Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(An Autonomous Institute Affiliated to University of Mumbai)

~~End Semester~~ Examination
Jan ~~November~~ 2019

Make-up Exam

Max. Marks: 60 **Duration: 180 Minutes**
Class: TE **Semester: V**
Course Code:IT54/CE55 **Branch: Information Technology /Computer Engineering**
Name of the Course: Theoretical Computer Science

Instructions:
(1) All Questions are Compulsory
(2) Draw neat diagrams
(3) Assume suitable data if necessary

Question No.		Max. Marks	CO
Q1	a. Convert PDA to CFG and simplify the CFG and describe the language it accepts. **(solve any one)** (i). PDA is given by M= $(q_0, q_1\}, \{0,1\}, \{0,1, z_0\}, \delta, q_0, z_0, \epsilon)$, transition function δ is defined by: $\delta(q_0, \epsilon, z_0) \rightarrow \{(q_1, \epsilon)\}$ $\delta(q_0, 0, z_0) \rightarrow \{(q_0, 0z_0)\}$ $\delta(q_0, 0, 0) \rightarrow \{(q_0, 00)\}$ $\delta(q_0, 1, 0) \rightarrow \{(q_0, 10)\}$ $\delta(q_0, 1, 1) \rightarrow \{(q_0, 11)\}$ $\delta(q_0, 0, 1) \rightarrow \{(q_1, \epsilon)\}$ $\delta(q_1, 0, 1) \rightarrow \{(q_1, \epsilon)\}$ $\delta(q_1, 0, 0) \rightarrow \{(q_1, \epsilon)\}$ $\delta(q1, \epsilon, z_0) \rightarrow \{(q_1, \epsilon)\}$ (ii). PDA is given by M= $(q_0, q_1\}, \{0,1\}, \{z_0, x\}, \delta, q_0, z_0, \phi)$ where δ is defined by: $\delta(q_0, 1, z_0) \rightarrow \{(q_0, xz_0)\}$ $\delta(q_0, 1, x) \rightarrow \{(q_0, xx)\}$ $\delta(q_0, 0, x) \rightarrow \{(q_1, x)\}$ $\delta(q_0, \epsilon, z_0) \rightarrow \{(q_0, \epsilon)\}$ $\delta(q_1, 1, x) \rightarrow \{(q_1, \epsilon)\}$ $\delta(q_1, 0, z_0) \rightarrow \{(q_0, z_0)\}$	08	CO4
	b. Construct the PDA for the following language L= {set of strings over alphabet {a, b} with exactly twice as many a's as b's}	04	CO4
Q2	a. Design a Turing Machine accepting following language L= The language of all non-palindromes over {a, b}	08	CO4

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	b. Write a short note on any two Variants of a Turing machine.	04	
Q3	a. Construct right-linear grammars for the following regular language **(any one)** (i). Student's grades in an examination are represented with the letters {A, B, C, D, F}. A string such as ABFCAD indicated the grades obtained by a student in six different subjects. The grammar must generate only those strings that have at most three D's and no F's. (ii). Strings over {a, b} where the last two symbols in each string are a reversal of the first two symbols (i.e., last symbol = first symbol and penultimate symbol = second symbol).	08	CO2 CO3
	b. Write a short note on: Post Correspondence Problem.	04	CO4
Q4	a. State the limitations of Finite Automata?	04	CO1
	b. Construct the finite automaton DFA first and then convert it into Regular Expression for "strings over {a, b} with an odd number of a's and an odd number of b's."	08	CO1
Q5	a. Design Moore machine to detect a run in the input, that is, sequences of two or more identical symbols. For example, given the input abaabbbabaa, the output should be 00010110001. Convert the Moore machine to Mealy machine	06	CO1
	b. Using Pumping Lemma prove that following languages are not regular (i). Odd palindromes over {a, b}, that is, WCW^R, where C is a special symbol making the midpoint of the string. (ii). Binary string containing more 1s than 0s.	06	CO2

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