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Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)
B.Tech.
SEM: III - CARRY OVER THEORY EXAMINATION - JUNE (2021 - 2022)
Subject: Discrete Structures

Time: 3 Hours Max. Marks: 100

General Instructions:
1. The question paper comprises three sections, A, B, and C. You are expected to answer them as directed.
2. Section A - Question No- 1 is 1 marker & Question No- 2 carries 2 mark each.
3. Section B - Question No-3 is based on external choice carrying 6 marks each.
4. Section C - Questions No. 4-8 are within unit choice questions carrying 10 marks each.
5. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION A 20

1. Attempt all parts:-

1-a. Two sets are called disjoint if there ______________ is the empty set. (CO1) 1
(a) Union
(b) Difference
(c) Intersection
(d) Complement

1-b. For two sets C and D the set (C – D) ∩ D will be __________ (CO1) 1
(a) C
(b) D
(c) Φ
(d) None of the mentioned

1-c. Let '*' be defined on the set N. Which of the following are both commutative and associative? (CO2) 1
(a) a*b=a+b
(b) a*b=a-b
(c) a*b=ab
(d) a*b=a

1-d. Which of the following is not a type of binary operation? (CO2) 1
(a) Transitive
(b) Commutative
(c) Associative
(d) Distributive

1-e. Which of the following relation is a partial order as well as an equivalence relation? (CO3) 1
(a) equal to(=)
(b) less than(<)
(c) greater than(>)
(d) not equal to(!=)

1-f. Let G be the graph defined as the Hasse diagram for the ⊆ relation on the set S{1, 2,..., 18}. How many edges are there in G? (CO3) 1
(a) 43722
(b) 2359296
(c) 6487535

(d) 131963

1-g. What is the value of x after this statement, assuming the initial value of x is 5? ‘If x equals to one then x=x+2 else x=0. (CO4) 1

(a) 1
(b) 3
(c) 0

1-h. Let P: If Sahil bowls, Saurabh hits a century.; Q: If Raju bowls, Sahil gets out on first ball. Now if P is true and Q is false then which of the following can be true? (CO4) 1

(a) Raju bowled and Sahil got out on first ball
(b) Raju did not bowled
(c) Sahil bowled and Saurabh hits a century
(d) Sahil bowled and Saurabh got out

1-i. Another name for the directed graph is (CO5) 1

(a) Direct graph
(b) Bigraph
(c) Dir-graph
(d) Digraph

1-j. The number of edges in a regular graph of degree 46 and 8 vertices is. (CO5) 1

(a) 123
(b) 187
(c) 184
(d) 186

2. Attempt all parts:-

2.a.	Define reflexive relation. (CO1)	2
2.b.	If (G, *) is a group and a is an element in G, such that a * a = a , then show that a = e , where e is identity element in G. (CO2)	2
2.c.	Write any two properties of lattices. (CO3)	2
2.d.	Show that ¬(¬p) and p are logically equivalent. (CO4)	2
2.e.	Describe is complete graph?(CO5)	2

SECTION B 30

3. Answer any <u>five</u> of the following:-

3-a.	If A, B, and C are sets,using example show that: A ∪ B ∪ C = A + B + C − A ∩ B − A ∩ C − B ∩ C + A ∩ B ∩ C. (CO1)	6
3-b.	Let f be the function from {a, b, c} to {1, 2, 3} such that f(a) = 2, f(b) = 3, and f(c) = 1. Is f invertible, and if it is, what is its inverse? (CO1)	6
3-c.	Let G be a group. Suppose that the number of elements in G of order 5 is 28. Determine the number of distinct subgroups of G of order 5. (CO2)	6
3-d.	Let x,y be generators of a group G with relation: $xy^2=y^3x$…(1), $yx^2=x^3y$...(2). Prove that G is the trivial group. (CO2)	6
3.e.	Draw the Hasse diagram of (A, ≤), where A= {3,4,12,24,48,72} and relation ≤ be such that a ≤ b if a divides b. (CO3)	6
3.f.	Use a truth table to verify the distributive law p ∧ (q ∨ r) ≡ (p ∧ q) ∨ (p ∧ r). (CO4)	6
3.g.	(i)Give an example of bipartite graph. (ii) Graph having neither Euler nor Hamiltonian circuit. (CO5)	6

SECTION C 50

4. Answer any <u>one</u> of the following:-

4-a. Explain the idea of Subset and Super set with example. State how a Null set can be a subset 10 of Singleton set. (CO1)

4-b. Prove the Distributive law of algebraic structure for Union and Intersection. (CO1) 10

5. Answer any <u>one</u> of the following:-

5-a. Let G be a group and let H1,H2 be subgroups of G such that H1 is not a subset of H2 and H2 is not a subset of H1. (a) Prove that the union H1 U H2 is never a subgroup in G. (b) Prove that a group cannot be written as the union of two proper subgroups.(CO2) 10

5-b. Let G be an abelian group. Let a and b be elements in G of order m and n, respectively. Prove that there exists an element c in G such that the order of c is the least common multiple of m and n. Also determine whether the statement is true if G is a non-abelian group.(CO2) 10

6. Answer any <u>one</u> of the following:-

6-a. for each of following expression . Find the minimum sum of product using k-map. 1). A'B'C' + AB'C' +A'BC' + ABC' (CO3) . 10

6-b. Answer these questions for the poset({3, 5, 9, 15,24, 45},). (CO3) 10

i. Find the minimal elements.
ii. Is there a greatest element?
iii. Is there a least element?
iv. Find all upper bounds of {3, 5}.

7. Answer any <u>one</u> of the following:-

7-a. Use proof by contradiction to prove that the sum of an irrational number and a rational number is irrational. (CO4) 10

7-b. Show that each of these conditional statements is a tautology by using truth tables. (CO4) 10

a) $(p \land q) \rightarrow p$,
b) $p \rightarrow (p \lor q)$,
c) $\neg p \rightarrow (p \rightarrow q)$,
d) $(p \land q) \rightarrow (p \rightarrow q)$,
e) $\neg(p \rightarrow q) \rightarrow p$, f) $\neg(p \rightarrow q) \rightarrow \neg q$

8. Answer any <u>one</u> of the following:-

8-a. Define planar graph. Prove that for any connected planar graph, v – e+ r = 2 Where v, e, r is the number of vertices, edges, and regions of the graph respectively. (CO5) 10

8-b. (a) Suppose a graph G contains two disctinct paths from vertex u to a vertex v. Show that G has a cycle. (b) Find the number of connected graph with 4 vertices. Also draw the graph. (CO5) 10