

CS 5720 Design and Analysis of Algorithms  
Homework #7

**Submission requirements:**

- Submit your work in PDF format to the appropriate assignment on Canvas.
- **5% extra credit** if your writeup is *typed*.

**Assignment:**

1. *Scheduling Compatible Intervals:* Suppose you have a server that can only process one job at a time, and you have  $n$  potential jobs that could be scheduled on it. Each job has a specific start time and end time, and your task is to design an algorithm to determine the **largest possible number of jobs** that can be scheduled. Specifically, for each  $i \in \{1, \dots, n\}$ , job  $i$  needs to start at time  $a_i$  and will run until time  $b_i$ . Your algorithm's input should be an array of start times and an array of end times; your algorithm should determine the largest possible number of jobs that can be scheduled and a list of those jobs' indices.

To illustrate, suppose you have 3 jobs, with start/end times of:

- (i) (1, 3),
- (ii) (2, 5),
- (iii) (4, 5).

For this problem, job (ii) overlaps with both of the other jobs, but (i) and (iii) don't overlap, so the optimal solution is to choose (i) and (iii).

**Your task: Design three possible greedy algorithms for this problem; the algorithms should be based on**

- (a) earliest start first,
- (b) shortest duration first,
- (c) earliest finish first.

For each of the three algorithms, provide pseudocode, and then either prove that the algorithm always gives an optimal solution or give a counterexample showing that this is not always the case.