K16P 0098

Reg. No. : ....

Name : ....

I Semester M.C.A. Degree (Reg./Sup./Imp.) Examination, February 2016
(2014 Admn. Onwards)
MCA1C01 : DISCRETE MATHEMATICS

Time : 3 Hours   Max. Marks : 80

Instructions : *1) Answer **any ten** questions from Section – **A**. **Each** question carries **three** marks.*

*2) Answer **all** questions from Section – **B**. **Each** question carries **10** marks.*

SECTION – A

Answer **any ten** questions. **Each** question carries **three** marks.

1. Construct the truth table for $(p \wedge q) \vee \sim r$.

2. Simplify the logical statement $\sim(\sim p \wedge q) \wedge (p \vee q)$.

3. Show that $\sim(p \to q) \equiv p \wedge \sim q$.

4. Given that ϕ is an empty set, find $P(\phi)$, $P(P(\phi))$, $P(P(P(\phi)))$.

5. Define one-one function and onto function. Give an example each.

6. If $A = \{\alpha, \beta\}$ and $B = \{1, 2, 3\}$, what are $A \times B$, $B \times A$, $A \times A$, $B \times B$ and $(A \times B) \cup (B \times A)$?

7. Let $A = \{a, b\}$, $R = \{(a, a), (b, a), (b, b)\}$ and $S = \{(a, b), (b, a), (b, b)\}$. Then verify that $(S \circ R)^{-1} = R^{-1} \circ S^{-1}$.

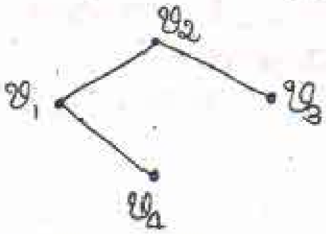
8. Define reflexive, irreflexive and antisymmetric relations with an example each.

P.T.O.

9. Find n if $2P(n, 2) + 50 = P(2n, 2)$.

10. Find the sequence represented by the recursive formula
$a_1 = 5, a_n = 2a_{n-1}, 2 \leq n \leq 7$.

11. Find the complement of the following graph.



12. Define graph, digraph and self-loop with an example each.

SECTION – B

Answer **all** questions. **Each** question carries **ten** marks.

13. a) Give the converse and contrapositive of the implications.
    i) If it is hot; then I take cold drinks.
    ii) If today is Monday, then tomorrow is Tuesday.
  b) Show that $((p \vee \sim q) \wedge (\sim p \vee \sim q)) \vee q$ is a tautology.
  c) Define Tautology and Contradiction. **(4+4+2)**

OR

  a) Show that $(p \wedge (\sim p \vee q)) \vee (q \wedge \sim(p \wedge q)) \equiv q$.
  b) Obtain disjunctive normal form of **(6+4)**
  $p \vee (\sim p \rightarrow (q \vee (q \rightarrow \sim r)))$

14. a) State and prove D'Morgan's laws for set theory.
  b) If $f : A \rightarrow B$ and $g : B \rightarrow C$ are bijective mapping, then show that
  $(g_\circ f)^{-1} = f^{-1}{}_\circ g^{-1}$. **(5+5)**

OR

  a) Use Venn diagram to show that $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$.
  b) If $f: R \rightarrow R$ is defined by $f(x) = ax + b$, where $a, b, x \in R$, $a \neq 0$, then show that f is invertible and find the inverse of f. **(5+5)**

15. a) Give an example of a non-empty set and a relation on the set that satisfies each of the following combinations of properties.

i) Symmetric and reflexive but not transitive.

ii) Transitive and reflexive but not anti-symmetric.

iii) Anti-symmetric and reflexive but not transitive.

b) Let R be a relation from the Set A to the Set B and S be a relation from the Set B to the Set C, then show that $(S_o R)^{-1} = R^{-1}{}_o S^{-1}$. **(6+4)**

OR

a) Explain Warshall's algorithm with suitable example.

b) Let A = {0,1, 2, 3, 4}. Find the equivalence classes of the equivalence relation R = {(0, 0), (0,4), (1, 1), (1, 3), (2, 2), (3, 1), (3, 3), (4, 0), (4, 4)} defined on A. Draw the digraph of R and write down the partition of A induced by R. **(5+5)**

16. a) For any finite Sets A, B, C, show that

$n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(A \cap C) - n(B \cap C) + n(A \cap B \cap C)$.

b) If P(n, r) = 5040 and C(n, r) = 210, find n and r. **(5+5)**

OR

a) State Pigeonhole principle. Show that among 100 people there are atleast $\left[{}^{100}\!/_{12}\right] = 9$ who were born in the same month.

b) What is the selection of the recurrence relation $a_n = a_{n-1} + 2a_{n-2}$ with $a_0 = 2$, $a_1 = 7$? **(5+5)**

17. a) Define Hamiltonian graph and Eulerian graph with examples.

b) Explain Dijkstra's algorithm of finding shortest path. **(4+6)**

OR

a) Explain depth-first search. Use it to find a spanning tree for the graph shown below. **10**