Discrete Structures

IIIT Hyderabad

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Tutorial 4

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Introduction

1. Questions
   - Question 1
   - Question 2
   - Question 3

Question 1

Prove the following -

1. $(R \cap S)^{-1} = R^{-1} \cap S^{-1}$
2. R, S are symmetric $\implies$ $R \cap S$ is symmetric.
3. R is transitive $\implies$ R^{-1} is transitive.
4. * [R, S are transitive $\implies$ $R \cap S$ is transitive.]

Question 2

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To answer the questions visit: tinyurl.com/dstut4

2.1: State true or false

1. If R and S are transitive, $R \cup S$ not always transitive.
2. Every relation must either be symmetric or anti-symmetric.

2.2: Mark as Reflexive, Symmetric, Anti-symmetric and/or Transitive.

1. $S = \mathbb{C}$, ${}_xR_y \iff x^2 + y^2 = 1$
2. $S = \mathbb{R}^2$, ${}_{(a,b)}R_{(c,d)} \iff a + d = b + c$
3. $S =$ The set of all lines the plane $\mathbb{R} \times \mathbb{R}$, ${}_lR_m \iff l \parallel m$
4. $S =$ The powerset of $\{1,2,3 \ldots 10\}$. ${}_AR_B \iff A \subseteq B$

2.3: A set S has 3 elements. Find -

1. Number of binary relations.
2. Number of anti-symmetric relations.
3. Number of equivalent relations.
4. Number of relations neither symmetric nor anti-symmetric.

Question 3

1. Let R be a symmetric and transitive relation on a set A. Show that if for every a in A there exists b in A such that (a, b) is in R, then R is an equivalence relation.
2. * [Let R be a reflexive relation on set A. Show that R is an equivalence relation if and only if (a, b) and (a, c) are in R implies that (b, c) is in R.]