MCA 18 Formal Language and Automata

SET: 1

Section-A

(Very Short Answer Questions)

1. (i) What do automata means?
   (ii) Define final state.
   (iii) Define grammar.
   (iv) Write the Chomsky hierarchy.
   (v) What is major difference between a Moore and Mealy machines?
   (vi) Define FSA.
   (vii)Write a regular expressions over {0, 1} denotes the set of all strings not containing 100 as a substring.
   (viii) Why we use Pumping Lemma?
   (ix) What is NDFA?
   (x) How many states are required to accept string ends with 10?

Section-B

(Short Answer Questions)

2. What are the characteristics of non regular languages?
3. State and explain pumping Lemma.
4. Write down the closure properties of regular languages. Also describe Pigeon-hole principle.
5. Find the language generated by the following grammars:

   $S \rightarrow 0S1 \mid 0A1, A \rightarrow 1A \mid 1$

   $S \rightarrow 0S1 \mid 0A1, A \rightarrow 1A0 \mid 10$
6. Prove the following identity $(a^*ab + ba)^*a^* = (a+ab+ba)^*$.
7. Let $\sum = \{a, b, c\}$

   Draw a DFA that rejects all words for which the last two letters match.

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8. Construct a FA for the regular expression

   i) $(ab + a)^* (aa+b)$

   ii) $a + bb + ba\, b^*\, a$
9. Construct the grammar, accepting each of the following sets:
   a) The set of all strings over {0, 1} consisting of equal number of 0's and 1's.
   b) $\{0^n 1^m\, 0^m 1^n \mid m, n \geq 1\}$
   c) $\{0^n 1^{2n} \mid n \geq 1\}$

Section-C

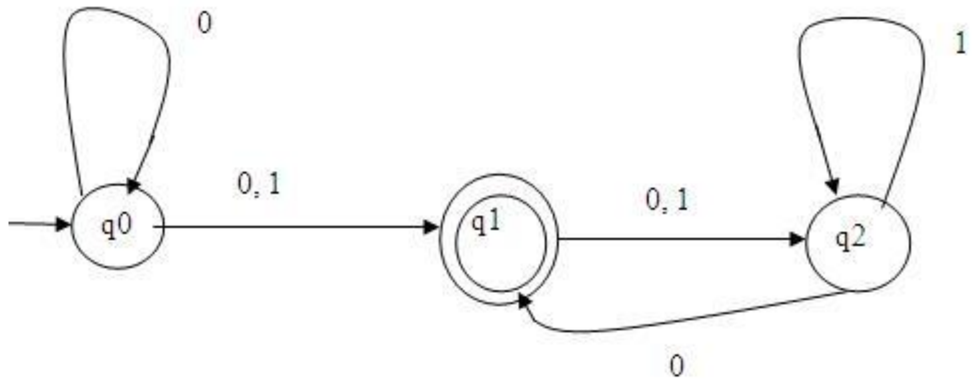
(Long Answer Questions)

10. Prove that language $L = \{a^n\, b^n \mid n \geq 0\}$ is not regular using method of contradiction.
11. Write a regular expression for each of the following language over the alphabet {a, b}.
    a) The set of string containing ab as a substring.
    b) The set of string having at most one pair of consecutive a's and at most one pair of consecutive b's.

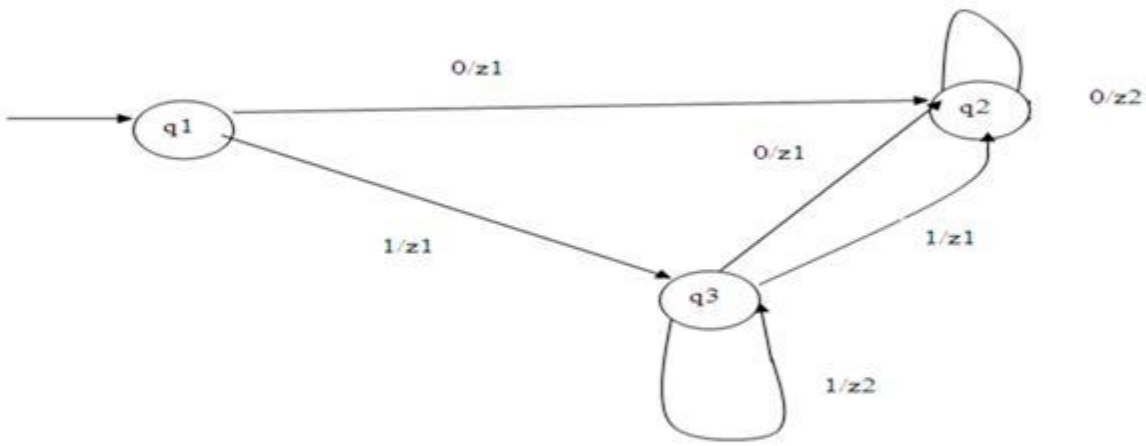
c) The set of stings whose length is divisible by 6.

d) The set of string whose 5^{th} last symbol (5^{th} symbol from end) is b.

