Code No.: DS402PC          R20   H.T.No. | | | 8 | R | | | | |

## CMR ENGINEERING COLLEGE: : HYDERABAD
## UGC AUTONOMOUS
### II–B.TECH–II–Semester End Examinations (Supply) - February- 2024
### DISCRETE MATHEMATICS
### (Common to CSC, CSD, AI&DS)

[Time: 3 Hours]                                                    [Max. Marks: 70]

**Note:** This question paper contains two parts A and B.
Part A is compulsory which carries 20 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

### PART-A                                                        (20 Marks)

1. a) Which of these sentences are propositions? What are the truth values of those that are propositions?   [2M]
   i) Boston is the capital of Massachusetts.
   ii) Miami is the capital of Florida.
   iii) $2 + 3 = 5$.
   iv) $5 + 7 = 10$.
   b) Construct a truth table for each of the compound proposition $p \rightarrow (\sim q \vee r)$   [2M]
   c) List the members of these sets.   [2M]
   i) $\{x \mid x$ is a real number such that $x^2 = 1\}$
   ii) $\{x \mid x$ is a positive integer less than 12$\}$
   d) Determine the relation $R=\{(0, 0), (1, 1), (2, 0), (2, 2), (2, 3), (3, 3)\}$ on set $\{0, 1, 2, 3\}$ is partial ordering relation or not   [2M]
   e) Explain the Principle of Mathematical Induction.   [2M]
   f) Differentiate between tractable and intractable problems.   [2M]
   g) Find the probability that a card selected at random from a standard deck of 52 cards is an ace?   [2M]
   h) List and explain the initial conditions of a recurrence relation.   [2M]
   i) Find the chromatic number of a complete graph with n vertices $K_n$.   [2M]
   j) Construct a complete binary tree of height 3.   [2M]

### PART-B                                                        (50 Marks)

2. a) Show that $\sim p \vee (\sim p \wedge q)$ and $(\sim p \wedge \sim q)$ are logically equivalent.   [5M]
   b) Show that $\sim p \wedge q, \sim q \vee r, \sim r \Rightarrow \sim p$.   [5M]

**OR**

3. Translate each of these statements into logical expressions using predicates, quantifiers and logical connectives.   [10M]
   i) Something is not in the correct place.
   ii) All tools are in the correct place and are in excellent condition.
   iii) Everything is in the correct place and in excellent condition.
   iv) Nothing is in the correct place and is in excellent condition.
   v) One of your tools is not in the correct place, but it is in excellent condition.

4. a) Show that A relation $R$ on $A$ is symmetric if and only if $R = R^{-1}$.   [5M]
   b) A relation $R$ on $A$ is reflexive if and only if $R -1$ is reflexive   [5M]

**OR**

5. a) Draw the Hasse diagram representing the partial ordering.   [5M]
      $\{(a, b) / a$ divides $b \}$ on $\{1,2,3,4,6,8,12 \}$.
   b) Give a poset that has   i). a minimal element but no maximal element.   [5M]
      ii). a maximal element but no minimal element.   iii). neither a maximal nor a minimal element.

6.a) Describe the bubble sort algorithm [4M]
  b) Apply bubble sort algorithm to sort the list 5, 2, 4, 1, 3 and Give a Big-O estimate for [6M]
     the number of comparisons used by the bubble sort

**OR**

7. Prove by Mathematical induction that $6^{n+2} + 7^{2n+1}$ is divisible by 43 for each positive [10M]
   integer n.

8.a) Define expected value variance of a random variable? [4M]
  b) State Bayes' theorem and use it to find p(F | E) if p(E | F) = 1/3, p(E | F) = 1/4 and [6M]
     p(F) = 2/3, where E and F are events from a sample space S

**OR**

9. Derive the recurrence relation of the Fibonacci series of numbers and find its time [10M]
   complexity.

10.a) Prove that a complete graph $Kn$ is planar if and only if $n \leq 4$. [5M]
   b) If G is a connected planar graph, then prove that $V - E + R = 2$. [5M]

**OR**

11. Define Spanning tree. Apply Krushkal's algorithm to find minimum spanning tree on [10M]
    the following weighted graph.



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