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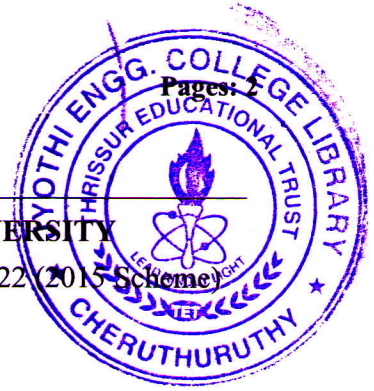
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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

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 $L = \{x \text{ in } \{a,b\}^* \mid x \text{ contains even number of } a's\}$ (3)
- 3 Explain Mealy machine. (3)
- 4 Illustrate the working of 2-way Finite 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 q_0 is the initial state and q_1 is the final state. (6)

	a	b
q_0	$\{q_0, q_1\}$	$\{q_0\}$
$*q_1$	$\{\}$	$\{\}$

- b) Design an e-NFA for the language $L = \{x \text{ in } \{0,1\}^* \mid x \text{ contains any number of } 0's \text{ followed by any number of } 1's\}$ (3)
- 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) $L = \{x \text{ in } \{a,b\}^* \mid x \text{ starts with } a\}$
 - ii) $L = \{x \text{ in } \{a,b\}^* \mid x \text{ contains } a \text{ as third character}\}$

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 $L1 = \{x \text{ in } \{a,b\}^* \mid x \text{ contains odd number of } b\text{'s}\}$ and $L2 = \{x \text{ in } \{a,b\}^* \mid x \text{ contains even number of } b\text{'s}\}$. 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 $L = \{WcW^R \mid \text{where } W \text{ is in } \{a,b\}^*\}$ (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)
