Reg. No. | | | | | | | | | | | | |

BCACACN 201

Second Semester B.C.A. Degree Examination, June/July 2024
(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) Define proper subset. Give example.
   b) Represent i) $A \cap B$ ii) $A - B$ using Venn diagram.
   c) Define bijective function. Give an example.
   d) An office building contains 27 floors and has 37 offices on each floor. How many offices are in the building ?
   e) Define independent events.
   f) What is the least common multiple of 17, 17^{17} ?
   g) Define isolated node with an example.
   h) Define a complete graph with an example.

PART – B

Unit – I

2. a) Show the following implications : i) $(P \wedge Q) \Rightarrow (P \to Q)$ ii) $P \Rightarrow (Q \to P)$.
   b) R = {(1, 1), (1, 2), (1, 4), (2, 1), (2, 2), (2, 3), (3, 2), (3, 3), (4, 2), (4, 4)}. Construct relation matrix of R and draw digraph of R.
   c) A = {1, 2, 3}, B = {1, 2, 5, 7, 9}. Write A + B, $A \cup B$ and $A \cap B$. **(4+4+4)**

3. a) Show the following equivalences :
   i) $P \to (Q \to P) \Leftrightarrow \neg P \to (P \to Q)$
   ii) $P \to (Q \vee R) \Leftrightarrow (P \to Q) \vee (P \to R)$.
   b) R = {(1, 2), (3, 4), (2, 2)}, S = {(4, 2), (2, 5), (3, 1), (1,3)}. Write $R \circ R$, $S \circ R$ and $R \circ (S \circ R)$.

P.T.O.

c) Given the relation matrices . Find $M_{R \circ S}$, $M_{\widetilde{R \circ S}}$.

$$M_R = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix}, M_S = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \end{bmatrix}.$$

(4+4+4)

Unit – II

4. a) Let X = {2, 3, 6, 12, 24, 36} and the relation <= be such that $x \le y$, if x divides y. Draw the Hasse diagram of $(X, \le)$.

b) Let $f(x) = x + 2$, $g(x) = x - 2$ and $h(x) = 3x$ for $x \in R$, R is a set of real numbers. Find $f \circ g$, $f \circ f$ and $f \circ (h \circ g)$.

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) 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 $s \circ s$, $f \circ h \circ g$, $s \circ g$ and $f \circ s$.

b) How many ways are there to select a first-prize winner, a second-prize winner and a third-prize winner from 100 different people who have entered a contest ?

c) Show that functions $f(x) = x^3$ and $g(x) = x^{1/3}$ for $x \varepsilon R$ are inverse of one another. **(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) Find the greatest common divisor of 414 and 662 using the Euclidean algorithm.

c) Show that if n is a positive integer, then $1 + 2 + ... + n = \frac{n(n+1)}{2}$. **(4+4+4)**

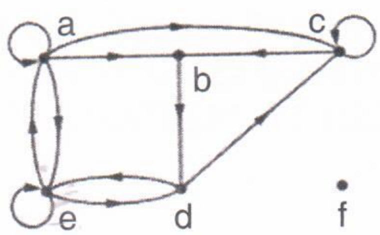
7. a) What is the conditional probability that a family with two children has two boys, given they have at least one boy ?

b) Find the prime factorization of 7007.

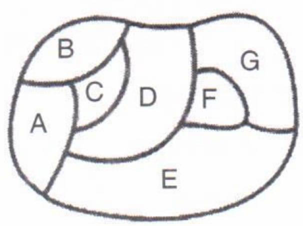
c) What is the variance of the random variable X, where X is the number that comes up when fair die is rolled ? **(4+4+4)**

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.

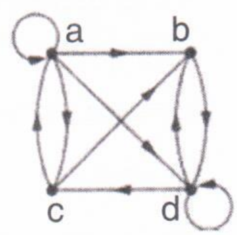


b) Construct the dual graph for the given map. Then find the number of colors needed to color the graph so that no two adjacent regions have the same color.

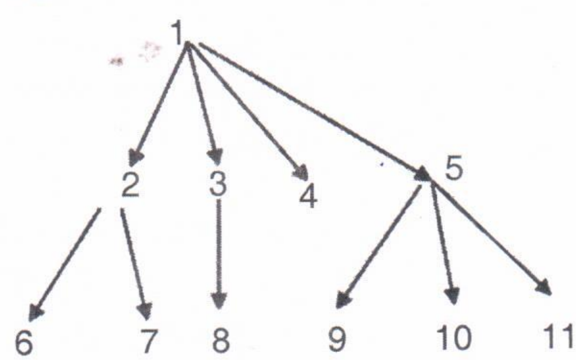


(6+6)

9. a) Represent the given graph with an adjacency list and adjacency matrix.



b) Convert the following tree into a binary tree.



(6+6)