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Paper Code : MCAN-E205F Automata Theory & Computational Complexity

UPID : 002527

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. Answer any ten of the following : [1 x 10 = 10]

(I) Find the string which is obtained by the language L = { $a^i b^{2i}$ | i ≥ 1 }.

(II) What will be the interaction of the sets {3, 5, 9, 10, 4, 7} and {1, 2, 10, 9, 3, 6, 8, 4}

(III) Write the mapping of Transition function of NFA.

(IV) Why does a palindrome cannot be recognized by a Finite State Machine?

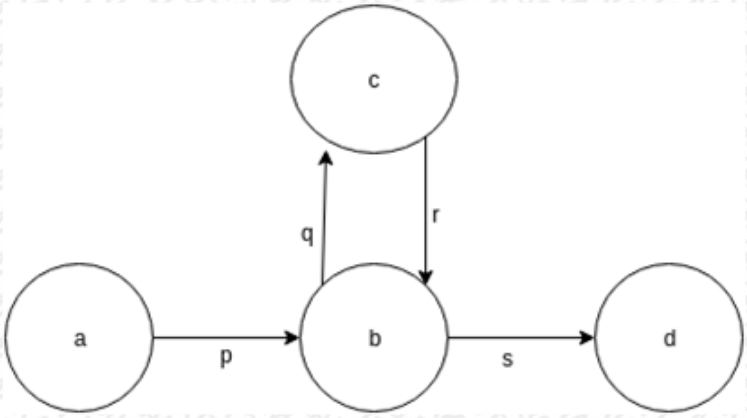
(V) What is Є-closure of a state q0?

(VI) Let P: I am in Bangalore.; Q: I love cricket.; Write the compound statement.

(VII) What is a Non-regular language?

(VIII) Write the closure property of Context Free Language.

(IX) If d is a final state, break the strings in terms of Pumping Lemma.



(X) What is the condition that a Turing machine will halt?

(XI) Find the property for R, where R be a relation on the set N of natural numbers defined by nRm if n divides m.

(XII) Write the output functions for Mealy and Moore machine.

Group-B (Short Answer Type Question)

Answer any three of the following : [5 x 3 = 15]

2. Write down the properties of Relations. [5]
3. What is DFA and NFA? Explain with example. [5]
4. Design an NFA in which all the string contain a substring 1110. [5]
5. Let G=({S, A}, {0, 1, 2}, P, S}, where P consists of S → 0 S A 2, S → 0 1 2, 2 A → A 2, 1 A → 1 1. Show that, L(G) = {$0^n 1^n 2^n$ I n ≥ 1} [5]
6. What is the 0/1 Knapsack Problem? Solve the problem using 0/1 knapsak problem where: Input: N = 3, W = 4, profit[] = {1, 2, 3}, weight[] = {4, 5, 1}. [5]

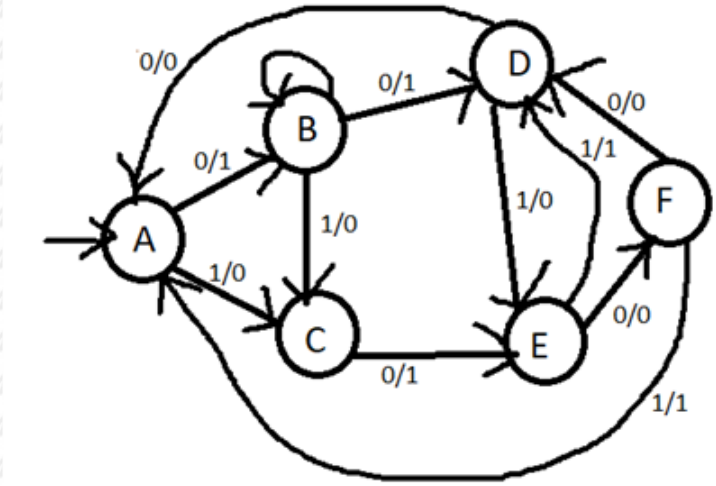
Group-C (Long Answer Type Question)

Answer any three of the following : [15 x 3 = 45]

7. (a) Design an NFA with ∑ = {0, 1} in which double '1' is followed by double '0 [5]
   (b) Design an NFA with ∑ = {0, 1} accepts all string in which the third symbol from the right end is always 0. [5]
   (c) DFA of all those Strings that do not contain the substring 110 [5]
8. (a) What are the closure properties of Regular sets? Explain. [5]
   (b) Find a grammar generating {$a^j b^n c^n$ I n ≥ 1, j ≥ 0}. [5]

(c) Let G=({s, C}, {a, b}, P, S), where P consists of S → aCa, C → aCa I b. Find L(G) [5]

9. (a) Find what type of machine the following diagram depicts. Convert the machine into its equivalent machine which outputs only depends on states. [5]



(b) Design an NFA that accepts set of all strings over 1101. [3]

(c) Design a Mealy machine that gives output as 2's complement of any input binary string (Assume that last carry bit is neglected). Discuss the design also. [7]

10. (a) Find the derivation and corresponding parse tree for the string (0 ∪ (10) 1) . Use Type 2 grammar to solve the problem. [5]

(b) Consider the language L = {amb2nc 3ndp : p > m, and m, n ≥ 1}. [10]
(i) What is the shortest string in L?
(ii) Write a context-free grammar to generate L.

11. (a) Design a NPDA for the language L ={w∈ {a,b}*| w contains equal no. of a's and b's} [7]

(b) Define what is a Turing Machine. Construct a Turing machine for L={0^n1^n|n>=1} [8]

*** END OF PAPER ***