Computer Science 2400
Fall 2021
Practice Quiz 4a
Binary Relations

For each yes/no question, circle yes or no. Circle the letter of the best answer for each multiple-choice question.

1. What is the definition of an equivalence relation?

2. What is the definition of a partial ordering?

3. The inverse R^{-1} of binary relation R is $\{(x, y) \mid (y, x) \in R\}$. If R is an equivalence relation, is R^{-1} necessarily an equivalence relation too? **yes no**

4. Suppose that Z is the set of all integers. Is set $\{(x, x) \mid x \in Z\}$ a partial ordering? **yes no**

5. Suppose S is a nonempty set and $\mathcal{P}(S)$ is the powerset of S. Is the subset relation ($\subseteq$) on $\mathcal{P}(S)$ symmetric? **yes no**

6. Suppose R is a binary relation on the set of real numbers defined by xRy iff $x + y = 1$.

   (a) Is R symmetric? **yes no**

   (b) Is R reflexive? **yes no**

   (c) Is R transitive? (Hint. Try some values.) **yes no**

7. If R is an equivalence relation, is the transitive closure of R always the same as R? **yes no**

8. Let R be the equivalence relation on Z (the set of all integers) defined by $R = \{(x, y) \mid x \text{ and } y \text{ have the same remainder when they are divided by } 6\}$. How many equivalence classes does R have? (If the answer is infinitely many, say infinite.)

9. Let R be the equivalence relation on the set of all real numbers defined by $R = \{(x, y) \mid \lfloor x \rfloor = \lfloor y \rfloor\}$ How many equivalence classes does R have? (If the answer is infinitely many, say infinite.)

10. Let R be relation on {1, 2, 3, 4} defined by R = {(1,2), (2,3), (3,4)}. Which of the following is the reflexive closure of R?

    (a) {(1,1), (1,2), (1,3), (1,4), (2,2), (2,3), (2,4), (3,3), (3,4), (4,4)}

    (b) {(1,1), (1,2), (2,2), (2,3), (3,3), (3,4), (4,4)}

    (c) {(1,1), (2,2), (3,3), (4,4)}

    (d) {(1,2), (2,1), (2,3), (3,2), (3,4), (4,3)}