2. Satisfiability of Comparisons

We consider *finite* sets of comparisons, that is, atoms with the predicates "$=$", "$\neq$", "$\leq$", and "$<$" (also called built-in predicates). An example of such a set is the following:

$$x \leq y,\ x < z,\ y \leq 5,\ y \neq 4.$$

We interpret built-in atoms either over the rational numbers $\mathbb{Q}$ or the integers $\mathbb{Z}$. We define as usual when an assignment that maps variables to numbers satisfies an atom. An assignment satisfies a set if it satiesfies every atom in the set. A set A of atoms is *satisfiable over* $\mathbb{Q}$ if there is an assignment that maps the variables in A to elements of $\mathbb{Q}$ and satisfies A. The set A is *satisfiable over* $\mathbb{Z}$ if there is an assignment that maps the variables in A to elements of $\mathbb{Z}$ and satisfies A.
We are interested in coming up with methods to check whether such a set is satisfiable. For each of the following classes of conjunctions of comparisons, describe a method by which one can check satisfiability: Comparisons with

1. "$=$"
2. "$=$" and "$\neq$"
3. "$\leq$", ranging over the rational numbers
4. "$\leq$" and "$\neq$", ranging over the rational numbers
5. "$\leq$" and "$<$", ranging over the rational numbers
6. "$\leq$", ranging over the integers
7. "$\leq$" and "$<$", ranging over the integers.