4E1213

Roll No. _____

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# 4E1213

## B. Tech. IV-Sem. (Back) Exam., Oct.-Nov. – 2020

## Computer Science & Engineering

## 4CS2-01 Discrete Mathematics Structure

## CS, IT

**Time: 2 Hours**



**Maximum Marks: 82**

**Min. Passing Marks: 29**

*Instructions to Candidates:*

***Attempt all ten questions from Part A, four questions out of seven questions from Part B and two questions out of five from Part C.***

*Schematic diagrams must be shown wherever necessary. Any data you feel missing may 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. NIL

2. NIL

## PART – A

**(Answer should be given up to 25 words only)** **[10×2=20]**

**All questions are compulsory**

Q.1 What do you mean by recursive definition of a set?

Q.2 Define Floor and Ceiling functions with example.

Q.3 Let A = {1, 2, 3, 4} and R be an equivalence relation on A which is defined as R = {(1, 1), (1, 2), (2, 1), (2, 2), (3, 4), (4, 3) (3, 3), (4, 4)}. Find A/R (Quotient set of A by R).

Q.4 Let $A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 0 & 1 \end{bmatrix}$

Find $A \vee B$ and $A \wedge B$.

Q.5 Prove that if n is an integer and $n^2 + 3$ is odd, then n is even.

Q.6 What is a Partial Correctness of a Program?

Q.7 A graph has degree sequence 1, 1, 2, 2, 2, 2, 4. Find the number of edges of this graph and draw the graph.

Q.8 Suppose that a connected planar graph has 30 edges and its planar representation divides the plane into 20 regions. How many vertices does this graph have?

Q.9 Define Converse, Contrapositive and Inverse.

Q.10 What is Disjunctive Syllogisms?

## PART – B

**(Analytical/Problem solving questions)** **[4×8=32]**

**Attempt any four questions**

Q.1 Among integers 1 to 1000,

(a) How many of them are not divisible by 3 nor by 5 nor by 7?

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

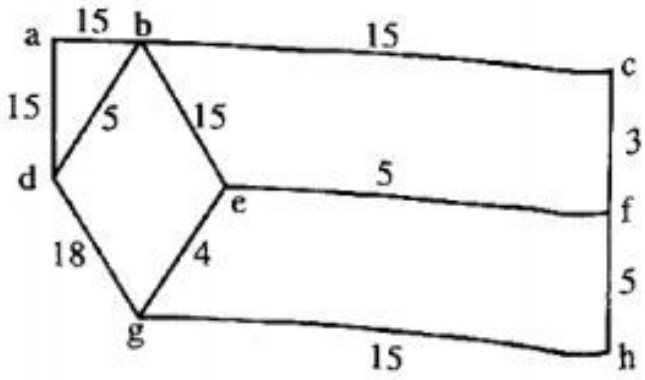
Q.2 Let A =Z, the set of integers relation R defined in A by aRb as "a is congruent to b mod 2". Prove that R is an equivalence relation.

Q.3 Prove that for all integers, $3^n > n^3$.

Q.4 Find the domain and range of $f(x) = \frac{ax+b}{cx-d}$.

Q.5 Prove that a simple graph with n vertices and k components can have at most $\frac{(n-k)(n-k+1)}{2}$ edges.

Q.6 Determine the minimal spanning tree in the following graph by using Kruskal's algorithm



# PART – C

**(Descriptive/Analytical/Problem Solving/Design Questions)** **[2×15=30]**

**Attempt any two questions**

Q.1 (a) Explain bubble and selection sort

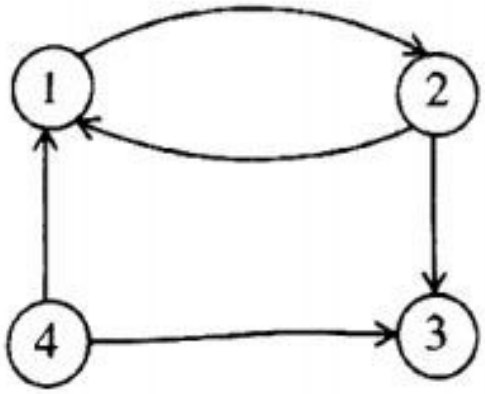
(b) Sort the list 29, 10, 14, 37, 13, 25 using the selection sort.

Q.2 (a) State and prove Principle of Inclusion and Exclusion.

(b) If (n + 1) integers are selected from the set {1, 2,....., 2n}, then show that one of them divides another integer that has been selected.

Q.3 (a) By using Warshall's algorithms, obtain the transitive closure of the relation R shown in the following figure:






(b) Show that $(Z^+, \text{divisibility})$ is a poset.

Q.4 (a) Let G be a connected planar graph with $n_v$ vertices, $n_e$ edges and $n_f$ faces. Then prove that $n_v - n_e + n_f = 2$.

(b) Find the number of paths of length 3 between two vertices of $K_4$.

Q.5 (a) Write an English sentence corresponding to each of the following:

(i) $\forall x\, P(x)$ (ii) $\exists x\, Q(x)$

(iii) $\forall x\, \exists y\, R(x, y)$ (iv) $\exists x\, \forall y\, R(x, y)$

(v) $\forall x\, (\sim Q(x))$ (vi) $\exists y\, (\sim Q(y))$

(vii) $\sim (\exists x\, P(x))$ (viii) $\sim (\forall x\, Q(y))$

Where $P(x)$: x is even, $Q(x)$: x is a prime number, $R(x, y)$: $x + y$ is even, $x, y \in I$ (set of integers).



(b) Examine the validity of the following argument.

"If prices are higher then 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".