Collaboration Policy: You are encouraged to collaborate with up to 4 other students, but all work submitted must be your own *independently* written solution. List the computing ids of all of your collaborators in the `collabs` command at the top of the tex file. Do not share written notes, documents (including Google docs, Overleaf docs, discussion notes, PDFs), or code. Do not seek published or online solutions for any assignments. If you use any published or online resources (which may not include solutions) when completing this assignment, be sure to cite them. Do not submit a solution that you are unable to explain orally to a member of the course staff. Any solutions that share similar text/code will be considered in breach of this policy. Please refer to the syllabus for a complete description of the collaboration policy.

Collaborators: list your collaborators here

Sources: list your sources here

PROBLEM 1 *Unit Intervals*

You are given a set of points $P = \{p_1, p_2, ..., p_n\}$ on the real number line (you may assume these are given to you in sorted order). Create an algorithm that determines the smallest set of unit-length closed intervals that contains all of the given points. For example, the points $\{0.9, 1.2, 1.3, 2.1, 3.0\}$ can be covered by $[0.7, 1.7]$ and $[2.0, 3.0]$. The runtime of your algorithm should be no worse than $O(n)$. Describe your algorithm and explain it's runtime. Make an informal proof for your algorithm's correctness (always returning the optimal solution) using an exchange argument.

Solution:

PROBLEM 2 *Crossing the Bridge*

n people need to cross a narrow rope bridge as quickly as possible, and each respective person crosses at speeds $s_1, s_2, ..., s_n$ (you can assume these are integers and are sorted in descending order). You must also follow these additional constraints:

1. It is nighttime and you only have a single flashlight. One requires the flashlight to cross the bridge.
2. A max of two people can cross the bridge together at one time (and they must have the flashlight).
3. The flashlight must be walked back and forth, it cannot be thrown, mailed, raven'd, etc.
4. A pair walking across together crosses at the speed of the slowest individual. They must stay together!

Describe a greedy algorithm that solves this problem optimally and explain the runtime of your algorithm. *NOTE: The obvious greedy algorithm does NOT work here. Be careful! This is more complicated than it appears.*

Solution: