Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S5 (S, FE) / S3 (PT) (S,FE) Examination June 2024 (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 the language L = {x in {a,b}* | x contains a as third character} (3)

3 Explain Mealy machine. (3)

4 Explain 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 (5)

b) Define e-closure of a state in an e-NFA. Give an example. (4)

6 a) State Myhill-Nerode theorem. Prove that $L = \{a^n b^n \mid m, n > 0\}$ is not regular using Myhill-Nerode theorem. (9)

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

b) Write regular expressions for the following languages (4)

i) L = {x in {a,b}* | x starts with a }

ii) L = {x in {a,b}* | x contains a as third character}

PART C

Answer all questions, each carries 3 marks.

8 Explain the two modes of language acceptance of a PDA (3)

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

10 Describe Chomsky's Normal Form. (3)

11 L1 = {x in {a,b}* | x contains odd number of b's} and L1 = {x in {a,b}* | x 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 a) State Pumping Lemma for regular languages. (3)

b) Prove that L = $\{a^n \mid n \text{ is prime}\}$ is not regular using Pumping Lemma. (6)

13 a) Write the formal definition of a PDA. (3)

b) Design a PDA which accepts the language L =$\{ WcW^R \mid$ where W is in $\{a,b\}^*\}$ (6)

14 a) Explain different steps involved in the simplification of a CFG. (6)

b) Show that S->E+E | E*E | a is ambiguous. (3)

PART E

Answer any four full questions, each carries 10 marks.

15 a) Prove that the language L = $\{ww \mid w \text{ in } \{a,b\}^*\}$ is not CFL using Pumping Lemma for CFL (6)

b) Write 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} (7)

b) Write and explain the instantaneous description of a Turing Machine (3)

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

b) Explain Universal TM (4)

18 a) Explain Chomsky's classification of grammars (7)

b) Describe the language acceptability of LBA (3)

19 a) Explain recursively enumerable set? (4)

b) Show that the complement of a recursive language is recursive. (6)

20 a) State and prove that halting problem of TM is undecidable (10)

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