

Homework 29

Due Date May 4, 2023
Name **Blake Raphael**
Student ID **109752312**
Collaborators **Alex Barry, Brody Cyphers, and Ben Kohav**

Contents

1	Instructions	1
2	Honor Code (Make Sure to Virtually Sign)	2
3	Standard 29: Computational Complexity: Problems in P	3
3.1	Problem 1 (4 Points)	3

1 Instructions

- The solutions **should be typed**, using proper mathematical notation. We cannot accept hand-written solutions. Here's a short intro to \LaTeX .
- You should submit your work through the **class Gradescope page** only (linked from Canvas). Please submit one PDF file, compiled using this \LaTeX template.
- You may not need a full page for your solutions; pagebreaks are there to help Gradescope automatically find where each problem is. Even if you do not attempt every problem, please submit this document with no fewer pages than the blank template (or Gradescope has issues with it).
- You are welcome and encouraged to collaborate with your classmates, as well as consult outside resources. You must **cite your sources in this document**. **Copying from any source is an Honor Code violation. Furthermore, all submissions must be in your own words and reflect your understanding of the material.** If there is any confusion about this policy, it is your responsibility to clarify before the due date.
- Posting to **any** service including, but not limited to Chegg, Reddit, StackExchange, etc., for help on an assignment is a violation of the Honor Code.
- You **must** virtually sign the Honor Code (see Section 2). Failure to do so will result in your assignment not being graded.

2 Honor Code (Make Sure to Virtually Sign)

- My submission is in my own words and reflects my understanding of the material.
- Any collaborations and external sources have been clearly cited in this document.
- I have not posted to external services including, but not limited to Chegg, Reddit, StackExchange, etc.
- I have neither copied nor provided others solutions they can copy.

Agreed (I agree to the above, Blake Raphael).

□

3 Standard 29: Computational Complexity: Problems in P

3.1 Problem 1 (4 Points)

Problem 1. Consider the decision variant of the Interval Scheduling problem.

- Input: Let $\mathcal{I} = \{[s_1, f_1], \dots, [s_n, f_n]\}$ be our set of intervals, and let $k \in \mathbb{N}$.
- Decide: Does there exist a set $S \subseteq \mathcal{I}$ of at least k pairwise-disjoint intervals?

Show that the decision variant of the Interval Scheduling problem belongs to P. You are welcome and encouraged to cite algorithms we have previously covered in class, including known facts about their runtime. [**Note:** To gauge the level of detail, we expect your solutions to this problem will be 2-4 sentences. We are not asking you to come up with a new algorithm nor to analyze an algorithm in great detail.]

Answer. Consider using Mergesort to sort our intervals in \mathcal{I} which has runtime of $\Theta(n \log n)$. Now lets consider using a greedy algorithm similar to Algorithm 4 from Levet's Algorithm Notes to select the first interval in \mathcal{I} that doesn't overlap with an interval in S . We do this for all intervals in \mathcal{I} and then check to see if we have at least k elements in S which takes $\Theta(n)$ time. Therefore, we have an algorithm that belongs to P since our runtime is $\Theta(n^2)$.

□