

Discrete Mathematics(MTH-S301)

Semester:2023-2024(Even Semester)

Year:Second Year

Mid Semester Examination-1

Time:1.5hrs

Maximum Marks:30

All questions are compulsory.

Section A

9 marks (Each question is of 1 mark)

1. (a) Write all max terms formed from 3 variables.  $(P \vee Q \vee R), (P \vee Q \vee \sim R), (P \vee \sim Q \vee R), (P \vee \sim Q \vee \sim R), (\sim P \vee Q \vee R), (\sim P \vee Q \vee \sim R), (\sim P \vee \sim Q \vee R), (\sim P \vee \sim Q \vee \sim R)$
- (b) "All integers greater than or equal to 10 are divisible by 5." Write its negation in symbolic form.  $(P \vee Q) \wedge R$
- (c) Write tautologically equivalent expression of  $P \vee (P \rightarrow Q)$
- (d) Find the PCNF of  $(P \rightarrow Q) \vee (P \wedge \sim Q)$
- (e) "If the ozone layer collapses, then global community will suffer". Write in symbolic form.
- (f) Write contrapositive of  $(\sim A \vee B)$ .
- (g) Simplify  $(\sim P \vee \sim Q) \wedge (P \vee \sim Q)$ .
- (h) Write converse of "If I study seriously, I will graduate with flying colors." in symbolic form.
- (i) What is the unique property of minterm.

Section B

9 marks (Each question is of 3 marks)

2. Find principal conjunctive normal form of  $(\sim P \vee R) \wedge P$ .
3. Prove that  $(P \wedge R) \vee [(P \vee Q) \wedge R] \equiv (P \vee Q) \wedge R$ .

4. Given  $A \equiv \prod_{(1,2,4,5,6)}$  find its principal disjunctive normal form.

### Section C

12 marks (Each question is of 6 marks)

5. Show that  $(P \vee \sim R) \rightarrow (P \wedge Q \wedge R) \iff (P \rightarrow Q) \wedge R$  without using truth table.
6. (Do Not Use Truth Table) Does the conclusion follow from the given premises:  
 $(P \rightarrow Q) \rightarrow R, R \rightarrow S, \sim S$  conclusion:  $Q \rightarrow P$ .  
Show the complete derivation.

Department of Computer Science & Engineering

UNIVERSITY INSTITUTE OF ENGINEERING AND TECHNOLOGY (GATEWAY TO KNOWLEDGE)

Discrete Mathematics (MTH-S301)

Semester: 2023-2024 (Even Semester)

Year: Second Year

Mid Semester Examination-2

Time: 1.5 hrs

All questions are compulsory.

Maximum Marks: 30

Section A

9 marks (Each question is of 1 mark)

1. (a) Find domain and range of relation  $R = \{(x, y) : x, y \in N, x + y = 8\}$   
(b) Write its negation of  $(x)P(x)$   
(c) Write in symbolic form "Every teacher of college is learned."  
(d) If  $R$  &  $S$  are symmetric relations. Is  $R \cup S$  symmetric?  
(e) Find a partition of set  $A = \{a, b, c, d\}$ .  
(f) If  $P(x) : x < 5$  and  $Q(x) : x \geq 2$  where universe is  $\{2, 3, 4, 5, 6\}$ , find true value of  $(x)(P(x) \rightarrow Q(x))$   
(g) Give an example of relation on set  $A = \{a, b, c\}$  which is neither symmetric or transitive.  
(h) Let  $R$  be an equivalence relation defined on  $Z \times Z$  by  $(a, b)R(c, d)$ , find  $a + d = b + c$ . Find  $[(4, 7)]$ .  
(i) Find  $R \circ S$  where  $R = \{(1, 1), (2, 2), (1, 3)\}$  and  $S = \{(1, 3), (3, 1)\}$ .

