CSCI 2824 Discrete Structures
Instructor: Hoenigman
Assignment 8
Due Thursday, November 21 at the beginning of class

Problems

1. Let A be the set consisting of the following 12 people: Andy, Angela, Brian, Chris, Clint, Jennifer, Jessica, Julie, Katie, Kristina, Luke, and Paula.

   Relation *SiblingOf* is defined on A such that $(x, y) \in SiblingOf$ means that x and y are siblings, where
   Andy and Katie are siblings
   Chris, Julie, and Brian are siblings
   Kristina and Paula are siblings
   Luke and Jennifer are siblings
   Jessica and Angela are siblings

   Relation *MarriedTo* is defined on A such that $(x, y) \in MarriedTo$ means that x is married to y, where
   Andy is married to Jennifer
   Katie is married to Luke
   Chris is married to Paula
   Brian is married to Jessica
   Kristina is married to Clint, an only child
   Julie and Angela are single

   Draw the arrow diagrams for the *SiblingOf* and *MarriedTo* relations. Describe, in English, the meaning of the relations $SiblingOf \circ MarriedTo$ and $MarriedTo \circ SiblingOf$ and then draw their arrow diagrams.

2. Let A be the set of all students at your school this semester, B the set of all sections of all courses offered at your school this semester, and C the set of all instructors at your school. If $(x, y) \in R$ means that student x is enrolled in course y, and $(a, b) \in S$ means course a is being taught this semester by instructor b, what is the meaning of the relation $S \circ R$?
3. Let A be the set of all students at your school this semester, B be the set of all towns on Earth, and C the set of all instructors at your school. If $(x, y) \in R$ means that student x was born in town y, and $(a, b) \in S \circ R$ means student a was born in the same town as instructor b, what is the meaning of the relation S?
4. Both problems here have the set of real numbers as their domain and codomain
   a. If $f(x) = 2x + 1$ and $g(y) = y^2 - 1$, what is $(g \circ f)(z)$?
   b. If $f(x) = 2x + 1$ and $g(y) = y^2 - 1$, what is $(f \circ g)(z)$?

5. Determine if each of the following relations is a function. Explain your answer.
    a. **Domain**: The set of all finite strings consisting of *a's* and *b's* with at least one of each. **Codomain**: $\mathbb{Z}$. **Rule**: $(s, z) \in R$ means that z is the number of *a's* minus the number of *b's* in the string s. For example, $(bbaabab, -1) \in R$.
    b. **Domain:** $\mathbb{Z}$. **Codomain**: The set M of all people who were alive at midnight, December 31, 1999. **Rule**: $(z, p) \in R$ means that person p is z years old at midnight, December 31, 1999.
    c. **Domain:** The set M of all people who were alive at midnight, December 31, 1999. **Codomain**: The same set M. **Rule**: $(x, y) \in R$ means that person x and y are siblings.