Given N.
Tell the min no of no.s whose sum of squares = N

N: 100 → 10^2 1
N: 101 → $10^2 + 1^2$ 2
N: 13 → $2^2 + 3^2$ 2

N: 12 → $10^2 + 1^2$ 2 ✓
→ 3^2

12 → 3^2 $1^2 + 1^2 + 1^2$ ×
$3^2 + 2^2 + 2^2$
→ 3

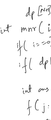
N ≥ 3

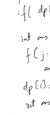
1 + min (1, 2, 3)
1 + 1 = 2

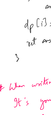
$$mnr(N) = 1 + \min_{i=1}^{N} \{ mnr(N - i^2) \}$$

N: 0 → 0

mnr(N) → min no of no.s using all squares = N







dp[sq] = 1
int mnr(i)
{
if(i==0) ret 0;
if(dp[i] != -1)
ret dp[i];
int ans = ∞;
f(j: 1 → √i)
ans = min(ans, 1 + mnr(i-j²));
dp[i] = ans;
ret ans;
}

Unique steps
T.C. for ret → O(√n)

TC: O(N √N)

SC: O(N)

* When working with DP.
It's your responsibility to figure out the order in which the no of states have to be updated!

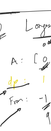
N: 0 → 0

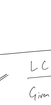
dp

0	1	2	3	4	5	6	7	8
0	1							

f(i: 1 → N)
ans = ∞
f(j: 1 → √i)
ans = min(ans, 1 + dp[i-j²])
dp[i] = ans;

N boxes in a straight line.
You are a thief. You want to rob the boxes.
Each box has some amount of gold in it.
Now, there is some above system.
If you rob the box no. i, then the box i-1 & i+1 would be alerted.
Maximize the amt of gold you can rob.





Longest Increasing Subsequence

Subs → 2^N

A: [0, 8, 4, 12, 2, 10, 6, 14, 1, 9, 5, 13, 3, 11, 7, 15]

dp	1	2	3	2	3	3	4	2	4	3					
Par	-1	0				2	6								

i → 6, 8, 9, 11

dp[i] → # L.I.S. ending at i.
idx: 0 → i-1

$$dp(i) = 1 + \max_{j=0}^{i-1} dp[j] \quad : A_j < A_i$$

Subs → 2^N

TRS → O(n²)

TC: O(n²)

SC: O(n)

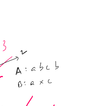
O(n log n)

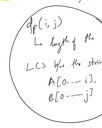
LCS [Longest Common Subsequence]

Given 2 strings. Find the length of the LCS of them.

A: a b c d g h
B: b b a d c g h

(bbgh) → 5





A, B

dp[i, j]
↳ length of the LCS for the strings A[0 ... i], B[0 ... j]

Base Cases
i < 0 || j < 0 → 0

A[i] == B[j]
1 + dp(i-1, j-1)

dp(i, j)

A[i] ≠ B[j]
max

dp(i-1, j)

dp(i, j-1)

A → N
B → M

TS → N×M
TRS → O(1)

TC: O(N×M)

SC: O(N×M)