

CSC 349: Assignment 4 - Greedy Proofs**1. Triathlon Competitor Scheduling**

You are trying to schedule triathlon contestants so that the triathlon completes as early in the day as possible. (The triathlon completes when all the contestants are done.) Each contestant has a projected swimming time, running time, and biking time. Since the pool is very small only one contestant can be in the pool at a time. Any number of contestants can be biking and running at the same time. The contestants first swim, then bike, and finally run. Assuming that each contestant will complete each event in their projected time, what is the best order to send the people out, if you want the whole competition to be over as soon as possible? That is, give an efficient algorithm that produces a schedule whose completion time is as early as possible.

- A. Specify an efficient greedy algorithm to achieve the goal of earliest completion of the competition.
- B. Prove your algorithm always finds an optimal solution.
- C. Analyze your algorithm's complexity.

2. Shipping Efficiently: A trucking company is responsible for shipping a large number of boxes that require many trips from New York to Boston each day. Each truck has a limit of W on the maximum amount of weight it is allowed to carry. Boxes arrive at the New York depot one at a time and each package has a weight of w_i . The depot is small and only one truck can be loaded at a time. Company policy is that boxes must be shipped in the order they arrive, since customers might get upset if they saw a box that arrived later get to Boston earlier than one they sent earlier. Thus, the company uses a simple greedy algorithm for packing the boxes onto a truck. Pack the boxes in the order in which they arrive and once a box does not fit then send the truck on its way.

The company asks you to determine if they can do better. E.g., perhaps they could reduce the number of trucks needed by sometimes sending off a truck that is less full but could allow later trucks to be better packed.

- A. Prove company's algorithm always ships the packages in the fewest trucks.
- B. Analyze the algorithm's complexity.