SantDeveloeper

R-6
29

Roll No. .....

67006

MCA 1st Semester (Current)

CBCS Scheme w.e.f. Dec.-2016

Examination – November, 2017

MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

Paper : MCA-101(C)

Time : Three Hours] *[Maximum Marks : 80*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

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) Determine the domain and range of the relation R defined by $R = \{(x, x + 5) : x \in (0, 1, 2, 3, 4, 5)\}$.

(b) Consider a relation R on $A = \{4, 5, 6, 7\}$ defined by $R = \{(4, 5), (5, 5), (5, 6), (6, 7), (7, 4)\}$. Find the symmetric closure of R.

(c) Write in symbolic form : If either Raman takes Computer Science or Pooja takes Mechanical

Engineering then Priti shall take Electrical Engineering.

(d) Define predicate logic with the help of example.

(e) Define partial order relation.

(f) Let $A = \{2, 3, 4, 6, 8, 24, 48\}$ with partial order divisibility. Determine all the maximal and minimal elements of A.

(g) If $\Sigma = \{a, b\}$ then find Σ^*.

(h) What is use of finite automata ?

UNIT– I

2. (a) Let $A = \{0, 1, 2, 3 \ldots\}$ and $R = \{(x, y) : x - y = 3k$, where k is an integer$\}$ i.e. xRy iff '$x - y$' is divisible by 3, then prove that R is an equivalence relation.

(b) Define function and prove that the function $f : R - \{-1\} \to R - \{1\}$ given by $f(x) = \frac{x}{x+1}$ is invertible.

3. (a) For both binary operation $*$ defined below, determine whether $*$ is commutative and associative

(i) $*$ on Q, defined by $a * b = ab + 1$

(ii) $*$ on Z, defined by $a * b = 2^{ab}$

(b) Consider an algebraic structure (G, $*$), where G is the set of non-zero real numbers and $*$ is a binary operation defined by $a * b = \frac{ab}{4}$. Show that $(G, *)$ is an abelian group.

UNIT– II

4. (a) Use laws to show that :

$$(p \rightarrow q) \wedge (r \rightarrow q) \equiv (p \vee r) \rightarrow q$$

(b) Determine the validity of the following argument without using truth table. " If the market is free then there is no inflation. If there is no inflation then there are price control. Since there are price controls, therefore, the market is free."

5. (a) Define tautology and contradiction and verify that the compound proposition given as $(\neg q \wedge (p \rightarrow q)) \rightarrow \neg p$ is tautology or not.

(b) Using principle of mathematical induction, prove that $(n^3 + 2n)$ is divisible by 3 for every positive integer n.

UNIT– III

6. (a) Consider the poset (A, /) where $A = \{1, 2, 3, 4, 6, 9, 18, 36\}$, Draw the Hasse diagram and find the greatest lower bound and least upper bound of the sets {6, 18} and {4, 6, 9}.

(b) Define bounded lattice and distributive lattice with the help of example.

7. (a) Show the following in Boolean algebra :

(i) $(x + y)(x' + z) = xz + x'y + yz$

(ii) $xy' + yz' + zx' = x'y + y'z + z'x$

(b) Let (L, $\wedge$, $\vee$) is a complemented and distributive lattice and any element $a \in L$, then prove that complement of a is unique.

UNIT– IV

8. (a) Define language and regular expression. Find the language for the regular expressions given as :

(i) $a + bc^*$

(ii) $bc^* b$

(b) What is Chomsky Hierarchy ? Explain with the help of example.

9. (a) Consider a Non-deterministic Finite State Automation (NDA) whose transition function is given in the table. Let $S = \{s_0, s_1, s_2\}$, $F = \{s_1\}$, $\Sigma = \{0, 1\}$

Transition Function Table

Σ / S	δ	
	0	1
$\rightarrow s_0$	$\{s_1\}$	$\{s_0\}$
s_1	$\{s_2\}$	$\{s_1, s_2\}$
s_2	$\{s_2\}$	$\{s_2\}$

Construct a transition diagram for NFA and DFA equivalent to NF A.

(b) Define Mealy machine with the help of example.