Printed Page:- Subject Code:- ACSE0306

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 - SEPTEMBER 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. What is the Cartesian product of A = {1, 2} and B = {a, b}? (CO1) 1

(a) {(1, a), (1, b), (2, a), (b, b)}

(b) {(1, 1), (2, 2), (a, a), (b, b)}

(c) {(1, a), (2, a), (1, b), (2, b)}

(d) {(1, 1), (a, a), (2, a), (1, b)}

1-b. What is the cardinality of the set of odd positive integers less than 10? (CO 1) 1

(a) 10

(b) 5

(c) 3

(d) 20

1-c. Let a binary operation '*' be defined on a set A. The operation will be commutative if _____. (CO 2) 1

(a) a*b=b*a

(b) (a*b)*c=a*(b*c)

(c) (b ○ c)*a=(b*a) ○ (c*a)

(d) a*b=a

1-d. A subgroup has the properties of _____. (CO 2) 1

(a) Closure, associative

(b) Commutative, associative, closure

(c) Inverse, identity, associative

(d) Closure, associative, Identity, Inverse

1-e. A Poset in which every pair of elements has both a least upper bound and a greatest lower bound is termed as _____ . (CO3) 1

(a) lattice

(b) sublattice

(c) trail

(d) walk

1-f. The relation $\leq$ is a partial order if it is _____. (CO 3) 1

(a) reflexive, antisymmetric and transitive

(b) reflexive, symmetric

(c) asymmetric, transitive

(d) irreflexive and transitive

1-g. 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-h. $(p \rightarrow q) \wedge (p \rightarrow r)$ is logically equivalent to _____ . (CO 4) 1

(a) $p \rightarrow (q \wedge r)$

(b) $p \rightarrow (q \vee r)$

(c) $p \wedge (q \vee r)$

(d) $p \vee (q \wedge r)$

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

(a) Direct graph

(b) Bigraph

(c) Dir-graph

(d) Digraph

1-j. The degree of any vertex of graph is. (CO 5) 1

(a) The number of edges incident with vertex

(b) Number of vertex in a graph

(c) Number of vertices adjacent to that vertex

(d) Number of edges in a graph

2. Attempt all parts:-

2.a. Name three operations possible on Sets. (CO1) 2

2.b. Show that G = {1, -1} is an abelian group under multiplication. (CO 2) 2

2.c. Define POSET with suitable example. (CO 3) 2

2.d. Use truth tables to verify the associative laws: 2

$(p \vee q) \vee r \equiv p \vee (q \vee r)$. (CO 4)

2.e. Define isomorphism between two graphs. (CO 5) 2

SECTION B 30

3. Answer any five of the following:-

3-a. Let f and g be the functions from the set of integers to the set of integers defined by f(x) = 2x + 3 and g(x) = 3x + 2. What is the composition of f and g? What is the composition of g and f ? (CO 1) 6

3-b. What is recurrence relation. Also define order and degree of recurrence relation. (CO1) 6

3-c. Show that G = {1, w, w^2} is an abelian group under multiplication. Where 1, w, w^2 are cube roots of unity. (CO2) 6

3-d. The set G = {0,1,2,3,4,5} is a group with respect to addition modulo 6. (CO2) 6

3.e. Explain Modular lattice, distribute lattice and bounded lattice with example and diagram (CO3) 6

3.f. What is a tautology, contradiction and contingency? Show that $(P \vee Q) \wedge (\neg P \vee R) \rightarrow (Q \vee R)$ is tautology, contradiction or contingency . (CO4) 6

3.g. Draw the graph : i) Graph having Euler's circuit and Hamiltonian circuit both. ii) Graph having Euler's circuit but not Hamiltonian circuit. (CO5) 6

SECTION C 50

4. Answer any one of the following:-

4-a. What is Ordered set and Ordered pairs. If set A have 5 numbers of elements and set B have 4 10

number of elements then what will be the cardinality of 'A X B', give example. (CO1)

4-b. How matrices is helpful to find composition of relation. 10
Let A = {2, 3, 4, 5}. Consider the relation R and S on A defined by
R = {(2, 2), (2, 3), (2, 4), (2, 5), (3, 4), (3, 5), (4, 5), (5, 3)}
S = {(2, 3), (2, 5), (3, 4), (3, 5), (4, 2), (4, 3), (4, 5), (5, 2), (5, 5)}. Find (i) R o S (ii) S o R (CO1)

5. Answer any one of the following:-

5-a. Explain Group with example. The set G = {1,2,3,4,5,6} is a group with respect to multiplication modulo 7. (CO2) 10

5-b. Let G be a group. Prove that every subgroup H of G of index 2 is a normal subgroup. (CO2) 10

6. Answer any one of the following:-

6-a. 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}.

6-b. find the product of sum expansion of each of the following 10
(a). f(x,y,z)=(x+z)y (b). F(x,y,z)= x (CO3)

7. Answer any one of the following:-

7-a. Use the quantifiers to express following statements: (CO4) 10
1. there is a student in the class who can speak Hindi.
2.every student in this class knows how to drive a car.
3.some student in this class knows has visited Alaska but not visited Hawaii.
4.all students in this class have learned at least one programming language.

7-b. Show that each of these conditional statements is a tautology by using truth tables. (CO4) 10
a) $(p \wedge q) \rightarrow p$,
b) $p \rightarrow (p \vee q)$,
c) $\neg p \rightarrow (p \rightarrow q)$,
d) $(p \wedge q) \rightarrow (p \rightarrow q)$,
e) $\neg(p \rightarrow q) \rightarrow p$
f) $\neg(p \rightarrow q) \rightarrow \neg q$

8. Answer any one of the following:-

8-a. Show that there does not exist a graph with 5 vertices with degrees 1, 3, 4, 2, 3 respectively. 10
Also explain Define Graph coloring. What is its application? (CO5)

8-b. Construct the binary tree using following in-order and post-order traversal. (CO5) 10
In-order : DBMINEAFCJGK
Post-order : ABDEIMNCFGJK
Also Find the Pre-order of the constructed Binary Tree.