4E 4161

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B.Tech. IV semester (Main/Back) Examination, May 2018
Computer Science & Engg.
4CS2A Discrete Mathematical Structures
CS,IT

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 26

Instructions to Candidates:

*Attempt any **five** questions, selecting **one question** from **each unit**. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Unit - I

1. a) If $A \cap C \subseteq B \cap C$ and $A \cap \overline{C} \subseteq B \cap \overline{C}$ then show that $A \subseteq B$. **(4)**

   b) Determine the number of positive integers n where $1 \le n \le 100$ and n is not divisible by 2,3 or 5. **(4)**

   c) Explain pigeonhole and extended pigeonhole principle with example. **(8)**

OR

1. a) Write short notes on

      i) Principle of Inclusion and Exclusion

      ii) Recursive Definition of sets **(4+4)**

   b) Show that the set of odd positive integers is a countable set. **(8)**

Unit - II

2. a) Let R be the relation defined on a set of natural numbers N such that for $x, y \in N, xRy \Leftrightarrow x - y$ is divisible by 3, then show that R is an equivalence relation on N. Find equivalence classes also. **(8)**

   b) Using Warshall's algorithm, find the transitive closure of the relation $R = \{(a,a),(a,b),(a,d),(c,b),(c,c),(d,b)(d,c),(d,d)\}$ on {a,b,c,d}. **(8)**

OR

2. a) If R and S be two equivalence relations in a set A, then prove that $R \cap S$ is also an equivalence relation in A. **(8)**

[Contd....

b) Draw the Hasse diagram and answer the following concerning the poset ({2,4,6,9,12,18,27,36,48,60,72}

i) Find the maximal and minimal elements

ii) Find the greatest and least elements, if exists

iii) Find LUB of {2,9}, if exists

iv) Find GLB of {60,72}, if exists *(8)*

Unit - III

3. a) Prove that there is no rational number $\frac{a}{b}$ whose square is 2. **(5)**

b) Give an indirect proof of the theorem "If 3n+2 is odd, then n is odd". **(5)**

c) Prove that the binary search algorithm works correctly for every ordered list of size $n \geq 0$. **(6)**

OR

3. a) Find and prove a formula for the sum of the first n cubes, that is, $1^3+2^3+....+n^3$. **(5)**

b) Find gcd of 414 and 662 using Euclidean algorithm. **(5)**

c) Sort the list X = {64, 25, 12, 22, 11} using selection sort algorithm. **(6)**

Unit - IV

4. a) Explain the following terms with example

i) Ring sum of two graphs

ii) Isomorphic Graphs

iii) Eulerian Graph

iv) Hamiltonian Graph **(4×2=8)**

b) Define chromatic number of a graph. Show that a graph G with one or more edges is bipartite if and only if the chromatic number of G is 2. **(8)**

OR

4. a) Suppose that G = (V, E) be a graph with k - component, where each component is a tree. Derive a formula in terms of $|V|,|E|$ and k. **(8)**

b) Explain the krushal algorithm with example. **(8)**

Unit - V

5. a) Show that $\sim(p \vee (\sim p \wedge q)) = ((\sim p) \wedge (\sim q))$ **(4)**

b) Define conditional and biconditional statements. Explain the following terms by giving suitable example

i) Converse

ii) Contrapositive

iii) Inverse **(4)**

c) Obtain the principle disjunctive normal form of $(p \wedge q) \vee (\sim p \wedge r) \vee (q \wedge r)$ by constructing truth table. **(8)**

OR

5. a) Write an english sentence corresponding to each of the following :

a) $\forall x P(x)$

b) $\exists x Q(x)$

c) $\forall x \exists y R(x, y)$

d) $\exists x \forall y R(x, y)$

e) $\forall x (\sim Q(x))$

f) $\exists y (\sim Q(y))$

g) $\sim (\exists x P(x))$

h) $\sim (\forall x Q(y))$

Where P(x) : x is even

Q(x) : x is prime numbers

R(x,y) : (x+y) is even, $x, y \in z$ (set of integers) **(8)**

b) Examine the validity of the following arguments, "If prices are higher than wages are high. Prices are high or there are price controls. 'If there are price controls then there is not an inflation. There is an inflation therefore wages are high". **(8)**