

(b) What do you understand by grammar? Explain different types of grammar with the help of example. 8

9. (a) Let M be the finite machine with state table given as 8

	f			g		
S \ A	a	b	c	a	b	c
→ s ₀	s ₀	s ₁	s ₂	0	1	0
s ₁	s ₁	s ₁	s ₀	1	1	1
s ₂	s ₂	s ₁	s ₀	1	0	0

- (i) Find the input state A, the state set S, the output set O and the initial state of M
- (ii) Draw the state diagram of M
- (iii) Find the output string for the input string aabbcc
- (b) Explain Moore and Mealy machine. 8

MCA 1st Semester Current Scheme (with new notes)
Maximum Marks Scheme 80 Examination,

December-2015

MATHEMATICAL FOUNDATION OF
COMPUTER SCIENCE

Paper-MCA-101

Time allowed : 3 hours] [Maximum marks : 80

Note : * Attempt five questions in all. Question No. 1 is compulsory and attempt four more questions by selecting one question from each unit.

* All questions carry equal marks.

1. (a) Define a relation on the set N of natural numbers given by

$$R = \{ (x, y) : y = x + 5, x \text{ is a natural number less than } 4 \text{ and } x, y \in N \}$$

Write R in roster form. $8 \times 2 = 16$

(b) Find the domain and range of function $y = |x|$

(c) Let * be the binary operation on Q defined by

$$a * b = \frac{2a + b}{4}, a, b \in Q, \text{ find } 2 * 5$$

- (d) Write the negation of the proposition :
If I am ill, then I can not go to university.
- (e) Define Tautology and Contradiction.
- (f) Draw the Hasse Diagram for the relation "Less than" on the set
 $A = \{2, 3, 4, 6, 12, 36, 48\}$. Here aRb if a less than b for $a, b \in A$

(g) Define Alphabet with the help of example

(h) If $\Sigma = \{a, b\}$, then find Σ^2 and Σ^3

Unit-1

2. (a) Define matrix representation of a relation and find the matrix of the relation

$$R = \{(p, 1), (p, 2), (q, 1), (r, 2), (s, 1)\},$$

defined on the set $A = \{p, q, r, s\}$ and $B = \{1, 2, 3\}$

- (b) Show that the relation R in the set $\{1, 2, 3\}$ given by

$$R = \{(1, 1), (1, 2), (2, 2), (2, 3), (3, 3)\}$$

is reflexive but neither symmetric nor transitive.

- (c) Let $A = R - \{3\}$ and $B = R - \{1\}$ and $f: A \rightarrow B$ defined by

$$f(x) = \frac{x-2}{x-3},$$

prove that f is one-one and onto. 6

3. (a) Let Z be set of Integers, show that the binary operation $*$ on Z , defined by $a * b = a + b + 1$ for all $a, b \in Z$ satisfies the closure property, associative law and commutative law. Find the identity element and inverse of an integer a . 8

- (b) Define Coset. Let $G = (Z, +)$ be a group, where Z is the set of integers and $+$ is an addition operator, also let $G_1 = \{\dots -14, -7, 0, 7, 14, 21, \dots\}$ be a subgroup consisting of the multiples of 7. Determine the coset of G_1 in Z . 8

Unit-2

4. (a) Construct the truth table of the proposition $[(p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow (p \rightarrow r)$ 8

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(4)

(b) Using Principle of mathematical induction prove that $9^n - 8^n - 1$ is divisible by 8 for all positive integer n . 8

5. (a) Show that $\sim p$ is a valid conclusion from the given premises $p \rightarrow \sim q, r \rightarrow q, r$ 8

(b) Explain the following terms with the help of example

(i) Predicate Quantifiers

(ii) Normal form

Unit-3

6. (a) Draw the Hasse diagram and determine whether or not each of the following sets is a lattice with respect to divisibility:

(i) $A_1 = \{1, 2, 4, 5, 20\}$ 8

(ii) $A_2 = \{2, 4, 8, 10, 20, 40\}$ 8

(b) Define Bounded lattice and Complemented lattice with the help of example. 8

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[See also 5th page

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7. (a) Let $B = \{1, 2, 4, 5, 10, 20\}$ be the set of positive factors of 20. Two binary operations '+' and '.' are defined as follows: 8

$a + b = 1$ cm (\bar{a}, b) and $a \cdot b = \gcd(a, b)$ for all $a, b \in B$

A unary operation ' $'$ ' on B is defined as $a' = \frac{20}{a}$ for all $a \in B$

Show that $(B, +, \cdot, ', 1, 20)$ is not a Boolean algebra.

(b) In the Boolean algebra $(B, +, \cdot, ', 1, 20)$; show that 8

(i) $(a + b) \cdot (a' b') = 0$ for all $a, b \in B$

(ii) $a \cdot b + [(a + b') \cdot b'] = 1$ for all $a, b \in B$

Unit-4

8. (a) Explain the following terms with the help of example 8

(i) Alphabet

(ii) String

(iii) Kleen star

(iv) Language.

[P.T.O.]

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