This homework covers developing greedy algorithms. It is due in class Friday, April 18.

Write your solutions carefully — your work should be neat, readable, organized, and polished. As with writing a paper, you will likely need at least two drafts — the first draft can be rough (similar to what was written in class) as the focus is on going through the steps and finding a solution, while in the final draft the focus is on clarity of explanation and the quality of writing (similar to what was written after class). While it is not required, you are encouraged to type your work so that the revisions for the final draft are easier to make.

See the Policies page on the course website for information about reviseand-resubmit, late work, and academic integrity as it applies to homework.

For the following problems, develop a greedy algorithm to solve the problem using the process discussed in class. Give each of the steps in the template — don't just give an algorithm. This is not a research task to look up the solution — the point here is to understand and be able to apply the process discussed in class to develop an algorithm yourself.

- 1. Your company has been hired to add closed captioning to live television broadcasts. Given a list of programs to be captioned (and the start and end times of each program), assign those programs to your employees using as few employees as possible. Note that each person can only caption one show at a time.
- 2. You are creating a playlist for a party. There are n songs that you are considering including; song i has a length l_i and a popularity p_i . Your goal is to create the most popular playlist possible (the playlist's popularity is the sum of the popularities of the songs included), but the playlist can't last any longer than the party does (a total time of L) so you have to decide which songs to include and which to leave out. However, you can include parts of songs; perhaps somewhat unrealistically, the popularity scales so that, for example, half of a song is half as popular as the whole song. Which songs do you include, and how much of each?
- 3. Print Services has n jobs to complete, and each job i has a length t_i and a deadline d_i . A feasible schedule is one in which all of the jobs get done before their respective deadlines. Find a feasible schedule if one exists.

Hint: While this isn't an optimization problem as such, there is an optimization version which, if solved, addresses the original problem. Solve the problem that way: Develop a greedy algorithm to find a schedule which minimizes the amount by which the most-late job misses its deadline. Then explain how finding such a schedule allows you to solve the original problem.