

6.0002 Fall 2016 OCW

Problem Set 1 Problem A.5: Writeup

Octavio V.

1. When I ran `compare_cow_transport_algorithms()`, I found the following results:
 - a. `greedy_cow_transport` executed in 0.003987789154052734 s in 6 trips
 - b. `brute_force_cow_transport` executed in 0.7275633811950684 s in 5 trips

Clearly, the greedy algorithm runs much faster. This is because it is implemented so as to only add the heaviest cows first, regardless of how many trips it will take, as opposed to exploring the entire space of all possible trip configurations. The brute force algorithm instead explores the space of all trip configurations (=partitions of the cows) before deciding which are valid and which is best, which involves exploring on the order of $2^{(\# \text{ of cows})}$, i.e. the size of the power set of the set of cows.

2. The greedy algorithm does NOT return the optimal solution. This is because it is only concerned with transporting the heaviest cows before transporting lighter cows from the sorted list of cows, as opposed to minimizing the number of trips this will take. If the weight limit were increased, then the number of trips required would begin to decrease under the greedy implementation.
3. The brute force algorithm DOES return the optimal solution. This is because it explores all possible trip configurations, and first decides which meet the weight limit constraint. Then it selects among all possible choices which minimizes the number of trips required.