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**PRESIDENCY UNIVERSITY  
BENGALURU**

**SCHOOL OF ENGINEERING**

**MAKE UP EXAMINATION – JAN 2023**

**Course Code:** CSE2016  
**Course Name:** Discrete Mathematical Structures  
**Program:** B.Tech (CSE)

**Date:** 24-JAN-2023  
**Time:** 01:00 PM – 04:00 PM  
**Max Marks:** 100  
**Weightage:** 50%

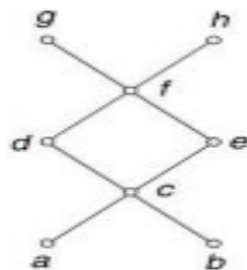
**Instructions:**

- (i) Read all the questions carefully and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and Non-programmable calculators are permitted.

**Part A [Memory Recall Questions]**

**Answer ALL the questions. Each question carries TWO marks. (10Q x 2M = 20M)**

1. Express the following sentence into a logical expression: “You can access the internet only if you are a computer science major or you are not a freshman.”  
(C.O.No.1) [Knowledge]
2. For the conditional statement “If file system is not locked then new messages will be queued”, write the converse and contrapositive.  
(C.O.No.1) [Knowledge]
3. What is the power set of the set  $S = \{ 0, \emptyset, \{\emptyset\} \}$ ?  
(C.O.No.2) [Knowledge]
4. The value of the floor function at  $- 8.6$ , i.e.,  $\lfloor - 8.6 \rfloor$  is \_\_\_\_\_ and the value of the ceiling function at  $- 7.4$ , i.e.,  $\lceil - 7.4 \rceil$  is \_\_\_\_\_.  
(C.O.No.2) [Knowledge]
5. Represent the relation  $R = \{ (a, b) \mid a \text{ divides } b \}$  defined on the set  $A = \{1, 2, 3, 4\}$ , in the form of a matrix.  
(C.O.No.2) [Knowledge]
6. Let  $R = \{ (1, 2), (3, 4), (2, 2) \}$  and  $S = \{ (4, 2), (2, 5), (3, 1), (1, 3) \}$  be relations.  
(a) What is the composition of R and S? (b) What is the composition of S and R?  
(C.O.No.2) [Knowledge]
7. For the given Hasse diagram, identify the maximal and minimal elements.



(C.O.No.3) [Knowledge]

8. Define a total ordered set. (C.O.No.3) [Knowledge]
9. What are the values of  $y$  which satisfy the linear congruence  $3y \equiv 4 \pmod{7}$ ? (C.O.No.4) [Knowledge]
10. The number of  $r$ -permutations with no repetition is \_\_\_\_\_ and the number of  $r$ -combinations with repetition is \_\_\_\_\_. (C.O.No.4) [Knowledge]

### Part B [Thought Provoking Questions]

**Answer ALL the questions. Each question carries TEN marks. (5Q x 10M = 50M)**

11. Verify that  $p \vee (q \wedge r)$  and  $(p \vee q) \wedge (p \vee r)$  are logically equivalent. (C.O.No.1) [Comprehension]
12. Establish the validity of the following argument: "All integers are rational numbers. Some integers are powers of 2. Therefore, some rational numbers are powers of 2". (C.O.No.1) [Comprehension]
13. The function  $f : \mathbb{R} \rightarrow \mathbb{R}$  is defined by  $f(x) = 2x + 1$ , for  $x \in \mathbb{R}$ . Show that  $f$  is invertible and find the inverse of  $f$ . (C.O.No.2) [Comprehension]
14. Let  $R$  be the relation on the set of ordered pairs of positive integers such that  $((a, b), (c, d)) \in R$  if and only if  $a + d = b + c$ . Verify that  $R$  is an equivalence relation. (C.O.No.3) [Comprehension]
15. a) What is the least number of area codes needed to guarantee that the 25 million phones in a state can be assigned distinct 10-digit telephone numbers? (Assume that telephone numbers are of the form  $NXX-NXX-XXXX$ , where the first three digits form the area code,  $N$  represents a digit from 2 to 9 inclusive, and  $X$  represents any digit.)
- b) How many ways are there to distribute 5 cards to each of four players from the standard deck of 52 cards? (C.O.No.4) [Comprehension]

### Part C [Problem Solving Questions]

**Answer ALL the questions. Each question carries FIFTEEN marks.**

**(2Q x 15M = 30M)**

16. Consider the poset  $(P, \leq)$ , where  $P = \{1, 2, 3, 5, 30\}$  and the partial ordered relation  $\leq$  is defined as  $x \leq y$  if and only if " $x$  divides  $y$ ". Show that the poset  $(P, \leq)$  is a lattice. Hence verify that the lattice is a distributive lattice. (C.O.No.3) [Comprehension]
17. a) Solve the system of congruences  $x \equiv 2 \pmod{3}$ ,  $x \equiv 3 \pmod{5}$  and  $x \equiv 2 \pmod{7}$ .
- b) Solve the recurrence relation  $a_n = 6a_{n-1} - 9a_{n-2}$ . (C.O.No.4) [Comprehension]