PAPER ID-421193

Subject Code: KCA201

Roll No: | | | | | | | | | | | | | |

MCA

(SEM II) THEORY EXAMINATION 2021-22

THEORY OF AUTOMATA & FORMAL LANGUAGES

Time: 3 Hours ***Total Marks: 100***

Note: Attempt all Sections. If you require any missing data, then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2*10 = 20

Qno	Questions	CO
(a)	Define alphabets and strings.	1
(b)	Differentiate between dead state and not reachable states.	1
(c)	What is Kleen Closure?	2
(d)	What do you mean by ambiguous grammar?	2
(e)	What is Useless Production is Context Free Grammar (CFG)?	3
(f)	Discuss the rules for Chomsky Normal Form (CNF).	3
(g)	What is an Instantaneous description in Push Down Automata (PDA)?	4
(h)	What is the problem associated with Finite Automata and how Push Down Automata (PDA) resolved it?	4
(i)	Discuss Universal Turing Machine.	5
(j)	What is Halting Problem in Turing Machine.	5

SECTION B

2. Attempt any *three* of the following: 10*3 = 30

Qno	Questions	CO
(a)	Design the Deterministic Finite Automata (DFA) over the input $\sum$= {0,1} that will accept the following languages**.** (i) The set of all strings having length 7. Provided that 2nd digit from left is 1 and 3rd digit from right is 0. (ii) Set of all strings containing 111 as sub string.	1
(b)	Write the regular expression for the following **(with explanation)** having input symbols {0,1}***** (i) The language of all strings containing at least two 0's. (ii) The language of all strings which starts and ends with same digits. (iii) The language of all strings containing 101 or 010 as sub strings. (iv) The language of all strings containing at most two 1's.	2
(c)	Define the syntax tree. Productions of a grammar 'G' are defined as: S → aB | bA A → a | aS | bAA B → b | bS | aBB. For the string aaabbabbba, (a) the leftmost derivation, (b) the rightmost derivation. (c) Derivation tree.	3
(d)	How two stack PDA differs from one stack PDA. Explain two stack PDA with suitable example.	4
(e)	Define Post Corresponding Problem (PCP)? Check does PCP with two lists X= (0101, 000111, 001, 10, 01, 00) and Y= (0101000, 11, 1001, 100, 10, 0) have a solution?	5

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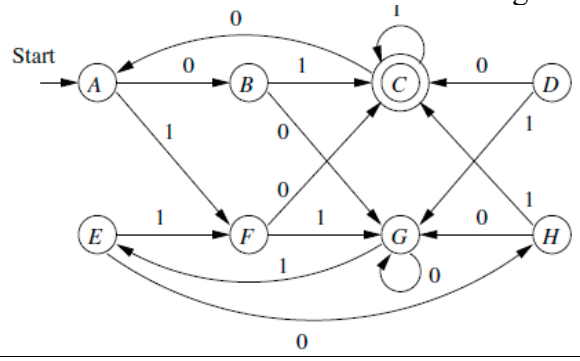
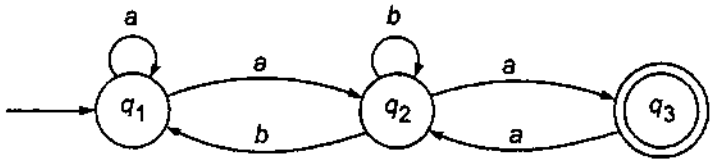
SECTION C

3. Attempt any *one* part of the following: 10*1 = 10

Qno	Questions	CO
(a)	Construct the Moore Machines that will count occurrences of substring 'ab' over the input ∑ = {a, b} and convert into Mealy Machine.	1
(b)	What is need minimization of DFA? Minimize the given DFA 	1

4. Attempt any *one* part of the following: 10 *1 = 10

Qno	Questions	CO
(a)	What is regular Expression? Using Arden's Theorem, convert the given transition diagram into regular expression. 	2
(b)	State Pumping Lemma. Check the strings accepted by Language L = $\{a^n b^n \mid n \geq 0\}$ are regular or not?	2

5. Attempt any *one* part of the following: 10*1 = 10

Qno	Questions	CO
(a)	Define grammar. Construct a grammar G for: (i) Set of odd length palindromes over input {0, 1}. (ii) L(G) = {w ε {a. b} | w has an equal number of a's and b's}.	3
(b)	What is the Chomsky hierarchy of languages?	3

6. Attempt any *one* part of the following: 10*1 = 10

Qno	Questions	CO
(a)	Write the formal definition of Push Down Automata (PDA). Construct a PDA that accepts language L = {wcw^r such that w ε (a, b) *}.	4
(b)	Differentiate between deterministic and non-deterministic PDA.	4

7. Attempt any *one* part of the following: 10*1 = 10

Qno	Questions	CO
(a)	What do you mean by Truing Machine? Design a Turing Machine that will accept all string specified the language L = {$a^n b^n$, n≥1}.	5
(b)	Write the short note on: (i) Multi-Tape and Multi-Head Turing Machine (ii) Church-Turing Thesis	5