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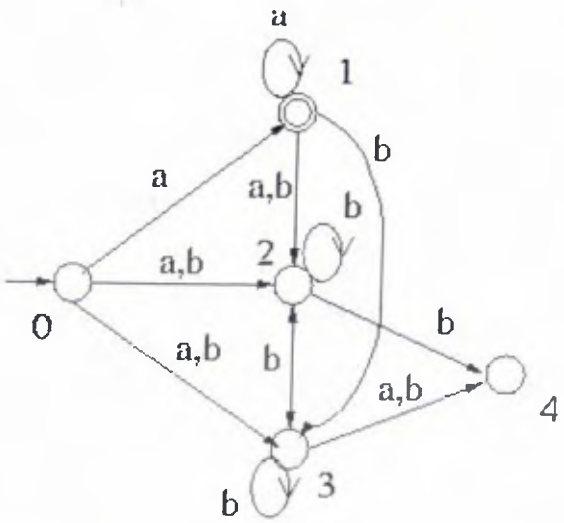
Thapar Institute of engineering & Technology, Patiala

Department of Computer Engineering

BE (Third Year): Semester-V (2018/19)	Course Code: UCS701
	Course Name: Theory of Computation
Time: 3 Hours, M. Marks: 100	Name Of Faculty: Rohit Ahuja

Note: Attempt all questions with proper Justification. Without Justification Zero marks will be awarded. Assume missing data, if any, suitably.

Q.1(a) Convert the following NFA to DFA. (10)



Q.2(a) Write down the Regular Expression for the following: (8)

1. Write down a R.E. over {0, 1} such that no. of 1's are divisible by 3.
2. Write down a R.E. for the language L={w: | w | mod 3=0}, $w \in (a,b)^*$ }
3. Write down a R.E. over alphabet $\Sigma = \{a,b,c\}$ containing at least one a and at least one b.

Q. 2(b) Design a deterministic finite automata to accept the following language: (5)

1. Design a DFA over {0,1} that accept all strings not containing substring 00.
2. Design a DFA over {0,1} that accepts all strings not containing even number of letters.

Q.3(a) Explicitly state the difference between following: (5)

1. Non-deterministic finite automata and deterministic finite

automata.

2. Push down automata and Non-deterministic push down automata.

Q.3(b) Explain the formal definition of following (5)

1. Push down automata
2. Turing machine
3. Deterministic and non-deterministic push down automata.

Q.3 (c) Explain how K Tape turing machine is equivalent to 1 Tape Turing machine. (5)
Hint: Explain this by stating the challenges while simulating K Tape turing machine using 1 Tape

Q.4(a) Design a Pushdown Automata by empty stack and by final state for the following language $L = \{0^n 1^m 0^n \mid m, n \geq 1\}$. (10)

Q.4 (b) Prove that the following context free grammar is ambiguous. (7)

S→ E*E/ E+E/ a
E→ a

Q.4 (c) Write the Context free grammar for the following language (8)

a) The set of odd-length strings in {a, b}* with middle symbol a

b) Write a CFG for the language of even palindrome and odd palindrome. $0^i 1^j 2^k$ where i, j and k are integers and i, j and k>=0

Q.5(a) I. Justify that L = {WW| W ∈ {a,b}* } is a regular language or not. If it is not a regular language then using pumping lemma prove it. (5)

II. Explain Chomsky Hierarchy with the help of diagram (7)

Q.5(b) Construct a Turing machine (using single R/W head) to perform the addition of two unary numbers. (10)

Q5(c) Design a complete push down automata machine M to accept the language L = $\{a^{3n} (ba)^{2n} \mid n>=0\}$. (10)

Q5 (d) Explain the following terms (5)

1. P and NP (2) NP-Complete