# Third Quiz for CSI35

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October 8, 2008

**Directions:** This quiz is due Thursday October 15, at 6:00 PM.

1. Let $A = \{0, 1\}$.
   (a) How many (binary) relations are there on $A$? List all of them.
   (b) Which of the relations you listed in par (a) are reflexive? Which are symmetric? Which are antisymmetric? Which are transitive?
   (c) How many ternary relations[†] (i.e. 3–ary relations) are there in $A$?
2. Prove that a relation is symmetric if and only if $R = R^{-1}$, where $R^{-1}$ stands for the inverse relation of $R$.
3. Let $R = \{(x, y) \in \mathbb{R} \times \mathbb{R} : y = x^2\}$.
   (a) Find $R^{-1}$
   (b) Find $R \circ R^{-1}$ and $R^{-1} \circ R$
4. Let $R$ be the "auntle" relation on the set of all humans: $(a, b) \in R$ if and only if, $a$ is an aunt or an uncle of $b$ (in other words $R$ is the composition $P \circ S$ where $P$ is the "parent relation" and $S$ is the "sibling" relation). What are the compositions $P \circ R$ and $R \circ P$?
5. Let $R$ be a relation on $A$. Is it possible $R$ to be a function and reflexive? If yes give an example, if no explain why not.
6. Let $A$ be a set of cardinality $n$. How many *symmetric* relations are there on $A$?

[†]Recall that a ternary relation on $A$ is a subset of $A \times A \times A$.