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YMCA UNIVERSITY OF SCIENCE& TECHNOLOGY, FARIDABAD

MTECH 1st Semester (RE-APPEAR) Dec, 2017

Mathematical Foundations of Computer Science (MTCE-603)

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

Instructions:

1. *It is compulsory to answer all the questions (2 marks each) of Part -A in short.*
2. *Answer any four questions from Part -B in detail.*

PART A

Q1 (a) Differentiate between DFA, NFA and ε-NFA on the grounds of transition function, ease of Construction, power and limitations (2)

(b) For the following languages write the corresponding regular expressions: (2)
L= {1,12,122, 1222,......}
L=Set of all strings over {a, b} having exactly one a.

(c) Discuss Chomsky's Classification of grammars (2)

(d) Differentiate between top down and bottom up parsing (2)

(e) What are the demerits of Finite Automata when compared with PDA? (2)

(f) From the following CFG G, remove unit production (2)

$S \rightarrow ABCD \quad A \rightarrow a \quad B \rightarrow c|b \quad C \rightarrow D \quad D \rightarrow c$

(g) Can we simulate multi-tape turing machine using single tape turing machine? Explain (2)

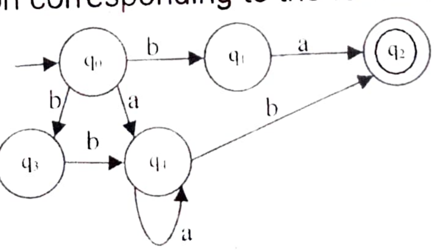
(h) What is left most derivation? Explain with a suitable example (2)

(i) What is a Universal Turing Machine? (2)

(j) Differentiate between Moore and Mealy Machine (2)

PART B

Q2 (a) Find a regular expression corresponding to the following (5)



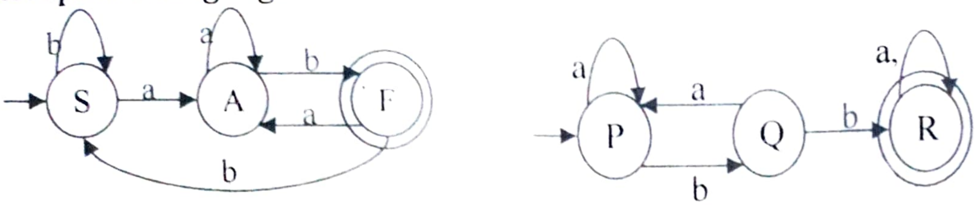
(b) Construct a DFA which accepts a string of 0's and 1's where the value of each string is represented as a binary number. Only the strings representing zero modulo 5 should be accepted. For example 0000,0101,1010,1111 etc should be accepted (5)

Q3 (a) Construct a PDA accepting the language $L=\{a^{2n}b^n | n \geq 1\}$ by null store (5)

(b) Design a Turing Machine to compute m-n where m and n are positive integers and m≥n. (5)

Q4 (a) Let M_1 and M_2 be two finite automata accepting the languages L_1 and L_2

respectively as shown in the following fig. Construct the finite automata to accept the language $L_1 \Pi L_2$ (5)



(b) Construct a 3-level equivalent FA for the following automata given in the table and check if it is the universal equivalent of the original FA. (5)

Current	Input	
	a	b
→q0	q2	q1
q1	q1	q3
q2	q1	q4
*q3	q3	q3
*q4	q4	q4
q5	q5	q3

*represents the final state

Q5 (a) Design the CFG G for the PDA M given by the following transitions (5)

$\partial(q_0,a,Z_0) \vdash (q_0, aZ_0)$

$\partial(q_0,a,a) \vdash (q_0, aa)$

$\partial(q_0,c,a) \vdash (q_1, a)$

$\partial(q_1,a,a) \vdash (q_2, \varepsilon)$

$\partial(q_2,a,a) \vdash (q_2, \varepsilon)$

$\partial(q_2,\varepsilon,Z_0) \vdash (q_2, \varepsilon)$

(b) State and prove Pumping Lemma for Regular Sets (5)

Q6 (a) Convert the following CFG to GNF : (5)

S → XY X→YSY X→YY|1 Y→0X1|1

(b) Prove that the language L = { a^p |p is prime} is not context free (5)

Q7 Write short note on following:

(i) Intractable Problems (5)

(ii) Halting Problem of Turing Machines (5)

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