

## Dynamic Programming

- Solving problems efficiently by reusing solutions that has already been computed.

Solving DP:

### 1. Solve the naïve way

- Brute force it without thinking of time complexity

→ permutations

} without time/space  
complexity first

### 2. Optimal Substructure & Overlapping Subproblems

- Optimal Substructures
- Overlapping Subproblems

↳ repeated solution

→ How to construct best solution  
given a iteration.

### 3. Top-Down vs Bottom Up approach

- - Not really important

### 4. Constraints

- What limitations are imposed when constructing the optimal substructure

Eg. min no. of coins, max. value of items, limited no. of items etc ... ..

### 5. Base Case

- -

### 6. Memoization Array

- 1D or 2D depending on problem statement constraints

↳ 2 more or more constraints,  
usually limited items will be 2D

↳ 1 constraint

## Rod Cutting Problem

Given a rod of length  $n$  inches and an array of prices that includes prices of all pieces of size smaller than  $n$ . Determine the maximum value obtainable by cutting up the rod and selling the pieces.

Length	1	2	3	4	5	6	7	8
Price	1	5	8	9	10	17	17	20

Value = 22,  $2 + 6$

Length	1	2	3	4	5	6	7	8
Price	3	5	8	9	10	17	17	20

Value = 24,  $1 * 8$

For given iteration

Eg.  $i = 4$

option

- ① \$1
- ② \$5
- ③ \$8
- ④ \$9

prev optimal

- $[3] = \$8$
- $[2] = \$5$
- $[1] = \$1$
- $[0] = \$0$

total

- \$9
- \$10 ← Max
- \$9
- \$9

options

- ① \$1 +
- ② \$5 +
- ③ \$8 +
- ⋮
- ⋮

prev optimal, memo  $[i - \text{option}]$

- $[i-1] = \$$
- $[i-2] = \$$
- $[i-3] = \$$

} Max of all option

memo	0	1	2	3	4	5	6	7	8
\$\$\$	0	1	5	8	10	13	17	18	22

Given a set of non-negative integers, find if we can partition it into two subsets such that the sum of elements in both the subsets are equal.

**TRUE** (1, 4) & {2, 3}

**TRUE** {1,3,4} & {1,7}

**FALSE**

# each cell represents a possible combination

$\{5, 8, 3, 1, 4, 7\} \rightarrow 28/2 = 14$

Each cell has (i) exclude,  $[i-1][j]$  ↑

condition :-

OR

② include,  $[i-1][j-\text{option}]$

Possible

[illegible]