Homework 10

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CS331 Algorithms and Complexity

Problem Q1(a). Given a collection of intervals on a time-line, and a bound k, does the collection contain a subset of nonoverlapping intervals of size at least k?
Claim: Interval Scheduling $\leq_p$ Vertex Cover

Problem Q1(b). Claim: Independent Set $\leq_p$ Interval Scheduling

Problem Q2. Is the set of rational numbers countably infinite or uncountably infinite?

Problem Q3. Show that the following problem is undecidable.

$$\mathbf{A} = \{< M > | \forall w \in \mathbf{S}\ M \text{accepts} w\} \text{ where } \mathbf{S} \text{ is the set of all strings}$$

Problem Q4(a). Given n containers of weight $w_1, \ldots, w_n$, trucks of capacity K, minimize the number of trucks to carry all the weight. This problem is NP-Complete.
Greedy Algorithm: Start with an empty truck, then begin piling containers $1, 2, 3, \ldots$ until you get to a container which would overflow the weight limit.
Now declare this truck "loaded" and send it off; then continue the process with a fresh truck.
Given an example of a set of weights, a value of K, where this algorithm does not use the minimum possible number of trucks.

Problem Q4(b). Show, however, that the number of trucks used by this algorithm is within a factor of 2 of the minimum possible number, for any set of weights and any value K