Sr. No.....

YMCA UNIVERSITY OF SCIENCE& TECHNOLOGY, FARIDABAD

M.Tech. Ist SEMESTER

Mathematical Foundation of Computer Science (MTCE-16-103)

Time: 3 Hours **Max. Marks: 60**

Note: *1. It is compulsory to answer the questions of Part –1. Limit your answers within 20-40 words in this part.*
2. Answer any four questions from Part –2 in detail.
3. Different parts of the same question are to be attempted adjacent to each other.

PART –1

Q1 (a) What is meant by Regular Expression? Describe the language sets over {a,b} represented by the following regular expressions: (2)
(i) $b^*ab^*ab^* + b^*ab^*$ (ii) $(aa)^* + (aaa)^*$

(b) Find regular expressions over the alphabet {0,1} for the languages defined as: (2)
$L1 = \{ 0^m1^m; m>0\}$
$L2 = \{ 0^{2m}1^{2n+1}; m\geq 0, n\geq 0\}$

(c) What is meant by Ambiguity in CFG's, Explain by example. (2)

(d) Let G be a Grammar S→ aB | ba, A→ a | aS | bAA, B→ b |bS |aBB. For the string *aaabbabbba*, find (2)
(i) leftmost derivation (ii) rightmost derivation

(e) Comment on the statement: A Turing machine is more powerful than the PDA. (2)

(f) Identify the type of grammar by explaining, whose Production set is given below: (2)
A →BCD, BA →BaC, abB→ bC, B →Bb

(g) Define the instantaneous state of the PDA. (2)

(h) What is halting Problem of Turing machine? (2)

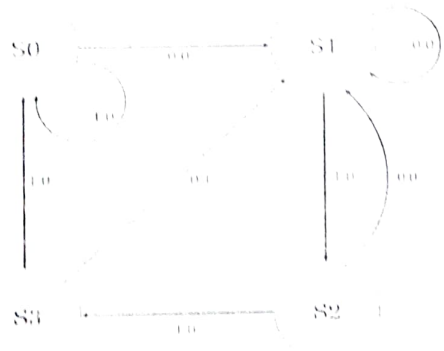
(i) How is a Multi-Tape Turing machine different than a basic Turing machine? (2)

(j) What is meant by equivalence of DFA's? What is the procedure to check the equivalence? (2)

PART –2

Q2 (a) What is basic difference between Deterministic and Non-deterministic Finite Automata? Construct DFA for regular expression: (11+10)*10. (5)

(b) What is the difference between Moore and Mealy machine. Convert the following Mealy machine to Moore machine with S_0 as initial state:

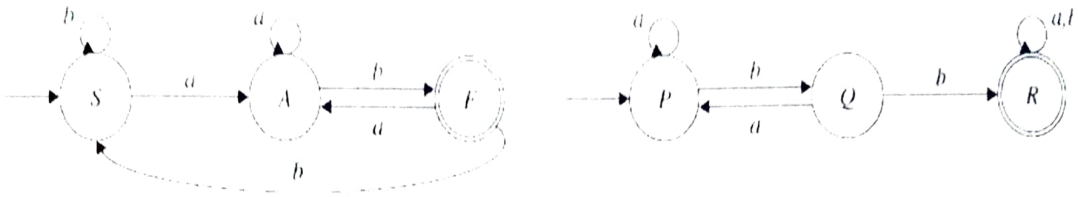


(5)

Q3 (a) State Pumping Lemma for regular sets. What are its applications? Use Pumping lemma to prove that the Language $L = \{a^{(n)}b^{(n)} \mid n>0\}$ is not regular. (5)

(b) Let M1 and M2 be two finite automata accepting languages L1 and L2 respectively as shown in the figure below. Construct the finite automata to accept the following languages:

(i) L1 ∩ L2
(ii) L1-L2



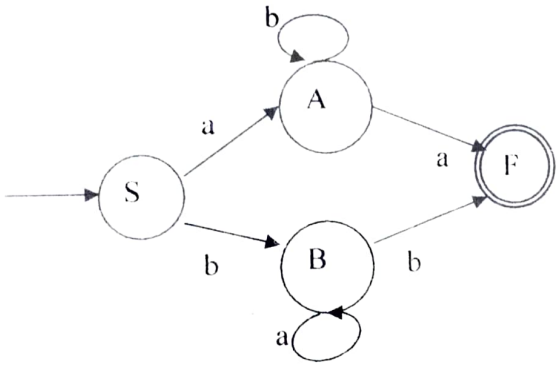
(5)

Q4 (a) Construct a PDA accepting L = {wcw^T | w ∈ (a,b)*} by final state. (5)

(b) Prove that the regular sets are closed under Closure, complementation and intersection. (5)

Q5 (a) Convert the following grammar to Chomsky's Normal Form (CNF): (5)
S→ 1A|0B, A→1AA|0S|0, B→0BB|1S|1

(b) What is Arden Theorem? Use it to find the regular expression corresponding to the finite automata shown below. (5)



Q6 (a) Define Turing machine. Design a Turing machine to accept the language given below: (5)
L= { $x^n y^n$ | n≥1 }.

(b) Describe in detail the concept of Universal Turing machine. (5)

Q7 (a) Discuss the Post-Correspondence problem. Find the solution to the instance of PCP given below:

S.N.	List A	List B
1	10	101
2	011	11
3	101	011

(2)

(b) Write a short note on Primitive Recursive Functions. (3)

(c) Convert the following CFG to GNF (5)
S→ XY, X→YSY, X→YY|1, Y→0X1|1

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