Section B

9 marks (Each question is of 3 marks)

2. Prove that  $R^{-1}$  is an equivalence relation if  $R$  is an equivalence relation.
3. Prove that  $A \times (B - C) = (A \times B) - (A \times C)$

4. Hasse diagram of  $(D_{36}, /)$  where  $D_{36}$  is set of divisors of 36.

### Section C

12 marks (Each question is of 6 marks)

5. Prove that  $x \equiv y \pmod{5}$  is an equivalence relation on set of integers.

6. Check whether

$$(\forall x)(P(x) \rightarrow Q(x)), \sim [(\exists x) Q(x)], (\exists x) (R(x) \rightarrow P(x)) \Rightarrow (\exists x)(Q(x) \rightarrow R(x))$$



## DEPARTMENT COMPUTER SCIENCE ENGINEERING

UNIVERSITY INSTITUTE OF ENGINEERING AND TECHNOLOGY, CSJM UNIVERSITY, KANPUR

### Discrete Mathematics (MTHS301)

Semester: 2023-2024 (Even Semester)  
(2K22)

Year: 2nd Year

#### End Semester Examination

Time: 3hrs

Maximum Marks: 50

All questions are compulsory.

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#### Section A

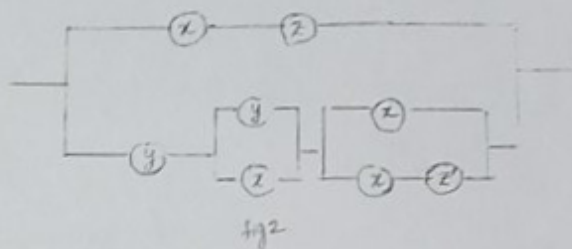
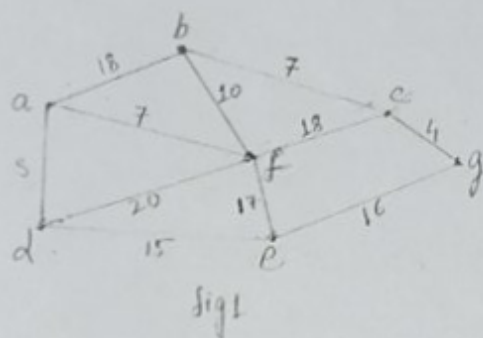
10 marks (Each question is of 1 mark)

1. (a) What is vertex of a degree zero called ?  
(b) Let  $G$  be a cyclic group of order 9. Find all generator of  $G$ .  
(c) If  $G(p,6)$  is self-complementary graph then find  $p$ .  
(d) If  $a.b' = 0$  prove that  $a' + b = 1$   
(e) Let  $A = \{1, 2, 3, 4, 5, 6\}$ . Defined  $R$  on  $A$  by  $R = \{(x,y) : x+y \text{ is a divisor of } 20\}$ . Find reflexive closure of  $R$ .  
(f) Simplify  $(a \vee b) \wedge \sim a \wedge \sim b$ .  
(g) Kruskal's method is for finding .....  
(h) If  $(G, *)$  is an abelian group then  $(ab)^2 = \dots\dots\dots$   
(i) What is the relation between number of vertices and number edges in a tree.  
(j) Define a POSET.

#### Section B

20 marks (Each question is of 4 marks)

2. Find principal conjunctive normal form of  $\sim [\sim (x \vee y) \vee (x \wedge y)]$  in three variables  $x, y, z$ .
3. Prove that  $A \times (B \cap C) = (A \times B) \cap (A \times C)$ .



4. Find the shortest path from a to g in graph(see fig 1) using Dijkstras algorithm.
5. Simplify the circuit in (fig 2) and replace it by a simpler one. Show complete working.
6. Using Warshall's algorithm find transitive closure of  $R = \{(1,2), (2,3), (3,4), (2,1)\}$ , where R is relation on set  $A = \{1,2,3,4\}$ .

### Section C

20 marks (Each question is of 10 marks)

7. (i) Draw Hasse diagram of  $(D_{24}, /)$ . Find its greatest and least element.  
(ii) Is  $(G, X)$  a group? Prove or disprove, where

$$G = \left\{ \begin{bmatrix} a & b \\ -b & a \end{bmatrix} : a, b \in \mathbb{R}, \text{ not both } a \text{ \& } b \text{ zero simultaneously.} \right\}$$

and X denotes matrix multiplication.

8. Given 4 X 4 Adjacency matrix, given by

$$a_{ij} = \begin{cases} 1 & \text{if } i+j \text{ is a multiple of 2 or 3, } i \neq j \\ 0 & \text{otherwise \& } i=j \end{cases}$$

- (i) Draw graph of G.
- (ii) Find complimentary graph of G. Is G self-complimentary? Justify.