12. Define the finite automata? Explain difference between deterministic and non deterministic finite automata. Find Deterministic Finite Automata (DFA) for following Non Deterministic Finite Automata (NDFA).



13. Consider a Mealy machine represented by figure. Construct a Moore machine equivalent to this Mealy machine.



MCA 18 Formal Language and Automata

SET: 2

Section-A

(Very Short Answer Questions)

1. (i) Define trap state.
   (ii) What is transition function?
   (iii) Name all four language defined by Chomsky and their FA.
   (iv) When we use PDA?
   (v) Which automata accept only regular language?
   (vi) How many tupels are there in Finite State Machine? Name them also.
   (vii) Can we design Complement of a DFA? If yes, then How?
   (viii) If L1 and L2 are regular sets then intersection of these two sets will be __________.
   (ix) Arden's theorem is used for?
   (x) Define Formal Language.

Section-B

(Short Answer Questions)

2. Explain the concept of regular sets and regular grammar with the help of an example
3. Explain in brief the pumping lemma theorem.
4. By using pumping lemma prove that L= $\{a^{n!} \mid n \geq 0\}$ is not regular.
5. Construct a Mealy machine which can output EVEN, ODD according as the total number 1's encountered is even or odd. The input symbols are 0 and 1.
6. Write down the regular expression and finite automata/Transition diagram for the following languages over alphabets $\sum = \{a, b\}$.
   (i) Set of string that starts with "aa" and end with "ab".
   (ii) Set of string that starts with "a" and ends with "b" and having at least one string of "abab".
7. M= ({q1, q2, q3}, {0, 1}, ∂, q1, {q3}) is a NDFA where ∂ is given by

$$\partial(q1, 0) = \{q2, q3\}$$
$$\partial(q1, 1) = \{q1\}$$
$$\partial(q2, 0) = \{q1, q2\}$$
$$\partial(q2, 1) = \Phi$$
$$\partial(q3, 0) = \{q2\}$$
$$\partial(q3, 1) = \{q1, q2\}$$

Construct an equivalent DFA.

8. For the given grammar
   S->aB/bA
   A->a/aS/bAA
   B->b/bS/aBB

Give the leftmost and rightmost derivation for the sting "aaabbabbba".

9. Construct a Mealy machine which is equivalent to Moore m/c given below

Present State	Next States a=0	a=1	O/P
Q0	Q2	Q1	1
Q1	Q3	Q0	0
Q2	Q0	Q3	1

	Q3	Q1	Q2	1

Where Q0 =initial state

Section-C

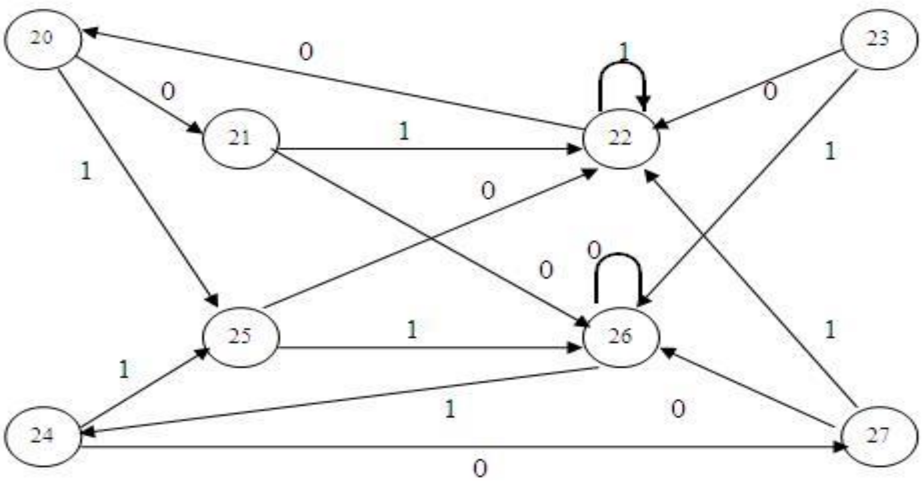
(Long Answer Questions)

10. Let L is the set of all palindromes over {a, b}. Construct a grammer generating L.

11. Define regular expressions and language associated with regular expressions. Write the regular expression and finite automata (Transition diagram) for the following languages over alphabets ∑= {a, b}.

   a) The set of strings that start with “ab” and end with “bb”.
   b) The set of strings that starts with 'a' and ends with 'b' and contain at least one sewuence of “aaa” in the sting.

12. Construct a minimum state automaton equivalent to the FA given below. Where 20 = Initial State and 22 = Final State.



13. Prove that following expression is regular or not regular using pumping lemma: $L = \{a^n b^m \mid n \leq m+3\}$.

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