Dynamic Programing - I

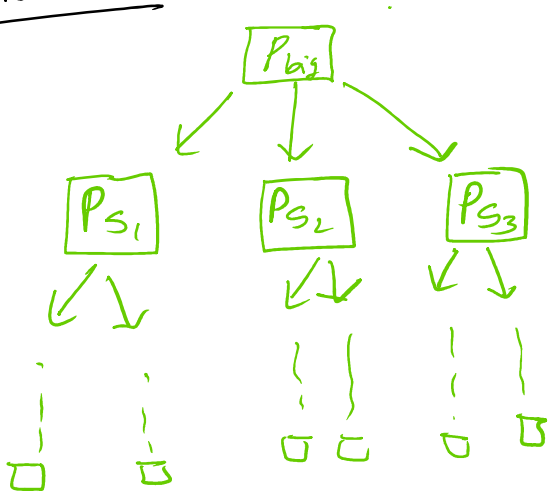
Thursday, February 29, 2024 9:19 PM

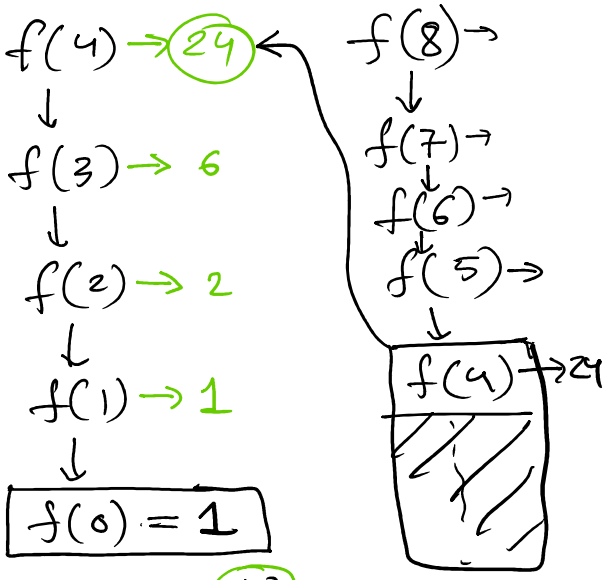
$N! = 1 \cdot 2 \cdot 3 \cdots (N-1) \cdot N$

$\%\ 10^9+7$

$^nC_r = \frac{n!}{r!(n-r)!}\ \%\ M$

① factorial





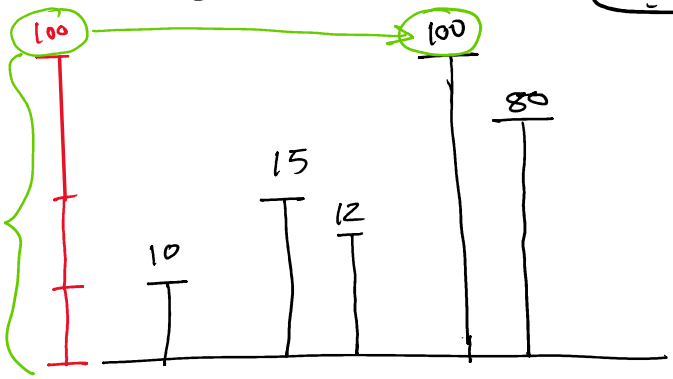
DP Concept keywords:
1. Overlapping Subproblem
2. Memorization

Test Case → T

↳ N!, M!, 0!

10!, 20!, 21!

$O(TN)$

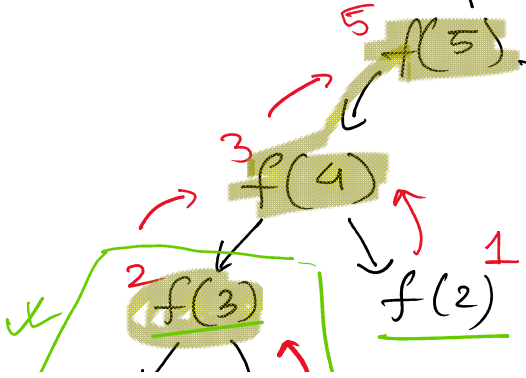


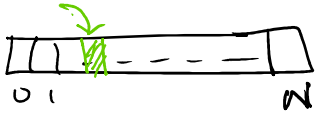
$O(N_{max})$

② Fibonacci

$f(N) = f(N-1) + f(N-2)$ | $N=0,\ f(N)=0$; $N=1,\ f(N)=1$

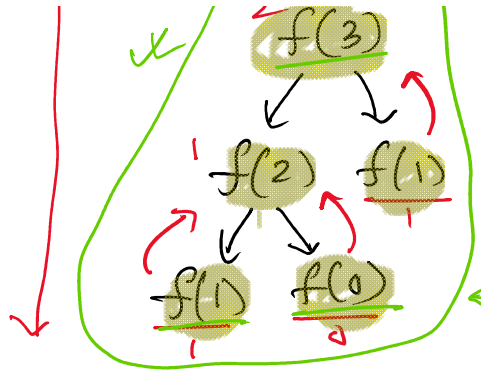
0 → 0
1 → 1
2 → 1
3 → 2
4 → 3





$O(N)$

4 → 3
5 → 5
6 → 8
7 → 13
$O(2^n)$

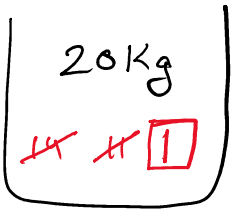


f(2)

