Lists, Permutations, Subsets

1. Suppose that R is a relation describing the function f. As we saw in class, for R to be such a relation, the first element in each ordered pair in R must be unique. What additional property or properties must R have if f is injective? If f is surjective?

2. Determine whether the following relations are reflexive, symmetric, antisymmetric, or transitive. Determine which are equivalence relations, which are partial orders, which are total orders, and which are well orders.

  a. "Is an ancestor of or is" on the set of people

  b. "Is a parent of or is" on the set of people

  c. "Is a sibling of or is" on the set of people

  d. "Is a cousin of or is" on the set of people

  e. "Is a brother of or is" on the set of people

  f. "Is older than or the same age as" on the set of people

  g. "Is divisible by" on the set of positive integers

  h. $\leq$ on the rational numbers r with $1 \leq r \leq 2$

  i. $\leq$ on any finite subset of the rational numbers

3. Explain why the relation given by x is related to y if $x^2 = y^2$ is an equivalence relation on the integers, and describe the equivalence classes.