Reg. No. ☐☐☐☐☐☐☐☐☐☐☐☐☐

BCACACN 201

Second Semester B.C.A. Degree Examination, July/August 2023
(NEP 2020) (2021 – 22 Batch Onwards)
DISCRETE MATHEMATICAL STRUCTURES (DSCC)

Time : 2 Hours   Max. Marks : 60

Note : *Answer **any six** questions from Part – **A** and **one full** question from **each** Unit in Part – **B**.*

PART – A

(6×2=12)

1. a) Represent the following using Venn diagram.

   i) $A \cup B$ ii) $A \cap B$

   b) Express the statement through appropriate symbols :

   It is not raining still it is pleasant.

   c) Let $x = \{1,5,p,Jack\}$, $Y = \{2,5,7,q,Jill\}$ and $f=\{(1,2), (5,7), (p,q), (Jack, q)\}$. Find D_f and R_f.

   d) How many ways are there to select 5 players from a 10-member tennis team to make a trip to a match at another college ?

   e) What is the probability that when two dice are rolled, the sum of the numbers on the two dice is 7 ?

   f) What are the quotient and remainder when 101 is divided by 11 ?

   g) How many edges are there in a graph with 10 vertices each of degree 6 ?

   h) Define root node and leaf node.

PART – B

Unit – I

2. a) Write which of these is a tautology or a fallacy with the help of truth table.

   i) $p \vee \rceil (p \wedge q)$ ii) $(p \wedge q) \wedge \rceil (p \wedge q)$

   b) A = {1, 2, 3}, B = {1, 2, 5, 7, 9}. Write A + B, A $\cup$ B and A $\cap$ B.

   c) Let X = {1, 2, 3, . . . , 7} and R = {(x, y) | x − y is divisible by 3}. Show that R is an equivalence relation.   **(4+4+4)**

3. a) Show the following implications :

   i) $(p \wedge q) => (p \rightarrow q)$ ii) $p => (q \rightarrow p)$

   b) A = {α, β} and B = {1, 2, 3}. Find A^2, B^2, A × B and B × A.

   c) R = {(1, 2), (3, 4), (2, 2)}, S = {(4, 2), (2, 5), (3, 1), (1, 3)}. Write R ∘ S, R ∘ R, S ∘ S and S ∘ R.   **(4+4+4)**

Unit – II

4. a) Draw the Hasse diagram of the set A, under the partial ordering relation "divides" and indicate whether it is totally ordered. A = {1, 2, 3, 6, 12}.

   b) Let X = {1, 2, 3}. f, g, h and s are the functions from X to X given by

   f = {(1, 2), (2, 3), (3, 1)}, h = {(1, 1), (2, 2), (3, 1)}

   g = {(1, 2), (2, 1), (3, 3)}, s = {(1, 1), (2, 2), (3, 3)}. Find f ∘ g, g ∘ f, h ∘ s and f ∘ s.

   c) How many bit strings of length eight, either start with a 1 bit or end with two bits 00 ?   **(4+4+4)**

5. a) Define Surjective and Bijective functions with example.

   b) There are 18 mathematics majors and 325 computer science majors at a college. In how many ways can two representatives be picked so that one is a mathematics major and the other is a computer science major ?

   c) A group of 30 people have been trained as astronauts to go on the first mission to Mars. How many ways are there to select a crew of six people to go on this mission (assuming that all crew members have the same job) ?   **(4+4+4)**

Unit – III

6. a) What is the probability that a positive integer selected at random from the set of positive integers not exceeding 100 is divisible by either 2 or 5 ?

   b) What is the expected value of the sum of the numbers that appear when a pair of fair dice is rolled ?

   c) Find the greatest common divisor of 414 and 662 using the Euclidean algorithm. **(4+4+4)**

7. a) A sequence of 10 bits is randomly generated. What is the probability that at least one of these bits is 0 ?

   b) Find the prime factorization of 7007.

   c) Use mathematical induction to prove the inequality $n < 2^n$ for all positive integers n. **(4+4+4)**

Unit – IV

8. a) Find the in-degree and out-degree of each vertex in the graph G with directed edges as shown in the figure :
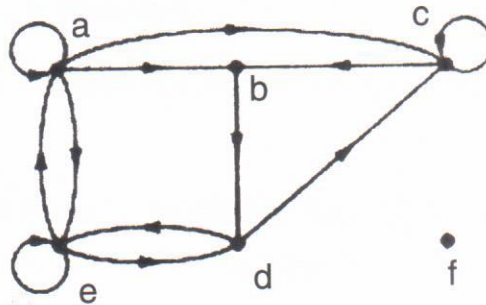
   b) Construct the dual graph for the given map. Find the number of colors needed to color the map so that no two adjacent regions have the same color. **(6+6)**
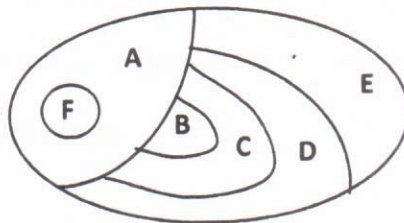
9. a) Define the following with example :

   i) Binary tree

   ii) Pendent node

   iii) Multigraph.

   b) Convert the following tree into a binary tree.   **(6+6)**

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