Lecture 32

CSE 331

Apr 19, 2021

A couple announcements

- NO lecture on FRIDAY (April 23)
  - Enjoy!
  - I may announce HW 7 a day or two earlier
    - Same deadline; you'll have more time
- No office hours for instructor on WED (April 21)

Give feedback!

note @1037

Feedback on CSE 331

Hi All,

I'm asking for your feedback about 331 and I prepared a form with custom questions. Please do give feedback via this anonymous form: https://forms.gle/zjC6JRwvLBKG92iQ7

Filling in this form is **completely optional** and **anonymous**.

I would love feedback even if it is critical. Also, after a week or so, I'll post my response to the feedback from y'all, though I might disagree with you on certain things. So at the ve
are in CSE 331. And then we can agree to disagree :)

Note that this is NOT the UB's course evaluation form; the results will be used to improve the class this semester and in future offerings.

logistics

edit · good note | 0

Subset sum problem

Input: n integers $w_1, w_2, \ldots, w_n$

bound W

Output: subset S of $[n]$ such that

(1) sum of w_i for all i in S is at most W

(2) $w(S)$ is maximized

Recursive formula

$OPT(j, B)$ = max value out of $w_1,\ldots,w_j$ with bound B

Can compute final S with recursion/ backtracking

If $w_j > B$

$$OPT(j, B) = OPT(j-1, B)$$

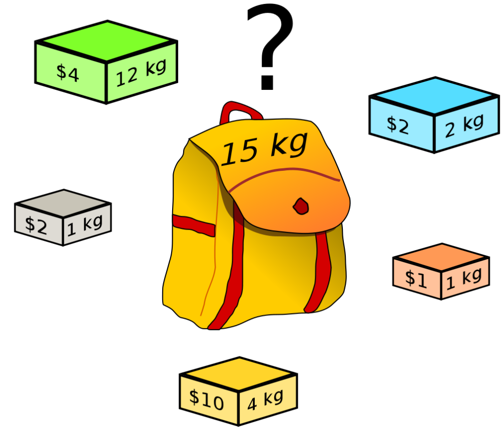
else

j not in OPT

j in OPT

$$OPT(j, B) = \max \{ OPT(j-1, B),\ w_j + OPT(j-1, B-w_j) \}$$

Knapsack problem



Input: n integers $w_1, w_2, \ldots, w_n$

n pairs $(w_1, v_1), \ldots, (w_n, v_n)$,

bound W

Output: subset S of $[n]$ such that

(1) sum of w_i for all i in S is at most W

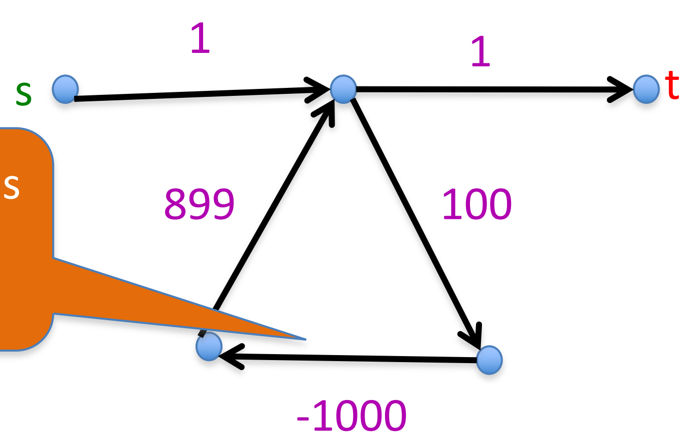
(2) $w(S)$ is maximized

Shortest Path Problem

Input: (Directed) Graph G=(V,E) and for every edge e has a cost c_e (can be <0)

t in V

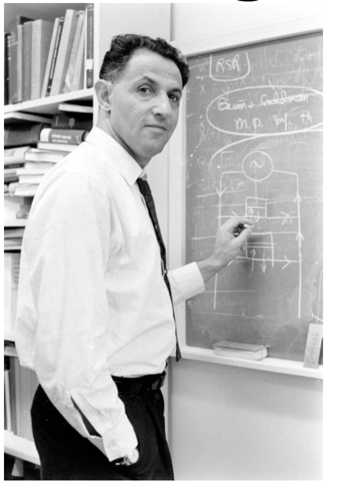
Output: Shortest path from every s to t



Shortest path has cost negative infinity

Assume that G has no negative cycle

When to use Dynamic Programming



Richard Bellman

There are polynomially many sub-problems

Optimal solution can be computed from solutions to sub-problems

There is an ordering among sub-problem that allows for iterative solution

Today’s agenda

Bellman-Ford algorithm