# Third Quiz for CSI35

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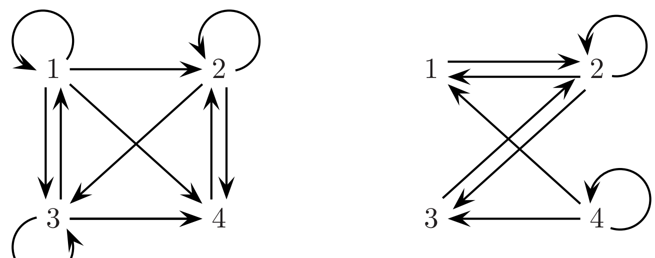
**Directions:** This quiz is due Thursday October 26, at 6:00 PM.

1. Consider the relations $R$, and $S$ on the set $\{1, 2, 3, 4\}$ represented by the digraphs:




$R$ $\qquad\qquad$ $S$

   (a) Find the matrices $M_S$ and $M_R$.

   (b) Use these matrices to compute the compositions $R \circ S$ and $S \circ R$.

   (c) Draw the digraphs that represent $R \circ S$ and $S \circ R$.

2. Let $R$ be the relation represented by the following matrix

$$M_R = \begin{pmatrix} 1 & 1 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{pmatrix}$$

   (a) Is $R$ reflexive?

   (b) Is $R$ symmetric?

   (c) Is $R$ antisymmetric?

   (d) Is $R$ transitive?

3. Which of the following relations defined on the set of all people are equivalence relations. Justify your answers:

   (a) $(a, b) \in R$ iff $a$ has the same parents as $b$.

   (b) $(a, b) \in R$ iff $a$ is parent of $b$.

   (c) $(a, b) \in R$ iff $a$ lives in the same town as $b$.

   (d) $(a, b) \in R$ iff $a$ lives one floor above $b$.

   (e) $(a, b) \in R$ iff $a$ is an acquaintance of $b$.

4. Consider the relation defined on the set of ordered pairs of natural numbers (i.e. on the set $\mathbb{N} \times \mathbb{N}$) as follows:

$$((m, n), (k, l)) \in R \quad \text{iff} \quad m + l = k + n$$

   (a) Prove that $R$ is an equivalence relation.

   (b) Find the equivalence class of $(5, 6)$.