Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

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

Course Code: IT303

Course Name: THEORY OF COMPUTATION

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) Define the terms: (4)
- Alphabet
- String
- Language
- Grammar

b) Design a DFA which accepts set of all binary strings containing **mod 4(** reminder when dividing with 4) as **one** . (6)

c) Convert the following NFA into DFA (5)

	0	1
$\rightarrow p$	$\{q, s\}$	$\{q\}$
$*q$	$\{r\}$	$\{q, r\}$
r	$\{s\}$	$\{p\}$
$*s$	$\emptyset$	$\{p\}$

2 a) Explain Chomsky Hierarchy of Grammars (8)

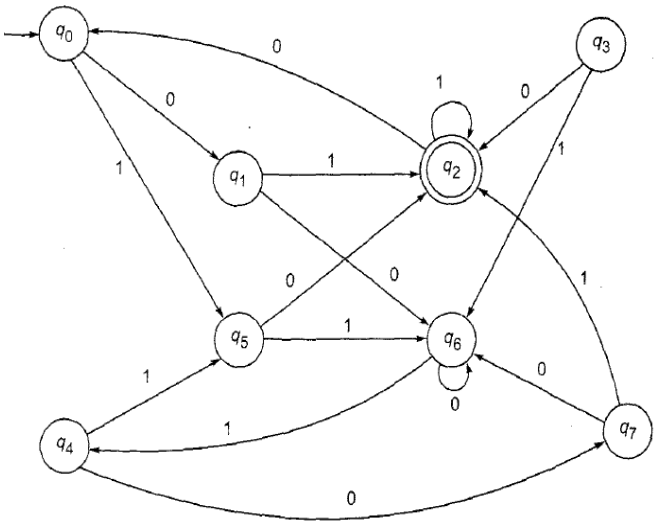
b) Design a Moore machine which calculates the sum of two positive binary numbers (4)

c) What are the applications of finite automata? (3)

3 a) Explain string reversal with an example. Which automaton is suitable to reverse a string ? (5)

b) Distinguish between Moore and Mealy machines (4)

c) Explain the minimization of NFA. Minimize the following NFA (6)



PART B

Answer any two full questions, each carries 15 marks.

4 a) Give a regular expression for each of the following languages. (6)
- The set of binary strings not containing consecutive 0's.
- The set of binary strings containing exactly one instance of 111 somewhere inside.
- The set of binary strings with at most one pair of consecutive 1's | i.e, if 11 is present, it can occur exactly once.

b) Using pumping lemma prove that the set $\{1^n: n \text{ is a prime number}\}$ is not regular. (4)

c) Construct a PDA from the following CFG, G = ({S, X}, {a, b}, P, S) (5)
where the productions are: S → XAS | Ɛ , A → aXb | Ab | ab , X → bab

5 a) Write the regular expression for the set o{w / w contains at least two 1s and at most two 0s}.Also draw the DFA for it. (4)

b) Convert to Greibach Normal Form the grammar G=({A1, A2, A3},{a,b},P,A1) (7)
where P consists of the following. $A_1 \rightarrow A_2A_3$, $A_2 \rightarrow A_3A_1$/bb, $A_3 \rightarrow A_1A_2$/aa.

c) What are Left and right linear grammars. Give examples (4)

6 a) Write the properties and rules for regular expressions (6)

b) Construct NPDA that accept the following language on $\Sigma = \{a, b, c\}$ (6)
$L = \{a^n b^m c^{n+m} : n \geq 0, m \geq 0\}$.

c) What are the applications of PDA and CFLs (3)

PART C

Answer any two full questions, each carries20 marks.

7 a) Construct a Turing machine for concatenation of the two strings of unary numbers. (8)

b) Show how the reduction of SAT to 3SAT can be done in polynomial-time (6)

c) Design a Turing machine that add numbers store as 0's separated by 1's (6)

8 a) How can you tell a problem being decidable or undecidable ? (6)

b) What is Universal Turing machine? (6)

c) Show that TSP is **NP**-complete. (8)

9 a) Prove that the class NP of problems solvable in non-deterministic polynomial time (4)

b) Show that there is no algorithm to decide whether or not an arbitrary Turing machine halts on all input. (4)

c) Consider the language $L = \{ww : w \in \{a,b\}+\}$. (12)
Construct a standard Turing machine acepting L,Discuss the construction and efficiency of algorithms for accepting *L* by a two-tape turing Machine

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