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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester, B. E. - Information Science and Engineering

Semester End Examination; July / August - 2022

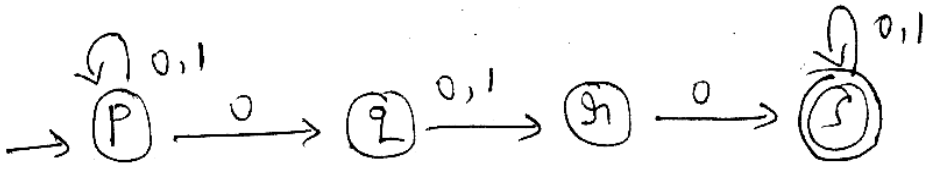
Finite Automata and Formal Languages

Time: 3 hrs *Max. Marks: 100*

Course Outcome

The Students will be able to:
CO1: Construct regular expression and finite automata
CO2: Analyze regular Language
CO3: Design context free grammars
CO4: Design push down automata
CO5: Design Turing machine

Note: *i) **PART-A** is compulsory. One question from each unit for maximum of 2 marks.*
*ii) **PART-B** Answer any **TWO** sub questions (from a, b, c) from each unit for a Maximum of 18 marks.*

Q. No.	Questions	Marks	BLs	COs	POs
	I:PART - A	**10**			
I. a.	Define Deterministic Finite Automata.	2	L1	CO1	
b.	Differentiate between Distinguishable and indistinguishable pair of states.	2	L1	CO2	
c.	Define Chomsky Normal Form.	2	L1	CO3	
d.	Define deterministic Pushdown automata.	2	L1	CO4	
e.	What are the components of Turing machine?	2	L1	CO5	
	II:PART - B	**90**			
	UNIT -I	**18**			
1 a.	Design DFA to accept the following languages: i) $L=\left\{ab^5wb^4 \middle| w\in\{a,b\}^*\right\}$ ii) Strings of *a*'s and *b*'s having even no. of *a*'s and *b*'s iii) Strings of *a*'s and *b*'s ending with substring *abb*	9	L3	CO1	
b.	Give the procedure to convert NFA to DFA. Convert the following NFA into equivalent DFA. 	9	L3	CO1	
c.	Define regular expression. Obtain regular expression for the following: i) Strings of 0's and 1's and having no consecutive zeros ii) String of *a*'s and *b*'s in which third symbol from right end is '*a*' and fourth symbol is '*b*'. iii) Strings of *a*'s and *b*'s whose length is multiple of 3	9	L3	CO1	

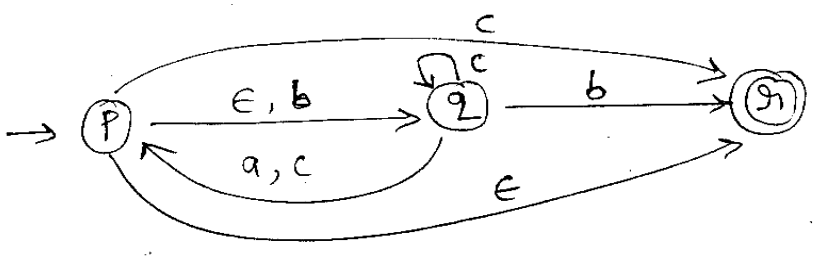
Contd…2

UNIT- II **18**

2 a. State pumping lemma for regular languages show that; 9 L3 CO2
L4

L = $\{a^{n!} : n \geq 0\}$ is not regular.

b. What is ∈-NFA? Covert the following ∈-NFA to equivalent DFA. 9 L3 CO2



c. Minimize the number of states in the following DFA: 9 L3 CO2

	0	1
→A	B	E
B	C	F
*C	D	H
D	E	H
E	F	I
*F	G	B
G	H	B
H	I	C
*I	A	E

UNIT- III **18**

3 a. Define CFG. Construct CFG for the following languages: 9 L1 L3 CO3

i) $L = \{a^n b^m : m \geq n \text{ and } n \geq 0\}$

ii) $L = \{0^i 1^j \mid i \neq j, i \geq 0 \text{ and } j \geq 0\}$

iii) L= {w: |w| mod 3≠ |w| mod2 } on ∑={a}

b. State and prove pumping lemma for context free languages. 9 L4 CO3

c. Define ambiguous grammar. Check whether the given grammar is ambiguous or not. 9 L2 CO5

$S \rightarrow iCtS / iCtSeS / a$

$C \rightarrow b$

UNIT - IV **18**

4 a. Construct NPDA to accept the following language: 9 L3 CO4

L= $\{ww^R : W \in \{a,b\}^+\}$

b. Convert a CFG to its equivalent PDA 9 L3 CO4

S→aABB/aAA

A→aBB/a

B→bBB/A

C→a

Contd…3

c.	Find a CFG corresponding to a PDA, whose transitions are given below: $\delta(q_0, a, Z) = (q_0, AZ)$ $\delta(q_0, a, A) = (q_3, \in)$ $\delta(q_0, b, A) = (q_1, \in)$ $\delta(q_1, \in, z) = (q_2, \in)$ $\delta(q_3, \in, z) = (q_0, Az)$	9	L3	CO4

UNIT - V **18**

5 a.	Discuss the working of standard Turing machine. Construct machine to accept the language of Palindromes over {0, 1}.	9	L2,3	CO5
b.	Discuss the following: i) Universal Turing machine ii) Non deterministic Turning machine	9	L2	CO5
c.	Discuss the working of multi tape turning machine.	9	L2	CO5

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