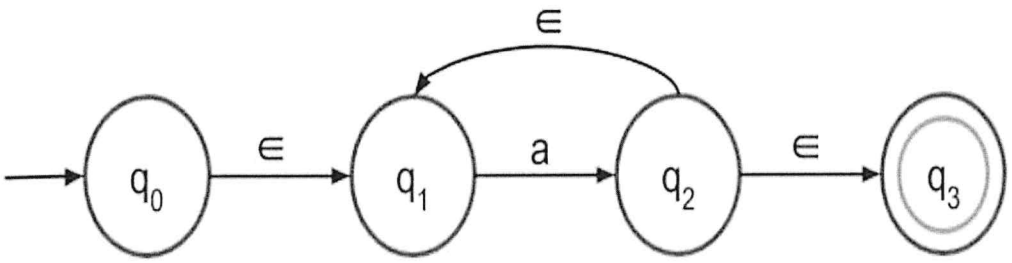
Academic Year (2021-22)
Year: 2 Semester: IV

Program: B. Tech. (Computer Engg.) **Max. Marks: 75**
Subject: Formal Language and Automata Theory **Time: 10: 30 am to 1:30 pm**
Date: **Duration: 3 Hours**

RE . EXAMINATION

ANSWER KEY

Question No.		Max. Marks
Q1 (a)	Step 1:STF 2marks Step 2: MTF 2marks Step3:Transition diagram 1 mark 	[05]
Q1 (b)	Step1: Definition 2marks Step2: Transition Table 2marks Step3: Implementation 4marks Step4:verify string 2marks OR Step1: RE to NFA 3marks Step2: NFA to DFA 4marks Step3: DFA to Min DFA 4marks	[10]



Q2 (a)

Step1: Simplify grammar 4marks
Step2: Convert simplified grammar into CNF 4marks

$A \rightarrow aBa \mid bBa$
$B \rightarrow aB \mid bB \mid \epsilon$

Soln:

Step 1: Remove ϵ-prodn

$A \rightarrow aBa \mid bBa \mid aa \mid ba$

$B \rightarrow aB \mid bB \mid a \mid b$

Step 2: CNF format
$A \rightarrow a$ or
$A \rightarrow BC$

Step 3: Let $X \rightarrow a$, $Y \rightarrow b$

$A \rightarrow XBX \mid YBX \mid XX \mid YX$

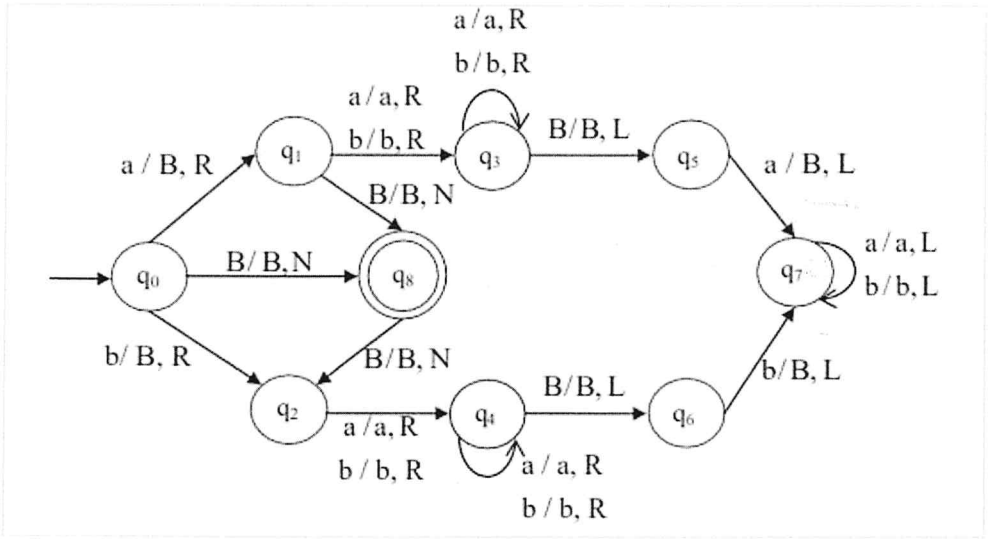
$B \rightarrow XB \mid YB \mid a \mid b$

