Roll Number: 101703036

Thapar Institute of Engineering & Technology, Patiala
Department of Computer Science & Engineering
MID SEMESTER EXAMINATION

B. E. (Third Year): Semester-V (COE)	Course Code: UCS701 Course Name: Theory of Computation
September 23, 2019	Monday, 13.00 – 15.00 Hrs
Time: 2 Hours, M. Marks: 30	Faculty: AKU,AA, ST,SSH,RAH

Note: Attempt all questions

Q1. Let $a_1, a_2, a_3, \ldots$ be an input bit string. Design a Moore machine that outputs the parity of every substring of three bits. The following equation illustrates the computation of parity by the Moore machine. **(6)**

$$S_i = \begin{cases} (a_{i-2} + a_{i-1} + a_i) mod\ 2 & i = 3,4,5, \ldots \\ 0 & i = 1,2 \end{cases}$$

For example, if the input is 100011, the Moore machine should produce 001010 as output.

Q2. a) Draw the minimal DFA which accepts the following regular language L'. Also, determine the left linear grammar G such that $L(G) = L'$. **(2+2)**

$$L' = \{w | w \in \{a, b\}^* \text{ and } (n_a(w) - n_b(w)) \bmod 3 > 0\}$$

Assume that $(-x) \bmod 3$ is equal to $-(x \bmod 3)$

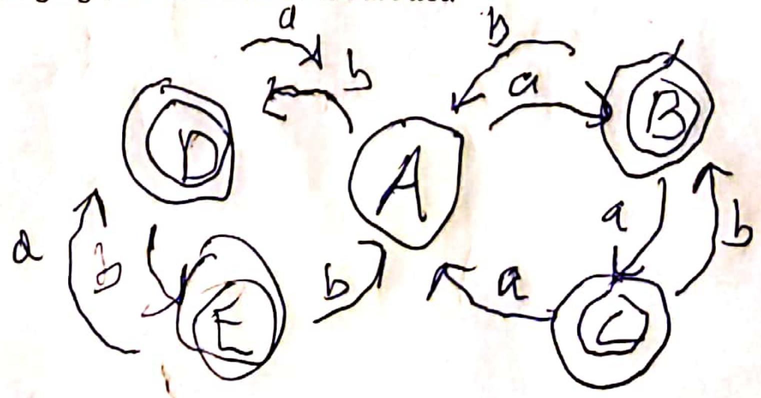
b) Find the regular expressions to represent: **(1+1)**

i) $L = \{0^n 1^m \mid n + m = even\}$

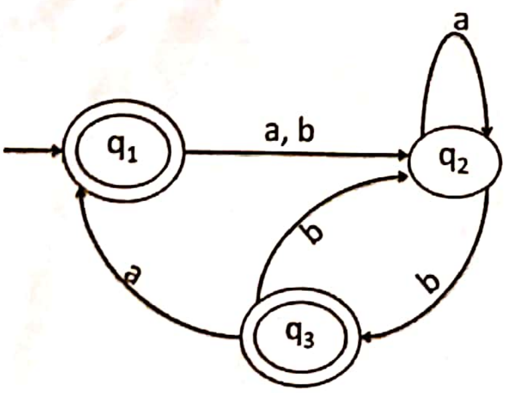
ii) All possible identifiers (variable name) of C language.

Q3. a) Check whether the language $L_3 = \{ww^r | w \in \{0,1\}^* \text{ and } w^r \text{ denotes reverse of } w\}$ is regular or not. If it is regular language, design deterministic finite automata for the same otherwise prove that it is non-regular using Pumping Lemma. **(3)**

b) Design a minimal DFA which accepts all binary strings in which every 00 is followed immediately by 1. For example, the strings 101, 0010, 0010011001 are in the language, but 0001 and 00100 are not. **(3)**



Q4. a) Convert the following deterministic finite automata into a regular expression by state elimination method? **(4)**



(Note: The sequence of state elimination will be q_1 then q_2 then q_3)

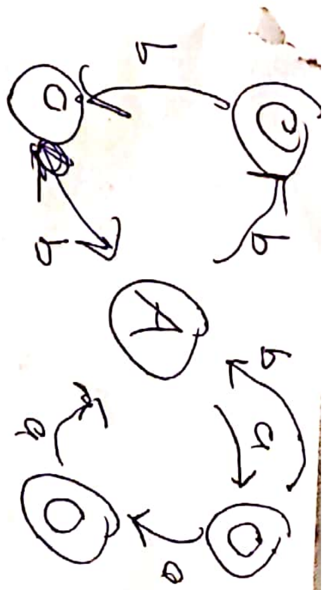
b) Give four applications of finite state automata. **(2)**

Q5. a) Convert the regular expression $((\varepsilon + a)b^*)^*$ into an equivalent DFA as per following methods: **(2+2)**

i) RE to NFA/Ɛ-NFA using Thompson's construction method.
ii) NFA/Ɛ-NFA to DFA using Subset construction method.

b) Construct the minimal DFA equivalent to the transition table shown below. **(2)**

State/Σ	a	b
$\rightarrow q_0$	q_1	q_0
q_1	q_0	q_2
q_2	q_3	q_1
$q_3{}^*$	q_3	q_0
q_4	q_3	q_5
q_5	q_6	q_4
q_6	q_5	q_6
q_7	q_6	q_3



Note: $\rightarrow q$ and q^* refers to the initial and final state, respectively.