K.L.E Society's
S. Nijalingappa College
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PG Department of Mathematics
QUESTION BANK

Discrete Mathematics [M303T]

7-MARKS

1. A = {a,b,c,d}
   R = {(a,d),(c.d),(b.a),(b,c),(d,c)}
   S = {(a,a),(b,b),(c,c),(d,d)}
   Find $R \circ S, S \circ R, R^2, S^2$

2. Using the Warshall's algorithm ,find the transitive closure of the relation 'R' defined on a set A = {a,b,c,d} & R = {(a,d),(c,d),(c,a),(b,a),(b,c),(d,c)}

3. Using the Warshall's algorithm ,find the transitive closure of the relation 'R' defined on a set A = {a,b,c,d} & R = {(b,e),(c,b),(c,e),(d,a),(e,b),(e,c)}

4. If R is a relation on A & |A| = n then $R^\infty = R \cup R^2 \cup R^3 \cup \ldots . R^n$.

5. If R & S are two relations define a given set A then prove that $(R \cap S)^2 \subseteq R^2 \cap S^2$.

6. Given a set A with |A| = n and a relation R on A, let M denote the matrix of R , then prove the following :

   i. R is reflexive if and only if $I_n \leq M$,
   ii. R is transitive if and only if $M^2 \leq M$,
   iii. R is antisymmetric if and only if $M \cap M^T \leq I_n$ where I_n is the unit matrix and M^T is the transpose of M.

7. Define Poset & Lattice .Draw Hasse digraph for $< D_{30}, / >$.

8. Define a distributive lattice & complemented lattice .In a distributive lattice, if an element has a complement then prove that this complement is unique.
9. In Boolean algebra for any two elements a&b & a=b iff $(a \wedge \bar{b}) \vee (\bar{a} \wedge b)$=0

10. For any a,b,c in a lattice (A,≼) prove

    i. $a \vee (b \vee c) = (a \vee b) \vee c$
    ii. $a \wedge (b \wedge c) = (a \wedge b) \wedge c$

11. State and prove Demorgan's law of Boolean algebra.
12. Find the generating function of the sequence
    - {1,1,1,-------}
    - {0,1,2,3-------}
    - $\{1^3, 2^3, 3^3 - --\}$
13. In how many ways we can distribute 8 identical chocolates among 3 distinct children if each receives atleast 2 chocolate but not more than 4.

14. Find the number of ways in which four of the letters of the word ENGINE be arranged by using exponential generating function.

15. Solve the recurrence relation
    - $a_n + a_{n-1} - 6a_{n-2} = 0$
    - $a_n = 3a_{n-1} - 2a_{n-2} \quad with\ a_1 = 5\ , a_2 = 3$

16. Solve recurrence relation using generating function $a_n = 3a_{n-1} + 2, \quad a_0 = 1$

17. Write a short on modeling "The Tower of Hanoi Problem" and solve it explicitly.

18. Write a short note on Rabbit population problem as a recurrence relation and solve it explicitly.
19. Define planar and non-planar graph .give an example for each

20. State and prove Euler's polyhedron formula.
21. If G is a plane graph in which every face is bounded by n-edges or n-cycle then $q \leq \frac{n(n-1)}{n-2}$
22. The complete graph K_5 and the complete bipartite graph $K_{3,3}$ are non-planar.
23. For any graph G,$K(G) \leq \lambda(G) \leq \delta(G)$.