Scientific Computing	$\sum_{n=1}^{\infty} Q^n ^2 Q^n \leq \frac{1}{2} Q^n \leq \frac{1}{2} Q^n ^2 Q^n ^2 \leq \frac{1}{2} Q^n ^2 Q^n ^$
Announcements	
-> HW 3 assigned today due n two weeks, Morch 5 -> Weelvesday, March 5 is also the midtern eram	n person
> Friday, March 7, no lecture, extra while you work on take-home (to	offre hours me TBD)
Today	Office Hours:
> Backtracking	Mont Friday
	9:30am-10:30am
.	Cudahy 307

Topiz 7 - Backtracking Like Dwide+ Conquer, Backtracking is a framework for finding the optimal solution in a sourch space without checking every condidate one-by-one. Very simple idea: Build solutions one port at a time, and give up when a partial solution violates the constraints.

Search space: All subsets of $\underline{z}_{1,2,3,4,5,6,73}$ $\underline{z}_{=128}^{7}$ With brute force: Ex #1: Knapsack Capacity = 10 item | weight | value Possibilities: Ø, E13, E23, 2 3 7 not just too heavy, but • 3 5 10 • 4 6 6 5 6 6 70 still too heavy if you remove any single item, so this is silly to even try-128 possibilities • 5 2 6 Z I I ×71 2 Wase of time to check & 1.3,4,5,73 because \$1,3,4,53 was already too heavy

w/v $= \frac{1}{8/13} \frac{2}{3/7} \frac{3}{5/10} \frac{4}{5/10} \frac{5}{2/1} \frac{6}{2/1} \frac{7}{2/1} \frac{1}{2/1} \frac{2}{10} \frac{7}{10} \frac{1}{10} \frac{1}{1$ in X - every sol from this branch is too heavy-so we cut 32 solutions out 8, -in x in X is heavy-so we in out $\sum_{i=1}^{n} X$ is $\sum_{i=1}^{n} \sum_{i=1}^{n} \sum_{i$

Messy picture, but way better than brute force, especially with lots of items! partally built What are we doing? - Patting a hierarchy on decisions that builds the whole space (math: poset) with the critical property that: if a condidate is bad, then the candidates below it <u>must</u> be bad.

Knapsach with 7 items: Candidates: subsets of £1,2,3,4,5,6.73 hierarchy: item 1 is in a out 213 Ø subsets of 213 item 2 in a out 213 23 Ø subsets of 21.23 item 2 in a out 21.23 213 23 Ø subsets of 21.23 item 3 mor out 123 12 13 1 23 2 3 0 Subsets of {1:2:33 Traverse this tree, and whenever you reach a candidate that is bad, stop traversing that branch.

So, we are checking or ruling out every candidate in the search space. In bad cases (high apacity, light items), we might not rule anything out, and so in the worst case this is as bad as brute force. demo