Lab7 Questions

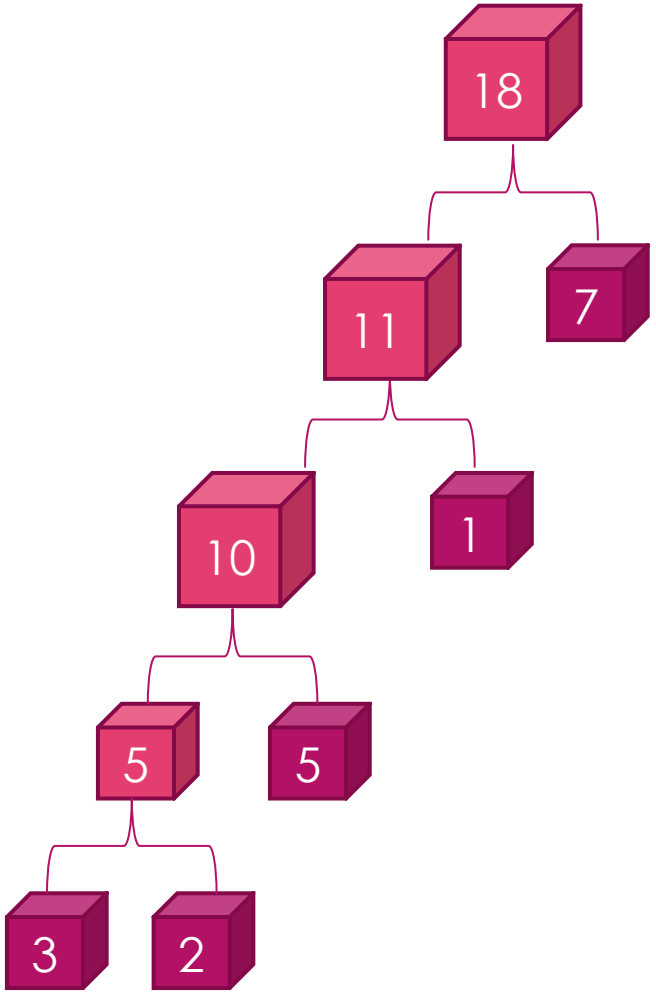
YAO ZHAO

Lab7.A: Merging Boxes

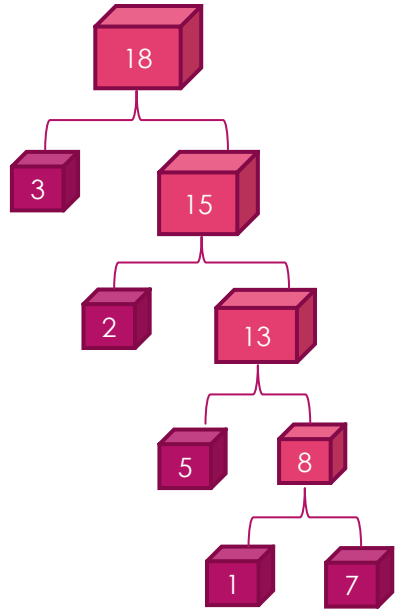
- N magic boxes $1, 2, \ldots, N$ line up from left to right. The i^{th} box weighs w_i.
- Two adjacent boxes x, y can be merged into a new box z weighing $w_z = w_x + w_y$.
  Box z appears at the place where x and y were. A such operation costs $w_x + w_y$ energy.
- **Tom** wants to merge N boxes into a single box with $N - 1$ operations. Help him find the minimal energy cost.

