14/12/17

Roll No. ..... Total Pages : 3

MCA/D-17 **10312**

DISCRETE MATHEMATICAL STRUCTURES

Paper : MCA-14-14

Time : Three Hours] [Maximum Marks : 80

Note : Attempt *five* questions in all. Question number 1 is compulsory. Attempt *four* more questions selecting *one* question from each unit. All questions carry equal marks.

Compulsory Question

1. Explain the following in brief using suitable example :

(a) Total order relation.

(b) Inverse function.

(c) Nested quantifier.

(d) Inclusion-Exclusion principle.

(e) Divide and Conquer approach.

(f) Principle of Duality.

(g) Isomorphism.

(h) Dual graphs. (8×2=16)

UNIT–I

2. (a) A survey among 100 students shows that of the three ice-cream flavours vanilla, chocolate and strawberry, 50 students like vanilla, 43 like chocolate, 28 like strawberry, 13 like vanilla and chocolate, 11 like chocolate and

strawberry, 12 like strawberry and vanilla, and 5 like all of them. Find the number of students surveyed who like each of the following flavours :

(i) Chocolate but not strawberry.

(ii) Chocolate and strawberry, but not vanilla.

(iii) Vanilla or chocolate, but not strawberry. 8

(b) What is Function? Explain injective, bijective and surjective function using suitable examples. 8

3. (a) Let R be a relation on a set A. Prove that there is a path of length n, where n is a positive integer from a to b if and only if (a, b) belongs to R^n. 8

(b) Let R be an equivalence relation on a set A. Prove that these statements are equivalent :

(i) $a \, R \, b$

(ii) $[a] = [b]$

(iii) $[a] \cap [b] \neq \varnothing$. 8

UNIT–II

4. (a) Show that $\neg (p \vee (\neg p \wedge q))$ and $\neg p \wedge \neg q$ are logically equivalent. 6

(b) Show that $(p \wedge q) \rightarrow (p \vee q)$ is a tautology. 5

Prove that sum of two rational numbers is rational. 5

5. (a) Show that among any $n + 1$ positive integers not exceeding $2n$, there must be an integer that divides one of the other integer. 8

(b) State and prove Pascal's Identity using binomial coefficients. 8

UNIT–III

6. (a) Solve the recurrence relation

$a_n = 7a_{n-1} - 13a_{n-2} - 3a_{n-3} + 18a_{n-4}$,

where $a_0 = 5$, $a_1 = 3$, $a_2 = 6$ and $a_3 = -21$. 8

(b) Write a recursive algorithm to compute the gcd of two positive integers x and y. 8

7. (a) Simplify the following expression and draw the switching AND gate circuit using NOR gates only :

$F = (x + y)(y + z)\ (z + x)xyz$. 8

(b) What is a lattice and special lattice? Explain both types of lattices using suitable examples and drawing Hasse diagrams for the lattices. 8

UNIT–IV

8. (a) What do you mean by Euler's path and circuit? Explain necessary and sufficient conditions for Euler's paths and circuits using suitable examples. 8

(b) Explain the Dijkstra's algorithm using suitable examples. Also explain limitations of this algorithm. 8

9. What is Minimum spanning tree? Compare and contrast both the algorithms for finding minimum spanning trees. 16
