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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019

Course Code: CS301

Course Name: THEORY OF COMPUTATION

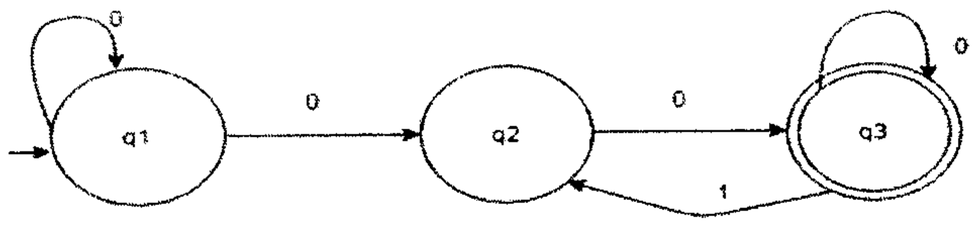
Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1 Define nondeterministic finite automata(NFA). Draw the NFA for the language $L=\{a^n b^m \mid n, m>=1\}$ 3

2 Convert the following NFA to DFA. 3



3 Write regular expression for the language $L=\{1^n 0^m \mid n>=1, m>=0\}$ 3

4 Differentiate Moore machine from Mealy machine. Write the tuple representation for both machines. 3

PART B

Answer any two full questions, each carries 9 marks.

5 a) Write the notation for the language defined by a DFA. Write a string belong to the language L^3 if $L=\{0,1\}$ 3

b) Construct NFA without ϵ – transitions from the following NFA. $M=(\{q_0, q_1, q_2\}, \{a, b, c\}, \delta, q_0, \{q_2\})$ and $\delta(q_0, a) = \{q_0\}$, $\delta(q_0, b) = \{q_1\}$, $\delta(q_0, c) = \{q_2\}$ $\delta(q_1, \epsilon) = \{q_0\}$, $\delta(q_1, a) = \{q_1\}$, $\delta(q_1, b) = \{q_2\}$, $\delta(q2, \epsilon) = \{q_1\}$, $\delta(q_2, a) = \{q_2\}$, $\delta(q2, c) = \{q_0\}$. 6

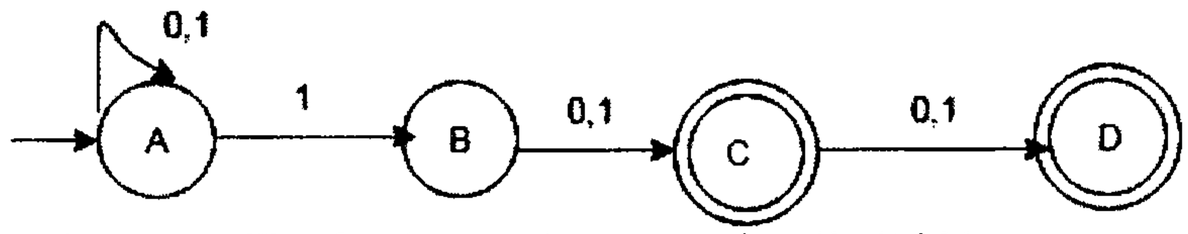
6 a) State Myhill-Nerode Theorem. 3

b) Minimize the following DFA. 6

δ	a	b
→ **P0**	P0	P1
P1	P2	P1
P2	P3	P1
***P3**	P3	P4
***P4**	P5	P4

*P5	P3	P4

7 a) Construct regular expression corresponding to the following state diagram: 4.5



b) Design an ϵ-NFA for the regular expression (0+1)*01 4.5

PART C

Answer all questions, each carries 3 marks.

8 Write the conditions for a pushdown automaton to be considered as deterministic. 3

9 Which are the methods to accept a string in a PDA? Whether both type of PDAs can define the same language. Justify your answer. 3

10 Convert the following grammar to Chomsky Normal Form. 3
S-> 0S0|1S1| ϵ

11 Whether the following grammar is ambiguous? 3
E-> E+E| E*E|I
I-> 0|1|a|b

PART D

Answer any two full questions, each carries 9 marks.

12 a) Verify that the following languages is not regular: 4.5
$\{a^n b^{2n} \mid n>0\}$

b) Which of the following operations are closed under regular sets. Justify your answer. 4.5
i) Complementation ii) Set difference iii) string reversal iv) Intersection

13 a) Give a CFG for the language N(M) where M = ({p,q,r}, {0, 1}, {Z, X_0}, δ, q_0, Z, r) and δ is given by $\delta(p, \epsilon, X_0) = \{(q, ZX_0)\}$, $\delta(q, \epsilon, X_0) = \{(r, \epsilon)\}$, $\delta(q, 1, Z) = \{(q, ZZ)\}$, $\delta(q, 0, Z) = \{(q, \epsilon)\}$. 4.5

b) Find the Greibach normal form grammar equivalent to the following CFG: 4.5
$S \rightarrow AB$
$A \rightarrow BS| 1$
$B \rightarrow SA|0$

14 a) Design a PDA to accept the language $\{0^{2n}1^n \mid n \geq 1\}$. 4.5

b) Find a CFG without ϵ-productions equivalent to the grammar defined by 4.5
$S \rightarrow ABaC$, $A \rightarrow BC$, $B \rightarrow b/\epsilon$, $C \rightarrow D/\epsilon$, $D \rightarrow d$

PART E

Answer any four full questions, each carries 10 marks.

15 a) State Pumping lemma for CFLs. Write the applications of pumping lemma for CFL s. 4

b) Check whether $L=\{a^i b^i c^i \mid i > 0\}$ belong to CFL or not. 6

16 a) Discuss about Multitape Turing Machines. Explain informally how they can 5

		simulate the moves of a Turing Machine	
	b)	Write a note on Universal Turing machines.	5
17	a)	How to identify deterministic Turing machine from nondeterministic TM	3
	b)	Write notes on the following: i) decidable and undecidable problems ii) Halting Problem of Turing machine.	7
18	a)	Write the properties of recursive languages and recursively enumerable languages.	3
	b)	Write the Chomsky hierarchy of languages. Prepare a table indicating the automata and grammars for the languages in the Chomsky Hierarchy.	7
19	a)	Define Turing machine [Write the tuple representation for TM].	5
	b)	Design a Turing machine to identify the strings belong to the language $L=\{0^n1^n \mid n>0\}$.	5
20		Design the Turing machine to recognize the language: $\{0^n1^n0^n \mid n >=1\}$.	10