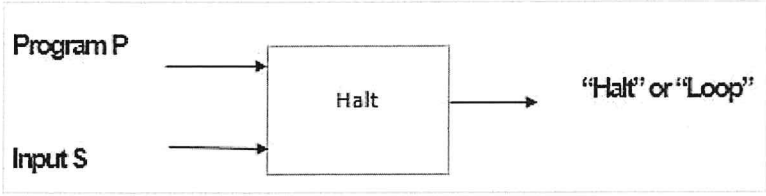
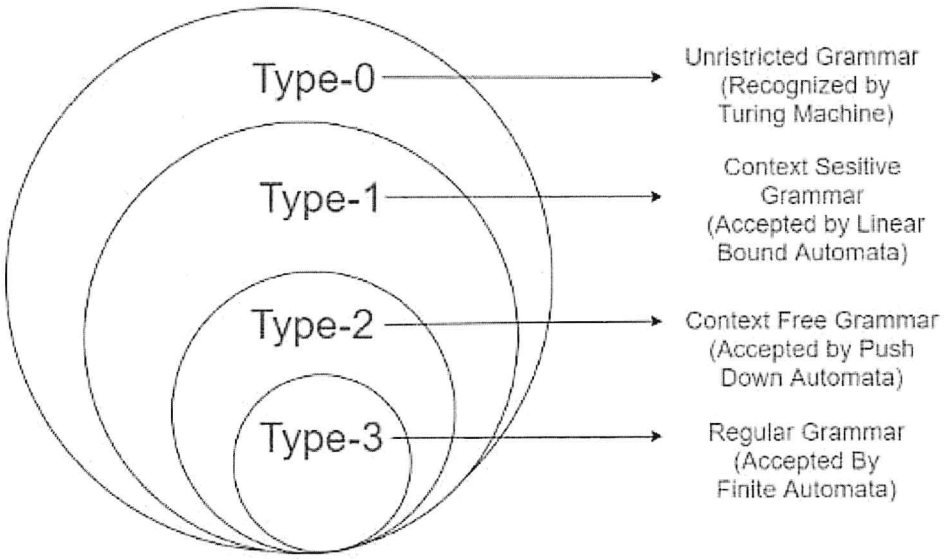
Let $U \rightarrow XB$
$V \rightarrow YB$

Step 4: $A \rightarrow UX \mid VX \mid XX \mid YX$
$B \rightarrow XB \mid YB \mid a \mid b$
$X \rightarrow a$
$Y \rightarrow b$
$U \rightarrow XB$
$V \rightarrow YB$

[8]

Q2 (b)	OR Step1: Leftmost Derivation 2.5marks Step2: Rightmost Derivation 2.5marks Step3: Parse tree 2marks **Leftmost derivation:** S => S + S S => SS + S (as S =>SS) S => a*S + S (as S =>a) S => a*b + S (as S =>b) S => ab + SS (as S => S*S) S => ab + aS (as S => a) S => ab + ab (as S => b) **Rightmost derivation:** S => S + S S => S + SS (as S =>SS) S => S + S*b (as S =>b) S => S + a*b (as S =>a) S => SS + ab (as S => S*S) S => Sb + ab (as S => b) S => ab + ab (as S => a)	[7]
Q3 (a)	Step1: Definition of PDA 2marks Step2: Logic 2marks Step3: Implementation 3marks OR Step1: Definition of PDA 2marks Step2: Logic 2marks Step3: Implementation 3marks	[7]
Q3 (b)	Step1: Definition of TM 2marks Step2: Logic 2mark Step3: Implementation 3marks Step4:Example 1Mark	[8]

		
Q4 (a)	Step1:Let L be the regular language. 1Mark Step2:Select a string Z as per given condition. 3 Marks Step3:Get required equation using pumping lemma.3Marks Step4:Prove that our assumption is wrong.3Marks $L_> = \{a^i b^j : i > j\}$ **$L_>$ is not regular.** • Fix an arbitrary pumping length n>0. • Choose a <u>proper</u> string s in $L_>$. • $s = a^{n+1}b^n \in L_>$. • Consider all possible splittings of s in x,y,z with the <u>desired properties</u>: $y = a^m$, $1 \le m \le n$. • $xz = a^{n+1-m}b^n \notin L_>$. • So $L_>$ is not regular!	[10]
Q4 (b)	The strings which end with 00 or 11. Let us find out L1 and L2. Hence R= [(00+11)(0+1)*]+[(0+1)*(00+11)] NFA diagram	[2] [3]
Q5 (a)	Diagram	[2]

	 And explanation. OR • A Turing machine is said to be universal Turing machine if it can accept: o The input data, and o An algorithm (description) for computing.	[3] (5) (10)
Q5 (b)	1. Type 0 is known as unrestricted grammar. 2. Type 1 is known as context-sensitive grammar. 3. Type 2 is known as a context-free grammar. 4. Type 3 Regular Grammar.  Explanation with grammar as examples	[2] [1] [2]