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Paper Code : PEC-DS 501A/PEC-IT501A Theory of Computation

UPID : 005509

Time Allotted : 3 Hours

Full Marks :70

The Figures in the margin indicate full marks.
Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

[1 x 10 = 10]

1. Answer *any ten* of the following :

   (I) Context sensitive language is a subset of context free language. The statement is false or true?

   (II) The Language accepted by Push Down Automata is called_____.

   (III) Assume the R is a relation on a set A, aRb is partially ordered such that a and b are _____.

   (IV) Which of the following is not a part of 5-tuple finite automata?

   (V) Boolean Satisfiability problem are unsolvable?

   (VI) What is Linear Bounded Automata?

   (VII) With reference of a DPDA, which among the following do we perform from the start state with an empty stack?

   (VIII) Binary search can be performed less quickly using RASP than a turing machine is true about RASP?

   (IX) Write the rule of Chomsky Normal Form.

   (X) A _____ is a multi tape turing machine whose input tape is read only.

   (XI) Recursive languages may not be recursively enumerable. The statement is true/false?

   (XII) Instantaneous description of a counter machine can be described using_____

Group-B (Short Answer Type Question)

Answer *any three* of the following :

[5 x 3 = 15]

2. Design DFA to accept strings over $\Sigma = (0,1)$ with two consecutive 0's. [5]

3. State and proof Arden's theorem. [5]

4. Design a Turing machine to implement $a^n b^n c^n$ for $n \geq 1$. [5]

5. Design a PDA for accepting a language $\{a^n b^{2n} \mid n >= 1\}$. [5]

6. Construct deterministic finite automata to recognize odd number of 1's and even number of 0's? [5]

Group-C (Long Answer Type Question)

Answer *any three* of the following :

[15 x 3 = 45]

7. (a) Explain Church's Turing Thesis. [2]

   (b) Design a Turing machine which can add two numbers. [6]

   (c) Describe the operation of Multi-Tape Turing Machine and Off-Line Turing machine. [7]

8. (a) Write the properties of regular expression. [3]

   (b) [ ]
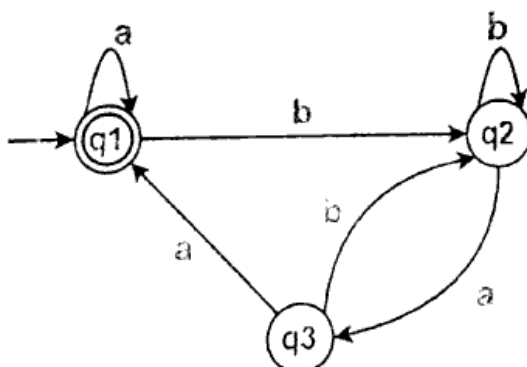
   Find the regular expression of the finite automata using Arden's Theorem.

   (c) State pumping lemma for regular language. [2]

   (d) Justify whether $a^n b^n$ n $\geq$ 0 regular or not. [4]

9. (a) When two states are equivalent and distinguishable? [4]

(b) What are the applications of regular expression? [3]

(c) What do you mean by dead state? [2]

(d) Differentiate between Positive closure and Kleen closure. [3]

(e) Differentiate between NFA and DFA. [3]

10. (a) Define PDA. [2]

(b) Is the language of Deterministic PDA and Non – deterministic PDA same? [3]

(c) Design a non deterministic PDA for accepting the language L = {ww^R w   (a, b)+} [7]

(d) Write the rule of GNF and CNF. [3]

11. (a) Is the following grammar is ambiguous? Justify your answer. [5]

E→ E+E |E*E | id 2. E→ E+E|E*E|(E)|a

(b) Remove the ambiguity from the above grammar. [4]

(c) Prove that if there exists a PDA that accepts by final state then there exists an equivalent PDA that accepts by Null state. [6]

*** END OF PAPER ***