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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester, B.E. - Computer Science and Engineering

Make-up Examination; March/April - 2022

Theory of Computation

Time: 3 hrs *Max. Marks: 100*

*Note: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Define DFA and language accepted by DFA. Design a DFA over $\sum = \{0,1\}$ such that every string must ends with 101. — 10

b. Define NFA and language accepted by NFA. Design NFA over $\sum = \{a,b\}$ such that every string must ends with "*bab*" and hence convert the same into its equivalent DFA. — 10

2 a. Design ε-NFA over $\sum = \{a,b,c\}$ such that every string must have zero or more number of a's followed by zero or more number of b's fallowed by zero or more number of c's and hence convert the same into its equivalent DFA. — 10

b. Obtain equivalent class of states for the following DFA and hence obtain minimum state DFA — 10

States	Σ	
	0	1
→ A	B	C
B	D	E
C	F	G
D	D	E
E	F	G
F	D	E
G	F	G

UNIT - II

3 a. Define regular expression and hence write regular expression for the following regular languages:

i) Ends with either 011 or 010 or 110

ii) $L = \{a^i b^j \mid i \ is \ odd \ and \ j \ is \ even\}$

iii) $|w| \bmod 3 = 0 \ over \ \sum = \{a,b\}$ — 10

b. Prove that for every regular expression R representing regular language L(R), there exists an equivalent finite automata , M such that L(R)=L(M) — 10

4 a. State and prove pumping lemma for regular language. — 10

b. Prove that the following operations on regular language are closed.

i) complement

ii) Reversal — 10

UNIT - III

5 a. Define CFG and hence write CFG for the following CFL's:

  i) $L = \{a^i b^i c^k \mid j = i + k\}$

  ii) Palindrome over $\sum = \{a, b, c\}$

  b. Define derivation LMD RMD and derivation tree with example for the following:

  CFG : $E \rightarrow E + T \quad T \rightarrow T * F \quad F \rightarrow id$ 10

6 a. Define Ambiguous grammars prove that the following CFG is ambiguous:

  $E \rightarrow E + E \mid E * E \mid id$ 10

  b. Prove that CFL's are closed under union, concatenation and star closure.   10

UNIT - IV

7 a. Define PDA instantaneous description and language accepted by PDA.   10

  b. Design a PDA to recognize the language,

  $L = \{ww^R \mid w\varepsilon\{a, b\}* \text{ and } w^R \text{ is the reverse of w}\}$ 10

8 a. Design a PDA to recognise the language $L = \{w\varepsilon\{0,1\}* \mid no(w) = n_1(w)\}$

  State whether the resultant PDA is deterministic or not. Justify your answer.   10

  b. Design a PDA to recognise the language $L = \{a^i b^j c^k \mid j = i + k\}$ 10

UNIT - V

9 a. Define TM. Design TM to recognse the language $L = \{a^n b^n c^n \mid n \geq 0\}$ 20

10. Write a note on;

  a) Extension to the basic TM   7

  b) Recursively Enumerable language   6

  c) Posts correspondence problem   7

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