Wed, Feb 7, 2024
Greedy Algorithms (continued)

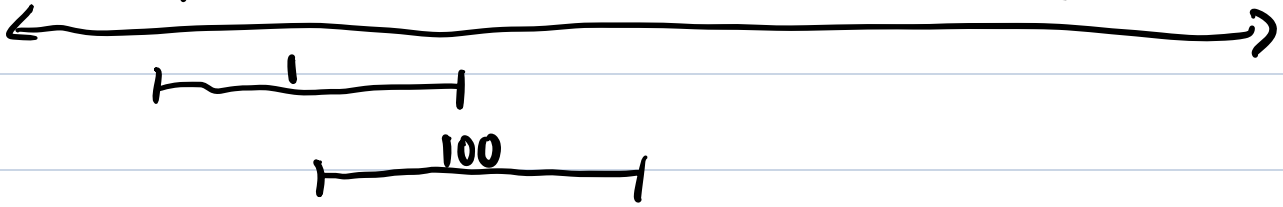
Announcements

- → HW 1 due Friday night
- → HW 2 assigned Friday
- → Office Hours! M 2:30 - 3:30
  W 2:00 - 3:00
  Th 10:30 - 11:30

Problem #3: Weighted Interval Scheduling

Like regular interval scheduling except each request r_i comes with a value v_i and the goal is to maximize the total value of these satisfied requests.

Our previous G.A. is now very bad



New GAs:

* best = highest value
* best = highest value density
  - value
  - duration
* best = shortest

Are any of these optimal? No.
There is no known G.A. that's always optimal.

Brute force: Trying every possibility
↳ every subset of meetings

If S is a set with n things in it, then there are 2^n subsets of S.

big-O notation: In CS, a way to express the time it takes for an algorithm to run.

Brute force: $O(2^n)$ time
(exponential = bad)

Problem #4 - Knapsack Problem

You have n items that each have a value v_i and a weight w_i.
You have a backpack that can carry a total weight of C (capacity).

What is the highest value of items that you can fit in your backpack?

Ex:

item	weight	value
1	8	13
2	3	7
3	5	10
4	5	10
5	2	1
6	2	1
7	2	1
	4.5	9

Capacity = 10

Possible Solutions:
* Items 1, 5
weight 8+2=10
value 13+1=14

* Items 2, 4, 7
  weight 3+5+2=10
  value 7+10+1 = 18 better

* Items 3, 4
  weight 10
  value 20 optimal!

Possible greedy algorithms:

* best = value density = $\frac{\text{value}}{\text{weight}}$

* best = weight is closest to the average of weights

* best = highest value

* best = lowest weight

Are any of these optimal? No.
(HW2 you'll implement 3 of these)