1 Countability
Show that the following sets are countable:

a) The set of all rational numbers (not just the positives)
b) The set of all pairs of binary strings

2 Computability
Show the following problem INFINITE is undecidable:
Given: $< Q >$, the code of a program $Q$
Output: 1 if $Q$ halts on an infinite number of inputs
0 if $Q$ only halts on a finite number of inputs

3 Another Computability Problem
(Note: The solution to this one will be posted online if we don’t have time to go over it.)
Show the following problem ONE is undecidable:
Given: $< Q >$, the code of a program $Q$
Output: 1 if $Q$ halts and outputs 1 on input $!$
0 if $Q$ runs forever or outputs something else on input $!$