2023

Full Marks: 75

Time: 3 hours

Answer from both the Groups as directed.

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP-A

(Compulsory)

1. Answer all the questions:

1 × 5

- (a) Suppose the set A has m elements and the set B has n elements. Then the number of different relations from A to B is
 - (i) 2^{m+n}
 - (ii) m+n

- (iii) mn
- (iv) 2mn
- (b) In the poset P={2,3,6,12,24,36} with divisibility relation, the minimal elements are
 - (i) 2,3
 - (ii) 2, 6
 - (iii) 3, 6
 - (iv) 3, 12
- (c) Let the truth values of p and q be true (T). Then
 - (i) $p \wedge q = F$
 - (ii) $(p \rightarrow q) = F$
 - (iii) $p \vee q = F$
 - (iv) $(p \wedge q) = F$

(d) Let $A=\{1,2,3\}$ and consider the relation $R=\{(1,1),(2,2),(3,3),(1,2),(2,3),(1,3)\}$. Then R is

- (i) Reflexive and transitive but not symmetric
- (ii) Reflexive but not transitive
 - (iii) Symmetric and transitive
 - (iv) Reflexive and symmetric
- (e) Let $R = \{(2,a),(4,a),(4,b)\}$ be a relation from set $A = \{1,2,3,4\}$ to set $B = \{a,b,c\}$. Then domain of R is
 - (i) {a,c}
 - (ii) {1,2,4}
 - (iii) {2,4}
 - (iv) $\{a,b\}$
- 2. Define equivalence and partial order relations on a non-empty set A.

2nd Sem-M-(MN-2A)

(Continued)

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(Turn Over)

 Let S be a non-empty set and P(S) be its power set. Then show that the partially ordered set $(P(S), \leq)$ is a lattice where $A \le B \Rightarrow A$ is a subset of B.

GROUP-B

Answer any four questions:

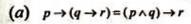
15×4

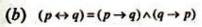
- 4. Let A={2,3,4,6,8,12,24,48} and '≤' be the partial order relation of divisibility. Let $B=\{4,6,12\}$ be a subset of A. Then find
 - (a) Hasse diagram of the poset (A,≤).
 - (b) All upper bounds of B
 - (c) All lower bounds of B
 - (d) The least upper bound of B
 - (e) The greatest lower bound of B
- 5. Show that each of the following is a tautology:



(Continued)

- (a) $[p \land (p \rightarrow q)] \rightarrow q$
- (b) $[(p \rightarrow q) \land (q \rightarrow r)] \rightarrow (p \rightarrow r)$
- 6. Show that





7. (a) Define relation and function on a non-empty set.

(5)

- (b) Write difference between relations and functions by giving an example.
- 8. Define partition of a set. State and prove fundamental theorem on equivalence relation.
- (a) Define tautology and contradiction.
 - (b) Show that $-(p \land q) \rightarrow (-p \lor (-p \lor q)) = -p \lor q$ without constructing truth table.

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