Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

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 Construct regular expression for the language that consists of all strings ending with 00. Assume Σ= {0, 1}. (3)

2 Design non deterministic automata (without ε moves) for the regular language that consist of all strings with at least two consecutive 0's. Assume Σ = {0, 1}. (3)

3 Define regular grammar with suitable example. (3)

4 List some of the applications of automata theory. (3)

PART B

Answer any two full questions, each carries 9 marks

5 Prove the equivalence of non deterministic finite automata and deterministic finite automata. (9)

6 Prove the equivalence of non deterministic finite automata with ε moves and regular expressions. (9)

7 a) Construct non deterministic finite automata (with ε moves) for regular expression $(0+1)^*1$. (4)

b) Compare and contrast Moore and Mealy machines. (Justify with diagrams). (5)

PART C

Answer all questions, each carries 3 marks

8 Construct context free grammar for L= {wcw^R | w in (a+b)*}, Reverse of w is denoted as w^R. (3)

9 List conditions for symbols to become *useful* symbols in context free grammar. (3)

10 List conditions required for push down automata to qualify as deterministic push down automata. (3)

11 List closure properties of context free language. (3)

PART D

Answer any two full questions, each carries 9 marks

12 Do the following: (9)

i) Construct push down automata with empty stack as final condition for Context free language, L= { wcw^R| w in (a+b)*} .Reverse of w is denoted as w^R.

ii) Describe all instantaneous descriptions from initial ID (start state, **abcba,** initial stack symbol) **|--*** to final ID (state, ε, ε) with respect to constructed push down automata.

13 Do the following: (9)

i) Derive any two representative strings with minimum length 4 from following context free grammar. G= ({S,A,B},{a,b},P,S)

S→ bA | aB

A→ bAA | aS | a

B→ aBB | bS | b

ii) Draw derivation tree corresponding to string **aabbab** with respect to aforementioned grammar.

14 Prove the equivalence of push down automata and context free grammar. (9)

PART E

Answer any four full questions, each carries 10 marks

15 a) State pumping Lemma for context free language (5)

b) Define formally Turing machine Model. (5)

16 a) Design Turing machine to accept language L=$\{0^n1^n \mid n >=1\}$ (6)

b) Describe all instantaneous descriptions (ID) from initial ID $q_0$01 to Final ID with respect to constructed TM. Assume q_0 as start state. (4)

17 a) Design Turing machine to compute addition of two numbers. Assume unary notation for number representation. (6)

b) Describe all instantaneous descriptions (ID) from initial ID: $q_0$010 to Final ID: 00 with respect to constructed Turing Machine.(assume q_0 as initial state.) (4)

18 a) Explain the significance of universal Turing machine. (5)

b) Compare and contrast recursive and recursively enumerable languages. (5)

19 a) Prove that union of two recursive languages is recursive. (5)

b) Explain the significance of halting problem. (5)

20 a) Explain general notations for productions of each formal language from Chomsky hierarchy. (5)

b) Prove that complement of a recursive language is recursive. (5)

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