Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fifth Semester B.Tech Degree (S,FE) Examination January 2022 (2015 Scheme)

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   Write a regular grammar for generating the language $L = \{a^m b^n \mid m, n > 0\}$ (3)

2   Design a DFA for $L = \{x \text{ in } \{a,b\}^* \mid x \text{ contains even number of } \textbf{a}\text{'s}\}$ (3)

3   Explain Mealy machine.   (3)

4   Illustrate the working of 2-way Finite State State Automata   (3)

PART B

Answer any two full questions, each carries 9 marks.

5   a)   Prove that the language accepted by NFA and DFA are same   (6)

     b)   Define e-closure of a state in an e-NFA. Give an example.   (3)

6   a)   Convert the following NFA to DFA using subset construction where q0 is the   (6)
           initial state and q1 is the final state.

	a	b
q0	{q0,q1}	{q0}
*q1	{}	{}

     b)   Design an e-NFA for the language $L = \{x \text{ in } \{0,1\}^* \mid x \text{ contains any number of}$ (3)
           $\textbf{0}\text{s followed by any number of } \textbf{1}\text{s }\}$

7   a)   With the help of an example explain Thompsons Construction (Regular   (5)
           Expression to NFA)

     b)   Write regular expressions for the following languages   (4)
           i) $L = \{x \text{ in } \{a,b\}^* \mid x \text{ starts with } \textbf{a} \}$
           ii) $L = \{x \text{ in } \{a,b\}^* \mid x \text{ contains } \textbf{a} \text{ as third character}\}$

PART C
Answer all questions, each carries 3 marks.

8 Design a CFG to generate $L = \{a^m b^n c^n d^m \mid m, n > 0\}$ (3)

9 List two CFLs which cannot be accepted by a DPDA (3)

10 Write the formal definition of PDA (3)

11 $L1 = \{x \text{ in } \{a,b\}^* \mid x \text{ contains odd number of b's}\}$ and $L2 = \{x \text{ in } \{a,b\}^* \mid x \text{ contains even number of b's}\}$. What is the union of L1 and L2? (3)

PART D
Answer any two full questions, each carries 9 marks.

12 State and prove Pumping Lemma for Regular Languages (9)

13 Design a PDA which accepts the language $L = \{ WcW^R \mid \text{where W is in } \{a,b\}^* \}$ (9)

14 a) Explain different steps involved in the simplification of a CFG (5)

   b) Explain two modes of language acceptability of a PDA (4)

PART E
Answer any four full questions, each carries 10 marks.

15 a) Prove that $L = \{a^n b^n c^n \mid n > 0\}$ is not Context Free using Pumping Lemma (6)

   b) Design a CSG for $L = \{a^n b^n c^n \mid n > 0\}$ (4)

16 a) Design a TM which accepts palindromes over the alphabet $\{a,b\}$ (6)

   b) Write and explain the instantaneous description of a Turing Machine (4)

17 a) Design a TM to increment a binary number (6)

   b) Explain Universal TM (4)

18 Prove that halting problem of TM is undecidable (10)

19 a) Explain Chomsky's classification of grammars (6)

   b) Write note on the language acceptability of LBA (4)

20 a) What is recursively enumerable set? (5)

   b) Complement of a recursive language is recursive. Explain why? (5)

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