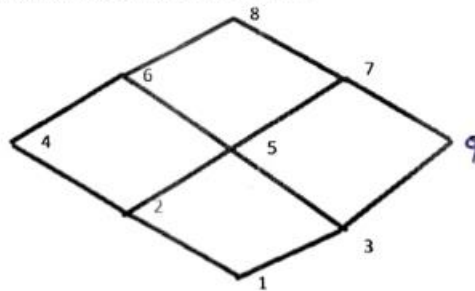


2022 – 2024 Batch Question Paper (Internal)

Bharati Vidyapeeth's
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FIRST SEMESTER [MCA] Internal Examination, December 2022

Paper Code: MCA-101	Subject: Discrete Structures
Time: 2 Hours	Maximum Marks: 45
Note: Attempt THREE questions in all. Question No. 1 is compulsory, and attempt one question from each unit.	

1. Answer all the following questions briefly: - 1.5 × 10 = 15
- (a) Prove $A \cap (B-C) = (A \cap B) - (A \cap C)$ CO1
 - (b) Make a Venn diagram and shade $A \cap B'$ CO1
 - (c) Determine which relation is a function with domain {1,2,3,4}. If any relation is not a function, explain why. i) $R_1 = \{(1,1)(2,1)(3,1)(4,1)(3,3)\}$ ii) $R_2 = \{(1,2)(2,3)\}$ CO2
 - (d) Develop CNF of the $(p \rightarrow (p \wedge (q \rightarrow p)))$ CO2
 - (e) Prove by mathematical Induction if $n \geq 1, 1(1!) + 2(2!) + 3(3!) + \dots + n(n!) = (n+1)! - 1$ CO1
 - (f) Develop the existential formula for the sentence "Not all rainy days are cold" considering $R(d)$: Rainy days and $C(x)$: Cold days CO2
 - (g) Assume $A = \{1,2,3,4,5,6,8,9,12,18,24\}$. Consider partial order of divisibility on A. Draw Hasse diagram for the PoSet. CO2
 - (h) Determine whether the relation R is a partial order on the Set S if $S = Z$ and aRb iff $a=2b$ CO2
 - (i) Determine all possible sublattices from this lattice CO2



- (h) Seven members of a family have total Rs. 2886 in their pockets. How much money will be found at least in one of persons pocket. CO1

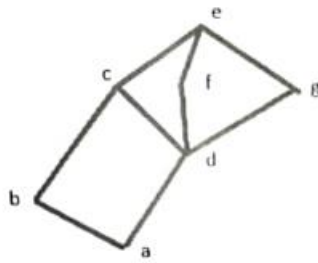
UNIT - I

2. (a) Assuming repetitions are not allowed, how many 4 digit numbers can 5 CO1

- be formed from 6 digits 1, 2, 3, 5, 7, 8?
- ii) How many of these are less than 4000?
- iii) How many in part i) are even?
- iv) How many in part i) contain both 3 and 5? 5 CO2
- (b) Consider $A = \{4, 6, 8, 10\}$ and $R = \{(4,4), (4,10), (6,6), (6,8), (8,10)\}$
- Evaluate
- i) Reflexive closure
- ii) Symmetric closure
- iii) Transitive closure
- (c) Find the solution of recurrence relation $a_r = a_{r-1} + 2a_{r-2}$ with $a_0=2$ and $a_1=7$ 5 CO3
3. (a) A survey on a sample of 25 new cars being sold by an auto dealer was conducted to see which of the three popular options: air conditioning, radio and power windows were already installed. The survey found: 15 had air conditioner, 12 had radio, 11 had power windows, 5 had air conditioner and power windows, 9 had air conditioner and radio, 4 had radio and power windows and 3 had all 3 options. Find no. of cars
- i) Only power window
- ii) Only one of the options
- iii) At least one option
- iv) None of the options
- (b) Justify by giving example of relation R_1, R_2, R_3 and R_4 on $A = \{a, b, c, d\}$ 5 CO2
- having property
- i) R_1 is irreflexive and antisymmetric
- ii) R_2 is asymmetric and antisymmetric
- iii) R_3 is asymmetric but $R_3 \cup R_3^{-1}$ is symmetric
- iv) R_4 is transitive but $R_4 \cup R_4^{-1}$ is not transitive
- (c) Solve the recurrence relation $a_r + a_{r-1} + a_{r-2} = 0$ and find the particular 5 CO3
- solution if $a_0 = 0$ and $a_1 = 2$

UNIT - II

4. (a) Prove the argument is valid by specifying rules 5 CO2
- i) $p \rightarrow q, q \vee r, p \vee u, \neg r \mid - u$
- ii) $p \vee r, p \vee q \mid - q \vee r$
- (b) Determine whether following lattice is distributive, complementary, 5 CO2
- both or neither



- (c) Minimize expression using k-map $F(A,B,C,D) = \sum(0,1,2,3,5,7,8,9,11,14)$ 5 CO3
- (a) Draw the Hasse diagram of D_{12} and find the complement of each element in D_{12} 5 CO3
- (b) i) Construct an argument using rules of inference to show that the hypothesis "she worked hard", "If she works hard, then she is intelligent" and if she is intelligent, then she will not go for movie" Therefore "She will not go for movie"
- ii) Let $p(x)$ = x is weak student, $q(x)$ = x is logical, $r(x)$ = x is able to pass exam. Assume universe as set of students. Express the following in quantifiers
1. Weak students are illogical
 2. Weak students are not able to pass exam
- (c) Minimize the four variable expression $f(A,B,C,D) =$ 5 CO3
 $ABC'D + A'BCD + A'B'C + A'B'D' + AC' + AB'C + B'$