Sample Input

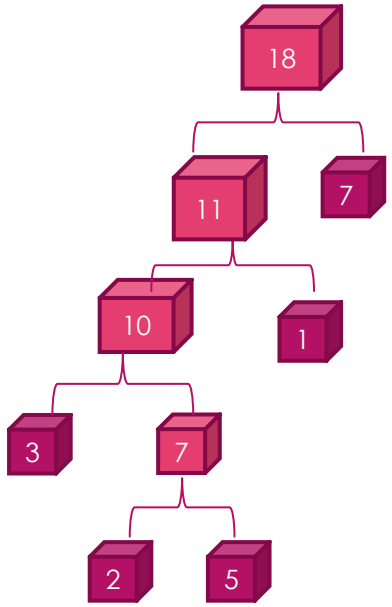
5
3 2 5 1 7



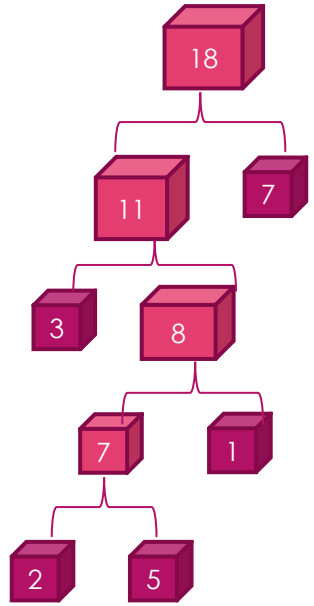
5+10+11+18 = 44



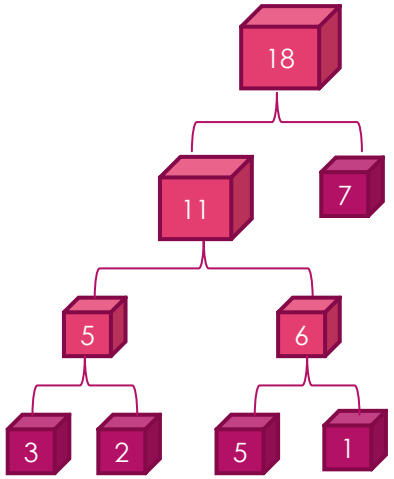
8+13+15+18 = 54



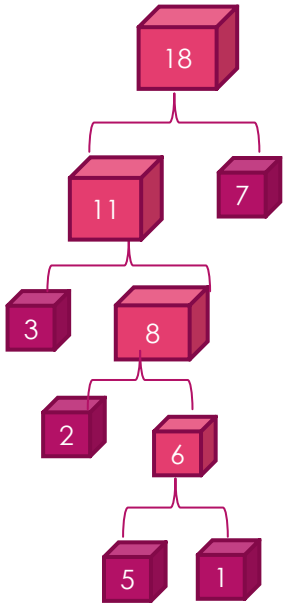
7+10+11+18 = 46



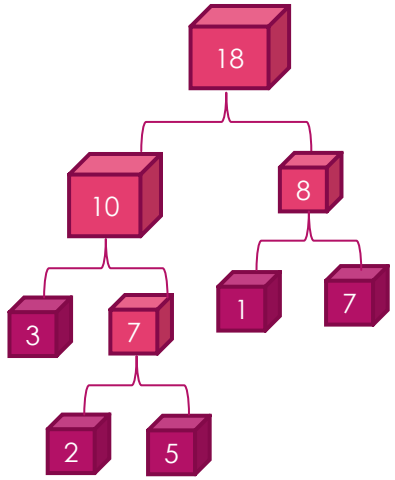
7+8+11+18 = 44



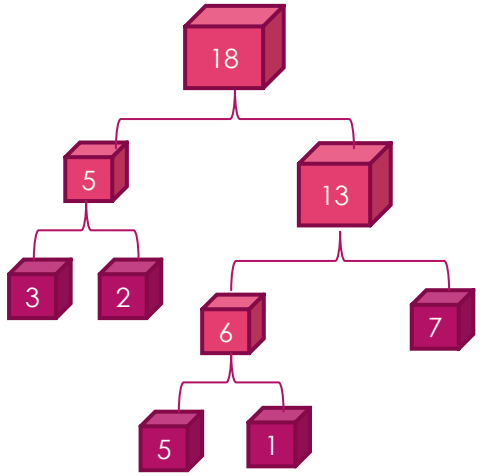
5+6+11+18 = 40



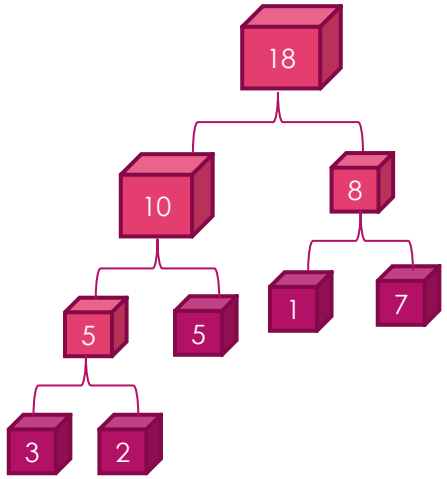
6+8+11+18 = 43



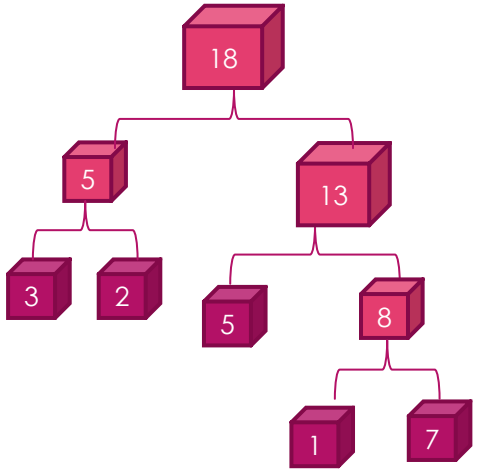
7+10+8+18 = 43



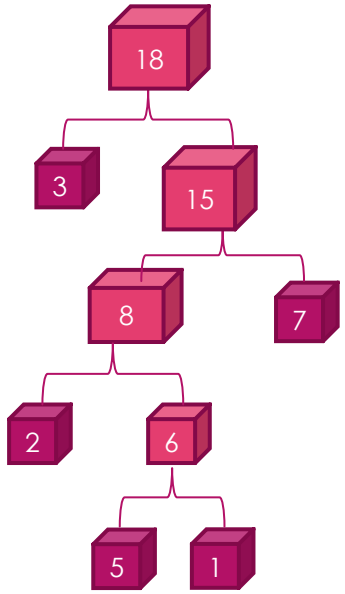
5+6+13+18 = 42



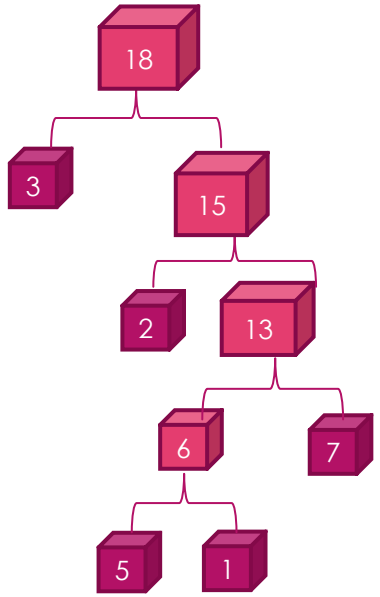
5+8+10+18 = 43



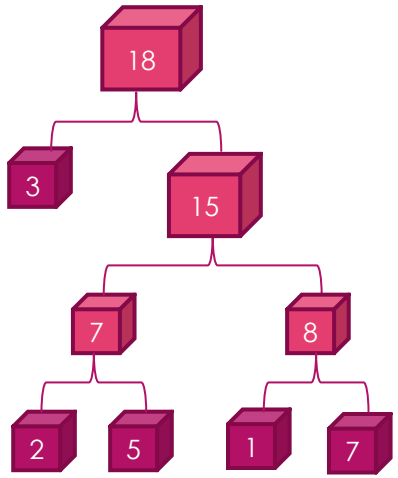
5+8+13+18 = 44



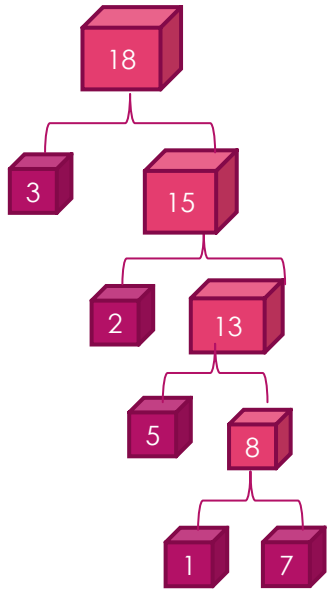
6+8+15+18 = 47



6+13+15+18 = 52



7+8+15+18 = 48



8+13+15+18 = 54

Solution: Problem analysis of Dynamic Programming(1).pdf P16~22

Lab7.B: Sly Bunny

- One day, FluffyBunny received a secret mail with three secret integers: n, m, k. She then came up with a game:
- The game consists of n turns and has a score that FluffyBunny tries to maximize, and Satori tries to minimize. Initially, the score is 0. In each turn, FluffyBunny first picks a **real** number from $[0, k]$ which Satori chooses to either add or subtract from the score of the game. Throughout the whole game, Satori must choose to add at least m times.
