CHAPTERWISE IMPORTANT QUESTIONS

DISCRETE MATHEMATICS **Question Bank** **A.Y 2021-22.**

Unit-I : The Foundations : Logic and Proofs

1. A) Construct the truth table for $(p \vee \neg q) \rightarrow (p \wedge q)$.
   B) Show that $\left(p \vee (q \wedge r)\right)$ and $(p \vee q) \wedge (p \vee r)$ are logically equivalent.
2. A) Show that $\neg\left(p \vee (\neg p \wedge q)\right)$ and $(\neg p \wedge \neg q)$ are logically equivalent without using truth table.
   B) Show that $(p \rightarrow q) \wedge (q \rightarrow r) \rightarrow (p \rightarrow r)$ is a Tautology.
3. A) Construct a Combinatorial (Digital) Circuit using Gates that produces the output $(\neg p \wedge \neg q) \vee (p \wedge r)$.
   B) Show that √2 is not a rational number using Method of Proof by Contradiction.
4. A) Check the validity of the argument If Ram has completed B.E Computer science or M.B.A, then he is assured of a good job. If Ram is assured of a good job, he is happy. Ram is not happy. Therefore, Ram is not completed M.B.A.
   B) Prove that if n is an integer and 3n+2 is odd, then n is odd.
5. A) Show that the Premises It is not Sunny this A.N and it is colder than yesterday. We will go swimming only if it is sunny. We will go swimming only if it is Sunny, If we do not go swimming, then he will take a canoe trip, and If we take a canoe trip, then we will be home by sunset lead to the conclusion we will be home by sunset.
   B) Consider the argument All men are fallible , All kings are men, Therefore, All kings are fallible.

Unit-II : SET THEORY, FUNCTIONS

6. A) a) Let A = {1, 2, 3, 4} and R = {(1, 2), (2, 3), (3, 4), (2, 1)}. Determine the
(i) Reflexive Closure of R (ii) Symmetric Closure of R (iii) transitive closure of R?

B) What are the truth sets of the Predicates of P(x),Q(x) and R(x), where the domain is the set of integers and P(x) is $|x| = 1$,Q(x) is $x^2 = 2$ and R(x) is $|x| = x$.
7.A) Describe Hasse diagram? Let X = {2, 3, 6, 12, 24, 36}, and the relation ≤ be such that x ≤ y if x divides y. Draw the Hasse diagram of (X, ≤).
B) Find fog and gof, where $f(x) = x^2 + 1$ and $g(x) = x + 2$ are functions from R to R.
8. A) Find the join ,meet and Boolean product of the zero-one matrices $A = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 0 & 1 \end{bmatrix}$.
B) Find the join and meet of the zero-one matrices
$A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ $and\ B = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 1 & 0 \end{bmatrix}$.
9. A) If f: R → R is defined by f (x) = a x + b, where a, b, x ∈ R and a ≠ 0 .
   Show that f is invertible and find the inverse of f.
   B) (i)Find the Fibonacci numbers f_2, f_3,f_4,f_5 and f_6. (ii) Find $\sum_{k=50}^{100} k^2$
10. A) Show that the relation greater than or equal to is a partial ordering on the set of Integers**.**
    B) Prove that the relation Congruent $a \equiv b \bmod m$ is an equivalence relation on R.

UNIT-III : ALGORITHMS

11. A) Explain the asymptotic notations with examples.

    B) Describe the Binary Search Algorithm in pseudo code.

12. A) Describe the *Bubble sort Algorithm pseudo* code *and Show the steps of bubble sort with 3 2 4 1 5*

    B) Explain the Insertion sort Algorithm in pseudo code and Show all the steps of insertion sort with Input: 3 2 4 1 5.

13. A) Describe the matrix multiplication *Algorithm* and explain the complexity of matrix multiplication.

    B) Show that $1^2 + 3^2 + 5^2 + - - - + (2n+1)^2 = \frac{(n+1)(2n+1)(2n+3)}{3}$**, Where n is a nonnegative integer.**

14. **A) Show that for any integer n,** $11^{n+2} + 12^{2n+1}$ is divisible by 133.

    B) Using the principle of mathematical induction, prove that
    1/(1 · 2) + 1/(2 · 3) + 1/(3 · 4) + ... + 1/{n(n + 1)} = n/(n + 1)

15. A) Prove that n ! > 2^n for n a positive integer greater than or equal to 4.
    (Note: n! is n factorial and is given by 1 * 2 * ...* (n-1)*n.)

    B) Prove that for every positive integer n, $9^n - 8n - 1$ is divisible by 64.

UNIT-IV : DISCRETE PROBABILITY AND ADVANCED COUNTING TECHNIQUES

16. A) A class consists of 6 girls and 10 boys. If a committee of 3 is chosen at random from the class, find the probability that (a) 3 boys are selected (b) exactly 2 girls are selected.

    B) What is the probability that a card drawn at random from the pack of cards may be either a queen or a king?

17. A) Two aero planes bomb a target in succession. The probability of each correctly scoring a hit is 0.3 and 0.2 respectively. The second will bomb only if the first misses the target. Find the probability that (i) target is hit (ii) both fails to score hits.

    b) First box contains 2 black, 3 red, 1 white balls; Second box contains 1 black, 1 red, 2 white balls and third box contains 5 black, 3 red, 4 white balls. Of these a box is selected at random. From it a red ball is randomly drawn. If the ball is red, find the probability that it is from second box.

17. A) In a bolt factory machines A, B, C manufacture 20%,30% and 50% of the total of their output and 6%,3% and 2% are defective. A bolt is drawn at random and found to be defective. Find the probabilities that it is manufactured from machine A.

