Homework 4

CS 331

Due Thursday, February 15

1. In class we discussed interval *packing* problems. Here we explore interval *covers*.

   (a) You are given a set of n intervals $[s_i, f_i)$ and a range $[0, T)$. You would like to find a minimal set $I \subset [n]$ of intervals whose union covers the range. That is, we say that I is a *valid cover* if, for all $t \in [0, T)$, there exists an $i \in I$ such that $t \in [s_i, f_i)$. Give (and prove correctness for) a greedy algorithm to compute a valid cover with the smallest number of intervals, in linear time after sorting.

   (b) (Optional) Now suppose that each interval also has a *cost* c_i, and your goal is to find a valid cover I minimizing the total cost $\sum_{i \in I} c_i$. Give a dynamic programming solution to this problem that takes $O(n^2)$, or even $O(n \log n)$, time.

2. There's a Jupyter Notebook linked from the class webpage.