O(N)

Overlapping Subproblem

③ 01-Knapsack



	P_i	W_i
0 →	5	3
1 →	3	10
2 →	2	7
3 →	7	6

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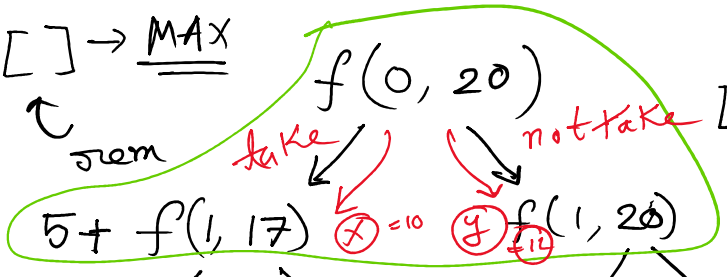
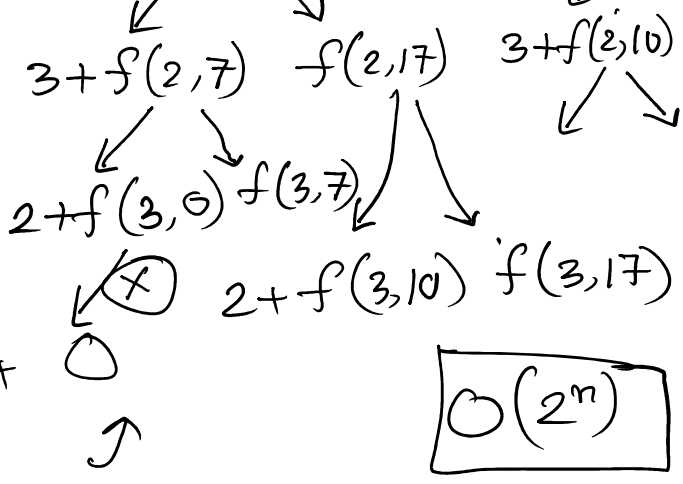
f(index, rem) = Max Profit taking or not taking items from [index, n) when remaining size of knapsack is 'rem'

dp[][] → MAX
index, rem



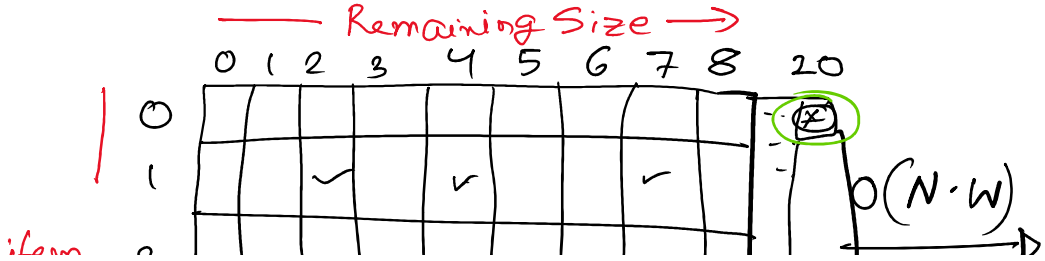
f (index, rem) →

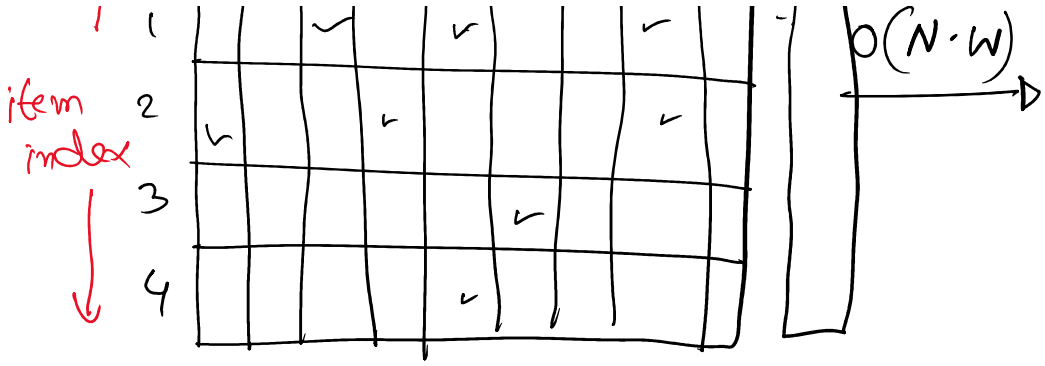


$O(2^n)$

	P_i	W_i
0 →	5	3
1 →	3	10
2 →	2	7
3 →	7	6

4 → 20Kg





* Iterative DP
* Bitmask DP
* Prob^{y} DP