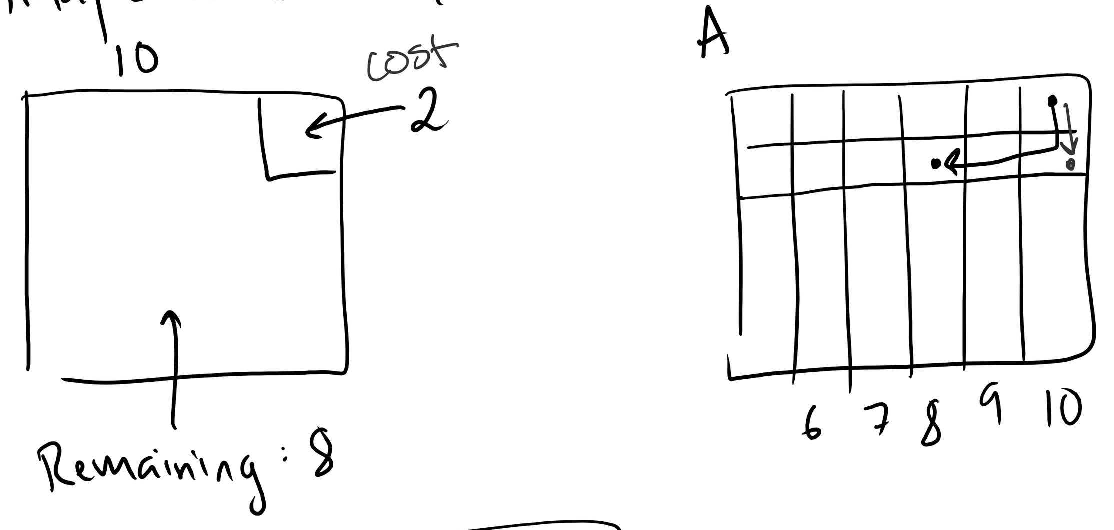
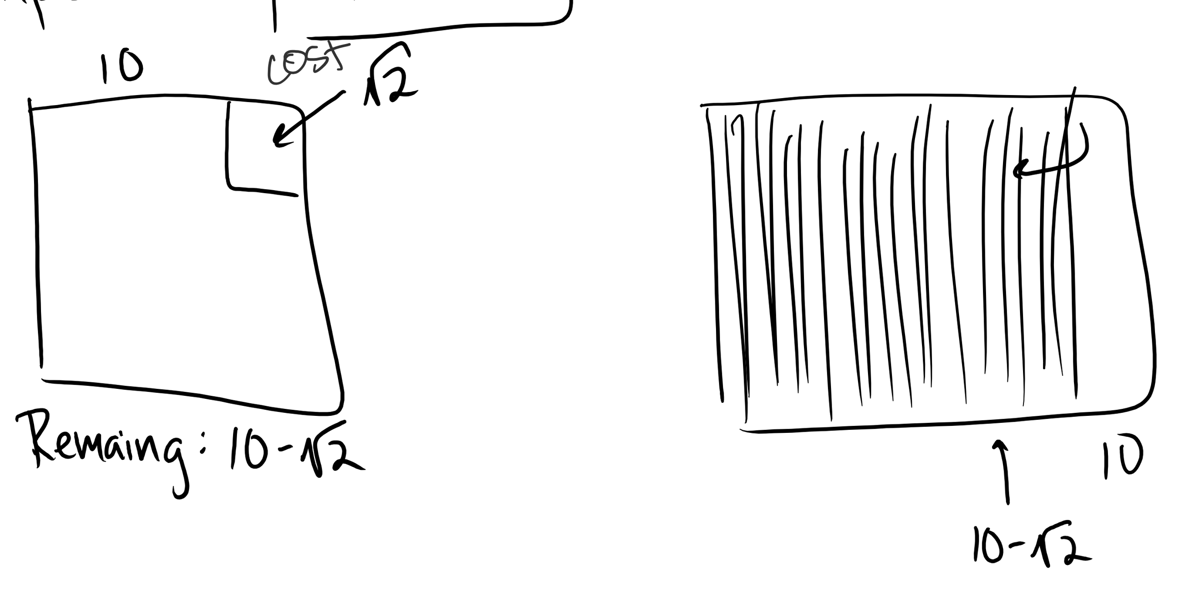
11: DP flexibility

Saturday, April 24, 2021   4:13 PM

Knapsack $c_i \in \mathbb{Z}^+ \in P$



Knapsack $\boxed{c_i \in \mathbb{R}^+}$ $\in NP$



Group Work:

- Create alg. to approximately solve knapsack with real costs, capacity.
- Reduce Knapsack with real costs to Knapsack with integer costs

