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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

**Course Code: CS301**

**Course Name: THEORY OF COMPUTATION (CS)**

Max. Marks: 100 Duration: 3 Hours

## PART A

***Answer all questions, each carries 3 marks.*** Marks

1 Define Non Deterministic Finite Automata? Compare its ability with Deterministic Finite Automata in accepting languages. (3)

2 Write the notations for the language accepted by DFA, NFA, ϵ-NFA (3)

3 Can we use finite state automata to evaluate 1's complement of a binary number? Design a machine to perform the same. (3)

4 Define Two-way finite automata (3)

## PART B

***Answer any two full questions, each carries 9 marks.***

5 a) Design a Finite state automata which accepts all strings over {0,1} with odd number of 1's and even number of 0's. (5)

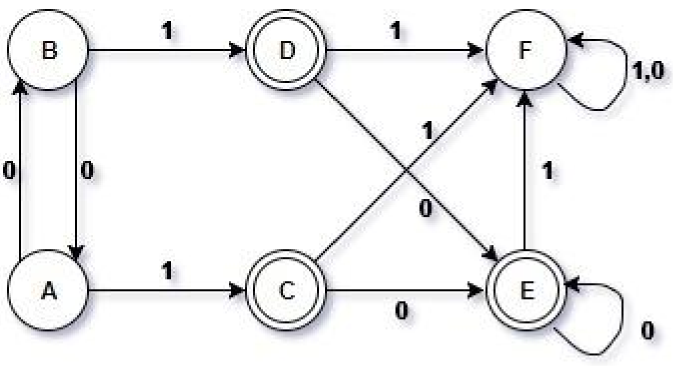
b) Show the changes needed to convert the above designed automata to accept even number of 1's and odd number of 0's (4)

6 a) Construct Regular grammar for the regular expression : (5)

$L = (a + b)^*(aa + bb)(a + b)^*$

b) List the closure properties of Regular sets. (4)

7 State Myhill-Nerode theorem. Minimize the following DFA by table filling method using Myhill-Nerode theorem describing the steps in detail. (9)




## PART C

***Answer all questions, each carries 3 marks.***

8 Which Normal Form representation of CFG will you prefer in converting CFG to NPDA? Why? (3)

9 What do you mean by useless symbol in a grammar? Show the elimination of useless symbols with an example. (3)

10 Explain the different methods by which a PDA accepts a language. (3)

11 Can we construct a Deterministic PDA for the language $ww^R$?Justify your answer. Otherwise how can we modify this language to make it accepted by DPDA. (3)

## PART D

***Answer any two full questions, each carries 9 marks.***

12 Define CFG for the following languages over the alphabets {a,b} (9)

i. $L = \{ a^{m+n}b^m c^n n,m>0 \}$

ii. L contains all odd length strings only

iii. $L = \{ 0^n 1^n 2^n \ n>0 \}$

13 Design a Push Down Automata for the language $L= \{a^n b^{2n} \mid n>0\}$ (9)
Trace your PDA with n=3.

14 Prove that the following languages are not regular (9)

i. $L = \{0^{i^2} such\ that\ i \geq 1\}$ is not regular

ii. $L = \{a^p\ such\ that\ p\ is\ a\ prime\ n\ \ umber$

## PART E

***Answer any four full questions, each carries 10 marks.***

15 State and prove pumping lemma for Context Free Languages. (10)

16 Construct a Turing machine that recognizes the language $L = \{ a^n b^n c^n \mid \ n>0 \}$ (10)

17 a) What is a Context sensitive grammar(CSG). Design a CSG to accept the language $L = \{ 0^n 1^n 2^n \mid \ n>0 \}$ (6)

b) Define Linear Bound Automata (4)

18 a) Write a note on Recursive Enumerable Languages (5)

b) Discuss about Universal Turing Machines (5)

19 a) Explain Chomsky's Hierarchy of Languages (6)

b) Let$L = \{x/\ x \in (a+b+c)^*$ and $|x|_a = |x|_b = |x|_c \}$. What class of language does Lbelong? Why? What modification will you suggest in the grammar to accept this language? (4)

20 Discuss the Undecidable Problems About Turing Machines (10)

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