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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

First Semester, Master of Computer Applications (MCA)

Semester End Examination; Jan. - 2020

Discrete Mathematical Structures

Time: 3 hrs Max. Marks: 100

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. How many numbers greater than 1000000 can be formed by using the digits 1, 2, 2, 2, 4, 4, 0? 6

b. Find the number of permutations of the letter of the following words, 7

i) PROGRESS ii) TOPOLOGY iii) ENGINEERING

c. Find the coefficient of the following, 7

i) $x^3 y^3 z^3 w^1$ in the expansion of $\left(2x+\frac{y}{3}-z+w\right)^{10}$

ii) $a^5 b^{10} c^{15}$ in the expansion of $\left(\frac{a}{2}+4b+3c+d\right)^{30}$

2 a. For any three sets A, B, C prove that $A\cup(B\cap C)=(A\cup B)\cap(A\cup C)$ 6

b. In a sample of 100 logic chips. 23 have a defect D_1, 26 have a defect D_2, 30 have defect D_3, 7 have defects D_1 and D_2, 8 have defective D_1 and D_3, 10 have defectives D_2 and D_3 and 3 have all three defectives. Find the number of chips having, (i) at least one defective (ii) no defect. 7

c. A fair die is tossed twice. Find the probability that, 7

(i) Even numbers occur on both throws

(ii) An even number occurs at least one throw.

UNIT - II

3 a. Verify that: $[p\rightarrow(q\rightarrow r)]\rightarrow[(p\rightarrow q)\rightarrow(p\rightarrow r)]$ is tautology. 6

b. Prove: $\neg[\{(p\vee q)\wedge r\}\rightarrow\neg q]\Leftrightarrow q\wedge r$ is logical equivalence by using laws. 7

c. Express symbolically and check validity of the given argument 7

Ram will get driving license or

He will join as a job driver

If Ram do not get loan, Ram will join as a job driver

Ram got DL, Therefore Ram will not join as a job driver.

4 a. Define quantifiers with an example. 4

b. Define rule of universal specification and generalization. 4

c. Write down the following proposition in symbolic form and find its negation "For all integers *n*, if *n* is not divisible by 2 then *n* is odd" 6

Contd…2

d. Prove that the following argument is valid 6

$$\begin{array}{l} \forall x[p(x) \rightarrow q(x)] \\ \forall x[q(x) \rightarrow r(x)] \\ \neg r(c) \\ \hline \therefore \neg p(c) \end{array}$$

UNIT - III

5 a. If n is a positive integer then prove that $1.2 + 2.3 + 3.4 + \ldots.. + n(n+1) = \frac{n(n+1)(n+2)}{3}$ 6

b. Define One–One function, Onto function and find the number of One-One and Onto functions from a set of m elements to a set of n elements. 7

c. Write the recursively relation for, 7

i) $a_n - 4n + 1 \quad a_0 = 1, n \geq 1$

ii) $a_n = 5a_{n-1}, n \geq 1, a_0 = 2.$

6 a. Show that if seven numbers are selected 1 to 12, then two of them will add upto 13. 6

b. State pigeon hole principle. Find the least number of ways of choosing three different numbers from 1 to 10 so that all choices have the same sum. 7

c. Define permutation function, Hashing function and characteristic function. 7

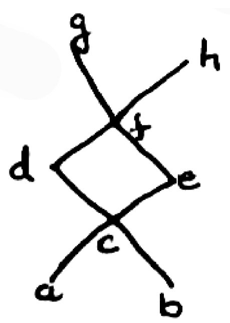
UNIT - IV

7 a. Let A = {1, 2, 3, 4, 6} and R be a relation on A defined by *a R b* iff *a* is a multiple of *b* represent *R* as a set of ordered pairs. Draw the diagraph and matrix representation of *R*. 6

b. Define partially ordered set and draw the Hasse diagram of all positive divisors of 36. 7

c. Prove that the Relation R = {(1, 1) (1, 2) (2, 1) (2, 2) (3, 4) (4, 3) (3, 3) (4, 4)} is an equivalence relation defined on the set A = {1, 2, 3, 4}. Also determine the partition induced. 7

8 a. Consider the Hasse diagram of a poset (A, R) given below, 6



If $B = \{c, d, e\}$ find,

i) All upper bounds of B

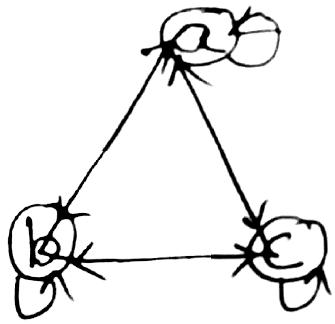
ii) All lower bounds of B

iii) The LUB of B

iv) The GLB of B

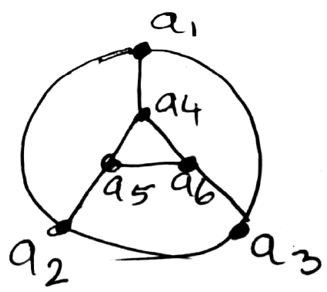
b. Draw four graphs that represent a lattice with valid reason. 7

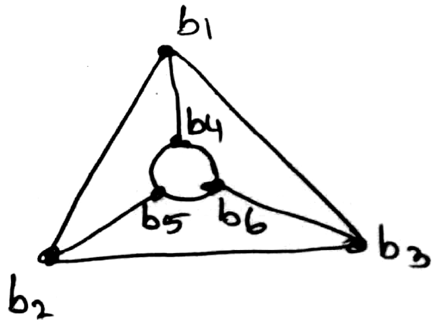
c. A relation R on the set {a, b, c} is represented by the diagraph below. Write *R* and prove that *R* is an equivalence relation. 7



UNIT - V

9 a. Show that the graphs are isomorphic, 6





b. Write short note on Konigsberg bridge problem related to origin of graph theory. 7

c. Prove that "A graph with *n* vertices is a tree if it is connected, posses (*n*–1) edges and conversely". 7

10 a. Define Rooted tree, M–ary tree and Balanced tree with an example for each. 6

b. Construct an optimal prefix code for the letters of the word ENGINEERING. Hence deduce the code for this word. 7

c. Define minimal spanning tree. Write an algorithm to find minimal spanning tree using Krushkal's algorithm. 7

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