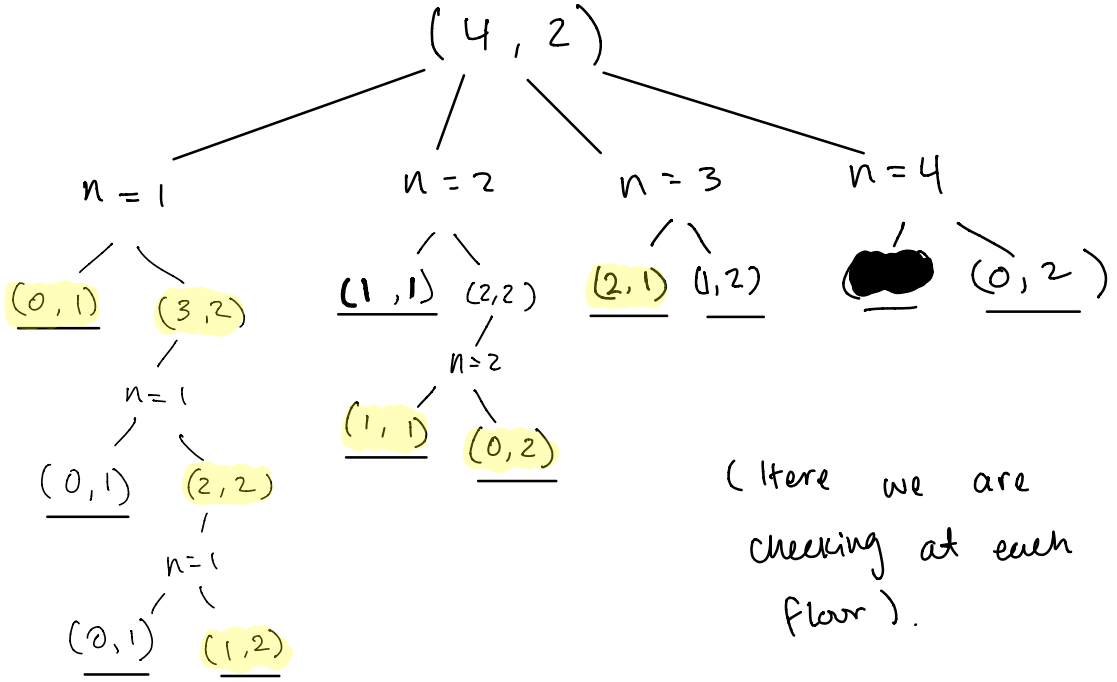
Falling Glass

a) Optimal Substructure: If an sheet breaks we subtract a sheet from our current amount and we go down a floor. If the sheet doesn't break when dropped, we go up one floor. If we only have 0 or 1 floor then we return the floor. The same is the case if we only have 1 sheet we return the number of floors.

b)



(Here we are checking at each floor).

((current floor - 1, sheet - 1) or (total floor - current floor, sheet)

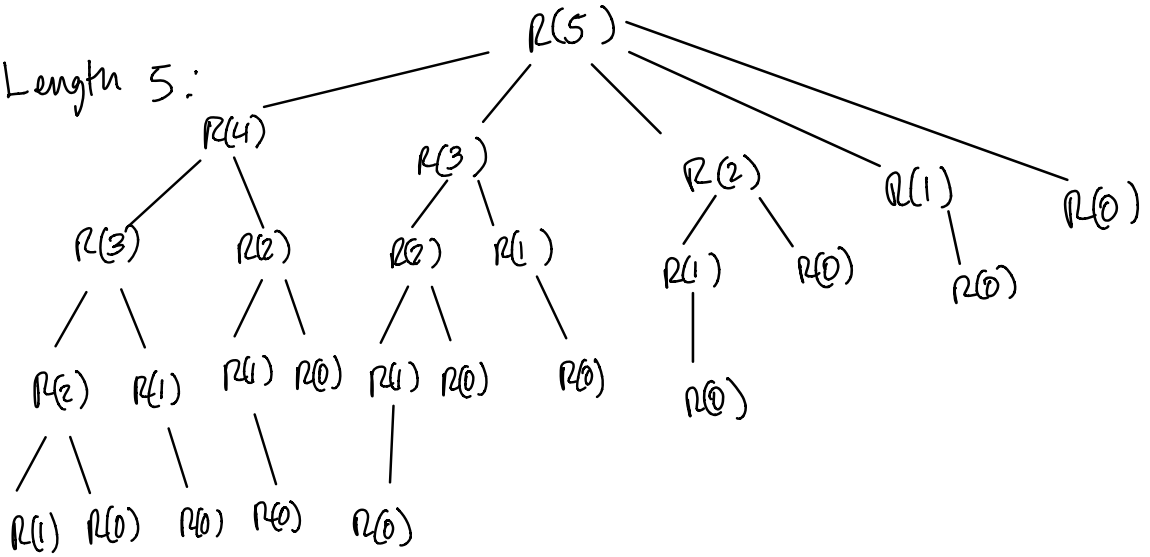
d/e) We have 8 distinct subproblems

So we have $n \times m$ distinct subproblems

f) We would memoize our recursive solution by saving the solution to the subproblems as we are solving for the main problem. This will save time since we won't have to solve overlapping subproblems more than once.

Rod cutting

a) Length 5:



b) Counter example showing that the greedy approach is not optimal.

Say we have total length of 10 and we have 4 different pieces (P). $p_1 \ldots p_4$ and these are their lengths and values

piece	length	profit
1	2	$ 10
2	3	$ 40
3	4	$ 40
4	5	$ 70
5	8	$ 80

The greedy approach would select piece 4 since it has the highest profit and then piece 1 since its the only one that fits, resulting in a total profit of $100. However if we selected pieces 1, 2 and 4 We would have the total rod length and profit of $ 120.