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Total No of Pages: **4****4E4161****4E4161**

B.Tech. IV-Sem (Main & Back) Exam; June-July 2016
Computer Science & Engineering
4CS2A Discrete Mathematical Structures
Common with CS, IT

Time: 3 Hours**Maximum Marks: 80****Min. Passing Marks (Main & Back): 26****Min. Passing Marks (Old Back): 24****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.

Use of following supporting material is permitted during examination.
 (Mentioned in form No.205)

1. _____

2. _____

UNIT-I

Q.1 (a) Among integers 1 to 1000

(i) How many of them are not divisible by 3 nor by 5 nor by 7? [8]

(ii) How many not divisible by 5 or 7 but divisible by 3?

(b) (i) Let there are 5 separate departments in a departmental store and the total number of employees are 36. Show that one of the departments must have at least 8 employees. [4]

(ii) Define with example. [4]

(a) Countable and uncountable sets

(b) Mod functions and Div functions

ORQ.1 (a) Prove that $A - B = A \cap B' = B' \cap A'$ [4]

(b) Consider the following collection of subsets [4]

 $\{A_1, A_2, A_3\}$ of a set $A = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ [a] $\{\{1, 6, 9\}, \{2, 3, 8\}, \{4, 5, 7, 10\}\}$ [b] $\{1\}, \{2, 4, 8\}, \{5, 7, 9\}$ and[c] $\{\{1, 5\}, \{2, 3, 8\}, \{4, 5, 6, 7, 9, 10\}\}$

Determine which one is a partition of a set A

- (c) Let f, g, h be mapping from N to N when N is the set of naturals such that
- $$f(n) = n + 1, \quad g(n) = 2n, \quad h(n) = \begin{cases} 0, & n \text{ is even} \\ 1, & n \text{ is odd} \end{cases} \quad [8]$$

- (i) Show that f, g and h are functions
(ii) Determine $f \circ f, f \circ g, h \circ g$ and $(f \circ g) \circ h$
Where 'o' stands for composition of functions

UNIT-II

- Q.2 (a) Define equivalence Relation. 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]

(b) Let $A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 1 \\ 1 & 0 \\ 0 & 0 \end{bmatrix}$

Find $A \odot B$ and $B \odot A$, if defined [4]

- (c) What is closure of relations? Let $A = \{1, 2, 3, 4\}$ and $R = \{(1, 2), (2, 3), (3, 4)\}$ be a relation in A . find its reflexive closure, symmetric closure and transitive closure. [4]

OR

- Q.2 (a) An equivalence relation R on a set A decomposes A into equivalence classes which are either distinct or completely overlapping and the set A is the union of such distinct equivalence classes. [8]
- (b) Let $x = \{1, 3, 5, 7, 15, 21, 35, 105\}$ and R be the relation '1' (divides) on the set x then x is the poset. Draw the Hasse diagram of the given poset. Determine the following. [8]
- (i) LUB of 3 and 7
(ii) GLB of 15 and 35
(iii) Greatest and least element of X .

UNIT-III

- Q.3 (a) Define the following with examples. [12]
- (i) Direct proof.
(ii) Proof by contra-position.
(iii) Proof by exhausting cases.
(iv) Proof by contradiction.
- (b) Sort the list $x = [34, 13, 21, 3, 89]$ using bubble sort algorithm. [4]

OR

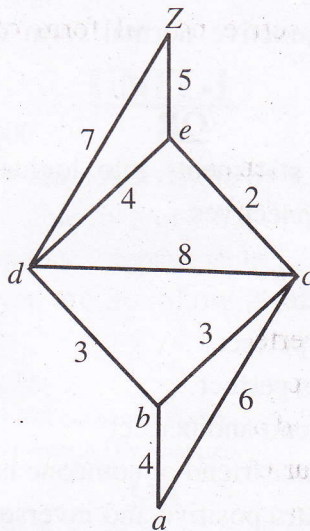
- Q.3 (a) Prove by mathematical induction that $6^{n+2} + 7^{2n+1}$ is divisible by 43 for each positive integer n. [8]
- (b) What is Linear and binary search algorithm. Show the correctness proof of linear and binary search algorithm. [8]

UNIT-IV

- Q.4 (a) Prove that the number of vertices of odd degrees in an undirected graph is always even. [4]
- (b) If G be a cyclic-free (acyclic) graph with n-vertices and r connected components, then G has n-r edges. [4]
- (c) Define Adjacency matrix and Incidence matrix with example. [8]

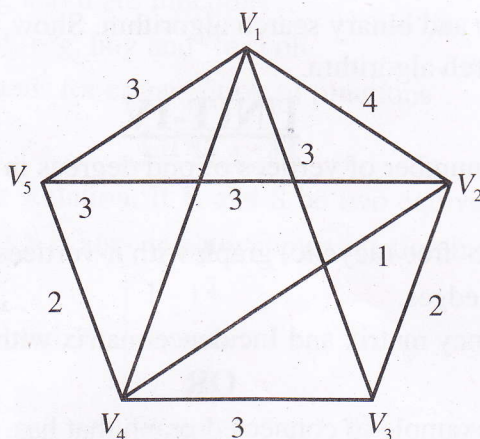
OR

- Q.4 (a) (i) Give an example of connected graph that has [4]
- (a) A Hamiltonian cycle but no Euler circuit
- (b) A Euler circuit but no Hamiltonian cycle
- (b) (ii) What is the length of shortest path between the vertices a to z in the following weighted graph [4]



- (c) (i) A woman bracelet is formed by placing three beads- red, white and blue, on a circular piece of wire. Bracelets are considered equivalent if one can be obtained from other by planar rotations. Find the pattern inventory of these bracelets. [4]

- (ii) By using Kruskal's algorithm determine a minimal spanning tree in the following graph. [4]



UNIT-V

- Q.5 (a) Prove that $(\sim p \wedge q) \rightarrow [\sim(q \rightarrow p)]$ is a tautology with constructing truth table. [8]
- (b) 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

- Q.5 (a) Translate each of these statements into logical expressions using predicates, quantifiers and logical connectives. [6]
- No one is perfect
 - Non everyone is perfect
 - All your friends are perfect
 - One of your friend is perfect
 - Everyone is your friend and perfect
 - Not every body is your friend or someone is not perfect.
- (b) Explain the converse, contra positive and inverse of the given implication "If it is snows today, then I will stay at home." [4]
- (c) Test the validity of the argument. [6]
- "If there was a ball game, then travelling was difficult. If they arrived on time, then travelling was not difficult. They arrived on time. Therefore, these was no ball game."