Real-Knapsack Input: C_1, $c_1, c_2, \ldots, c_n \in \mathbb{R}^+ \rightarrow \boxed{f} \rightarrow$ Int-Knapsack Input: C_1', $c_1', c_2', \ldots c_n' \in \mathbb{Z}^+ \rightarrow \boxed{\text{Knapsack}} \rightarrow$ Optimal set S' for Int-Knapsack $\rightarrow \boxed{g} \rightarrow$ ~Optimal set S for Real Knapsack

Runtime?   Runtime?   Runtime?

f: Choose M. Bigger M → closer to optimal
↳ longer runtime

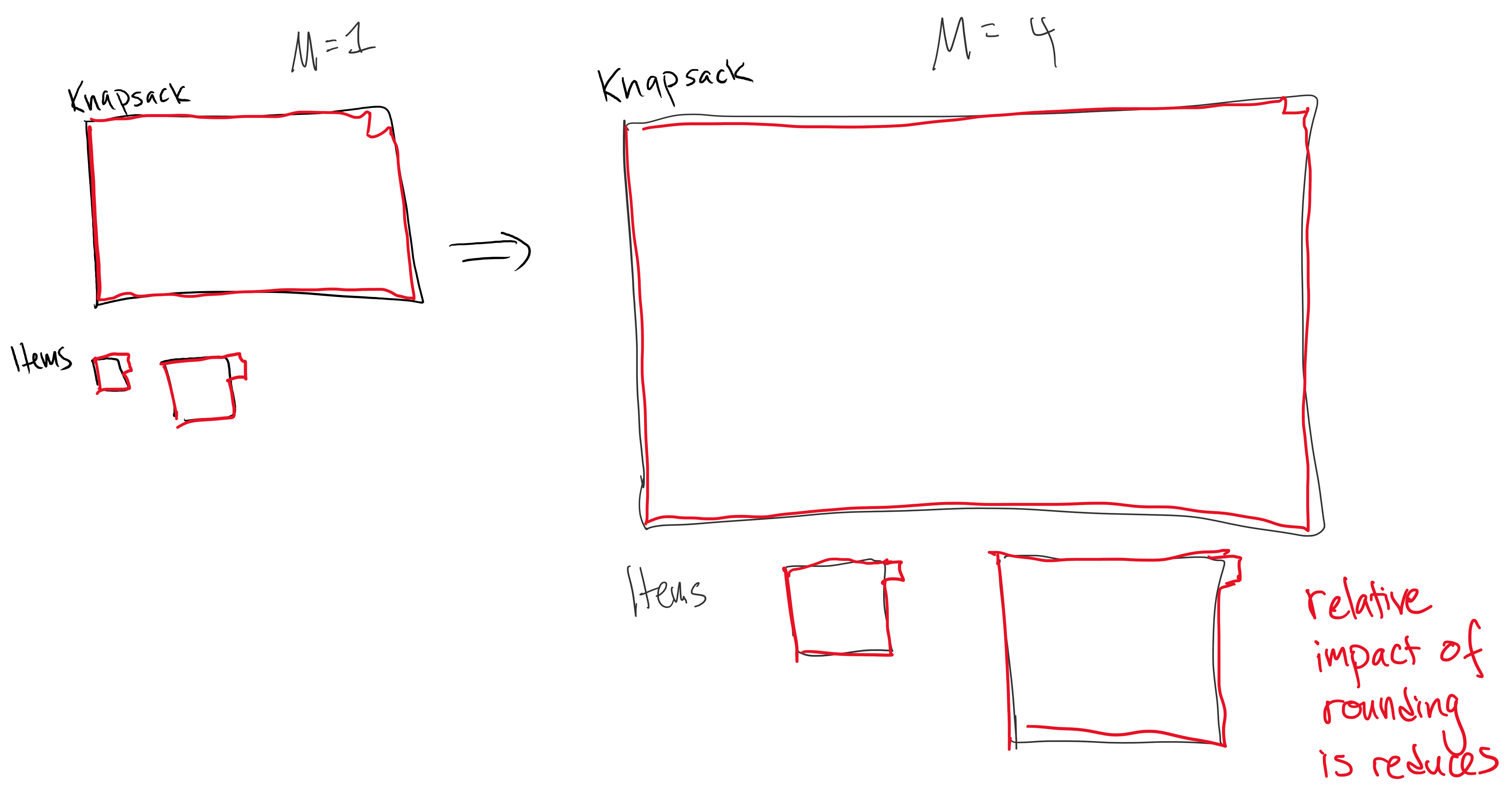
$C' = \lfloor CM \rfloor$

$c_i' = \lceil c_i M \rceil$

Reduction

g: $S = S'$

Result: S will always fit in knapsack, but maybe not optimal
→ Knapsack too small
→ Items too big
} solutions could be valid in original that aren't in reduction



Runtime:

f: $O(n)$

g: $O(1)$

Knapsack: $O(nC') = O(nMC)$

Why dependence on C is good to know!