- Satori has agreed that if the final score >= 0 , she will offer FluffyBunny a free lunch.
- Suppose the two girls play optimally, please tell them the final score.
- Note that the integers n, m, k and the choices that the two players make are open to both players at any time.

Sample Input

7
3 3 2
2 1 10
6 3 10
6 4 10
100 1 1
4 4 0
69 4 20

3 turns, at least 3 times to add, [0, 2]

So, each turn Satori has to add the picked number, FluffyBunny would pick the biggest number from [0, 2], that is 2.

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Sample Input

7
3 3 2
2 1 10
6 3 10
6 4 10
100 1 1
4 4 0
69 4 20

[0, 10]
First turn: if FluffyBunny pick 10, Satori choose - , let final score -10,
If FluffyBunny pick 0, Satori choose +, let final score +0.
So, FluffyBunny has to pick 10/2 ， then if Satori choose -, final score -5,
FluffyBunny can pick 10 in the 2nd turn, final score = -5+10 =5;
If Satori choose +, final score +5, FluffyBunny can pick 0 in the 2nd turn,
final score = +5-0 = 5.

FluffyBunny	Satori	FluffyBunny	Satori	final score
10	0-10	10	0-10+10	0
0	0+0	0	0+0-0	0
5	0-5	10	0-5+10	5
5	0+5	0	0+5-0	5
7.5	0-15/2	10	0-15/2+10	5/2
2.5	0+5/2	0	0+5/2-0	5/2

Optimal result

Hint:

$if\ n = m$: FluffyBunny always pick the biggest number from [0, k]
$if\ m = 0$: FluffyBunny always pick 0
then consider $more\ cases$: $n = m + 1$ ...etc.