

CS 2100: Discrete Mathematics for Computer Science

Quiz 2

Instructor - John Augustine

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- Write your name and roll number clearly on the first page of your answer booklet. It should also be written on the first page of each additional booklet.
- Write spaciously and legibly. Avoid overly verbose answers.
- The quiz starts at 2PM and ends at 4:50PM. This is almost 3 hours, but keep in mind that the exam is also long.

Questions

1. (6 pts) Suppose R and S are binary relations on a set A . Answer the following questions and provide brief (one or two sentence) justifications. (1 point each)
- (a) If R and S are reflexive, is $R \cap S$ reflexive?
 - (b) If R and S are symmetric, is $R \cap S$ ^{symmetric} reflexive?
 - (c) If R and S are transitive, is $R \cap S$ ^{transitive} reflexive?
 - (d) If R and S are reflexive, is $R \cup S$ reflexive?
 - (e) If R and S are symmetric, is $R \cup S$ ^{symmetric} reflexive?
 - (f) If R and S are transitive, is $R \cup S$ ^{transitive} reflexive?
2. (4 pts) Prof. Doofus claims that a symmetric and transitive relation is also reflexive. He gives the following "proof" for his claim.

Proof: Let R be a binary relation on a set A and suppose R is symmetric and transitive. For any two elements x and y in A , if xRy then yRx because R is symmetric. But now, it follows by transitivity that xRx . Hence R is reflexive.

What is the mistake in Prof. Doofus' proof.

3. (12 pts) Suppose that R is a partial order on a set A and that B is a subset of A . Consider the relation R' on B defined as:

$$R' = \{(x, y) | x \in B, y \in B, \text{ and } (x, y) \in R\}.$$

In other words, two elements in B are related by R' if, and only if, they are related by R . Prove that R' is also a partially ordered set.