Report

2b)

Lemma sorted2IfSorted1

If sorted1 holds for a sequence *ints*, then sorted2 will hold for *ints*
Let there be two integers *a* and *b* and let *0 <= a < b <* |*ints*|, we have to show that
ints[a] <= ints[b]
Because we know that *a < b*, we know that there is a integer *c* for which *a + c = b*
Let's show that *ints[a] <= ints[a+c]* through induction on *c*

Base case: *c = 1*
When *c = 1* we get *ints[a] <= ints[a+1]*, which is true by the definition of sorted1 where a number *i* gives us that *ints[i] <= ints[i+1]*

Step case: Assume that *c* will hold for any integer *n*, show that it holds for
ints[a] <= ints [a+c+1]
Like for the base case, this can be proven by using sorted1, hence
ints[a] <= ints [a+c] <= ints [a+c+1]. It follows through transition that
ints [a] <= ints [a+c+1].

We have shown by induction that *ints [a] <= ints [a+c]*, hence for any integers
0 <= a < b < |*ints*| we get *ints[a] <= ints [b].* Thus we have proven sorted2.

Lemma sorted1IfSorted2

If sorted2 holds for a sequence *ints*, then sorted1 will hold for *ints*
Let there be an integer *a*, we have to show that *ints[a] <= ints[a+1]*.

By the definition of sorted2, we know that *forall i, j :: 0 <= i < j <* |*ints*| *⇒ ints[i] <= ints[j]*
Particularly, forall i :: 0 <= i < i+1 < |ints| ⇒ ints[i] <= ints [i+1]
We see that if sorted2 holds for a sequence, then sorted1 will also hold.

3a)

A multiset counts the number of each unique element in a set. In this case two sequences *a* and *b* are compared to each other to check if they are the same via multisets.