    B) A random variable X is the sum of the numbers on the faces when two dice are thrown. Find the mean of x.

1. A) A businessman goes to hotels X, Y, Z, 20%, 50%, 30% of the time respectively. It is known that 5%, 4%, 8% of the rooms in X, Y, Z, hotels have faulty plumbings. What is probability that businessman's room having faulty plumbing is assigned to hotel Z?

   B)A Random variable X has Probability function

X	0	1	2	3	4	5	6	7
P(x)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2 + k$

Evaluate (i) K (ii) $P(X < 6)$, $P(X \geq 6)$, $P(0 < X < 5)$ and $P(0 \leq X \leq 4)$ (iii) if $P(X \leq k) > \frac{1}{2}$, find the minimum value of k and (iv) Mean (v) variance and (vi) Determine the distribution function of X.

2. **A)** Find all solutions of the recurrence relation $a_n = 3a_{n-1} + 2n$.
   What is the solution with $a_1 = 3$?

   b) What is the solution to the recurrence relation $a_n = a_{n-1} + 2a_{n-2}$ with $a_0 = 2$ and $a_1 = 7$?

3. A) Find an explicit formula for the Fibonacci numbers. The sequence of Fibonacci numbers satisfies the recurrence relation $f_n = f_{n-1} + f_{n-2}$ with the initial conditions: $f_0 = 0$ and $f_1 = 1$.

   b) What is the solution to the recurrence relation $a_n = 6a_{n-1} - 9a_{n-2}$ with $a_0 = 1$ and $a_1 = 6$?

UNIT-V : GRAPHS - TREES

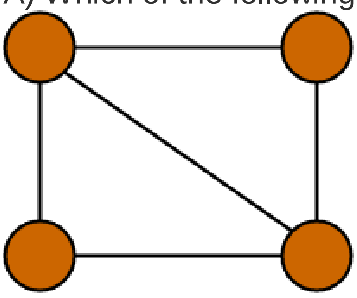
4. A) (i) What is Handshaking Theorem? (ii) A graph contains 21 edges, 3 vertices of degree 4 and all other vertices of degree 2. Find total number of vertices.

   B) What is Graph Traversal? Explain Breadth First Search?

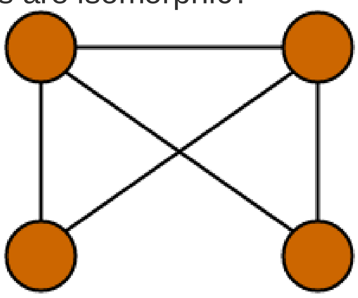
5. **A) Explain Depth First Search Algorithm?**

   B) A simple graph contains 35 edges, four vertices of degree 5, five vertices of degree 4 and four vertices of degree 3. Find the number of vertices with degree 2.

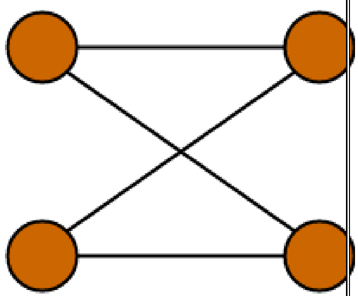
6. A) Which of the following graphs are isomorphic?



G1

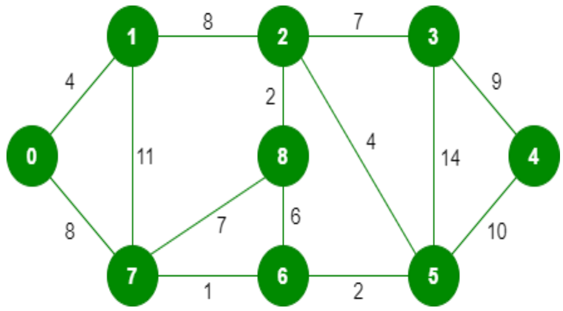


G2

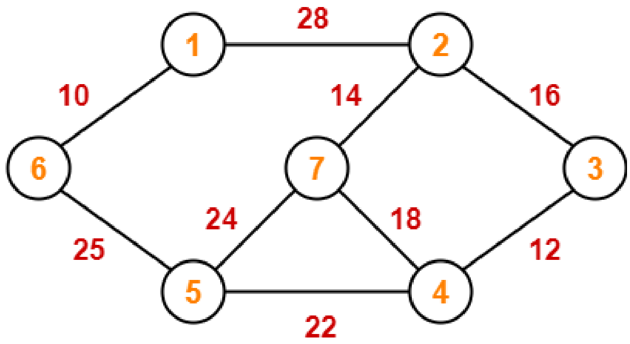


G3

   B) What is Minimum Spanning Tree? Explain Kruskal's Algorithm? Construct the minimum spanning tree (MST) for the given graph using Kruskal's Algorithm Consider the below input graph?



7. **A) Explain Prim's Algorithm? Construct the minimum spanning tree (MST) for the given graph using Prim's Algorithm?**



B) Define the following with Diagram. (i) Chromatic Number (ii) Euler Path (iii) Euler circuit (iv) Hamiltonian cycle (v) coloring of a graph.

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NARSIMHA REDDY ENGINEERING COLLEGE

MODEL QUESTION PAPER

(UGC AUTONOMOUS)

II B.Tech I Semester (NR21) Regular Examination, February 2023

DISCRETE MATHEMATICS

(CSE / Common to -CS/DS/AI & ML) Time :3 hours Maximum marks: 70

Note:
- This question paper contains two parts A and B
- Part A is compulsory which carries 20 marks (10 sub questions are two fromeach unit carry 2 Marks). Answer all questions in Part A
- Part B Consists of 5 Units. Answer any one full question from each unit. Eachquestion carries 10 Marks and may have a, b sub questions