(a) at least one head occured

(b) at most tow heads occured

5. Using truth table show that the following proposition is a tautology

(a) $(p \rightarrow q) \wedge (q \rightarrow r) \rightarrow (p \rightarrow r)$

(b) $[(p \vee q) \wedge \sim p] \rightarrow q$

6. (a) Explain the finite automata.
   (b) Discuss language of deterministic finite automata

7. (a) Design regular expression for the set of string given as $\{a^n / n$ is divisible by 2or 3, $n >= 0\}$ over $\{a\}$
   (b) Design regular expression for language $L = \{a^m b^n / m, n > 0\}$ over $\{a,b\}$

8. (a) Construct DFA and transition diagram by the following grammar

   $S \rightarrow 01A, \ A \rightarrow 10B, \ B \rightarrow 0A/11,$

   (b) Construct DFA which is equivalent to regular expression $(a+b)^*(ab+ba)(a+b)^*$

9. Write notes on any three of the following
   (a) Moore Machine
   (b) Turing Machine
   (c) Pushdown automata
   (d) Language of a DFA

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MCA(II)-CS(23)

2018

Time : 3 hours *Full Marks : 80*

Candidates are required to give their answers in their own words as far as practicable.

The questions are of equal value.

Answer any five questions, in which Q.No. 1 is compulsory.

1. Choose the correct answer of the following:

   (i) The number of elements in the power set P(S) of the set $S = \{\{\phi\}, 1, \{2,3\}\}$ is

   (a) 2

   (b) 4

   (c) 8

   (d) None of.these

   (ii) The rank of the matrix $\begin{pmatrix} 2 & 2 \\ 0 & 0 \end{pmatrix}$ is

   (a) 0

   (b) 1

   (c) 2

   (d) 4

P.T.O.

(iii) $(p \to q) \wedge (r \to q)$ is equivalent to

    (a) $(p \vee r) \to q$

    (b) $p \vee (r - p)$

    (c) $p \vee (r \to q)$

    (d) $p \to (q - r)$

(iv) The Boolean function $\bar{x}\,\bar{y} + xy + \bar{x}y$ is equivalent to

    (a) $\bar{x} + \bar{y}$

    (b) $x + y$

    (c) $x + \bar{y}$

    (d) $\bar{x} + y$

(v) The set of integer Z with the binary operation '*' define as $a * b = a + b + 1$ for a, $b \in Z$ is a group. The identity element of this group is

    (a) 0

    (b) -1

    (c) 1

    (d) 2

(vi) A graph is a collection of

    (a) row & columns

    (b) vertices & edges

    (c) equations

    (d) None of these

(vii) Language of finite automata is

    (a) Type 0

    (b) Type 1

    (c) Type 2

    (d) Type 3

(viii) The maximum number of transition which can be performed over a state in a DFA $\sum = \{a, b, c\}$ is

    (a) 1

    (b) 2

    (c) 3

    (d) 4

2. (a) Prove that
$$(A \cap B)^C = A^C \cup B^C$$

    (b) Prove by the principle of mathematical induction
$$1^2 + 2^2 + \ldots\ldots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

3. Find the inverse of the matrix
$$A = \begin{pmatrix} 1 & -2 & 2 \\ 2 & -3 & 6 \\ 1 & 1 & 7 \end{pmatrix}$$

4. Explain probability of an event. A coin is tosed three times, find the probability that .