

Let's start at 9:05 PM

L68

DP with Bitmasking

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RECAP

Let's dive right into it

Let's understand bitmask DP

N numbers

$dp[m]$ \Rightarrow represents the answer for a subset of the given set corresponding to the mask m .

1. Best Permutation

Given an integer N . Assume there is an array \Rightarrow
 $a = [0, 1, 2, \dots, N-1]$

2D $N \times N$ array

$\hookrightarrow \text{row}[i][j] \Rightarrow$ Reward points
if the final position
of the number i
is at index j .

$$1 \leq N \leq 20$$
$$0 \leq \text{row}[i][j] \leq 10^6$$

$$N = 3 \quad a = [0, 1, 2]$$

$$\text{perm} \Rightarrow [1, 2, 0]$$

$\begin{array}{ccc} \uparrow & \uparrow & \uparrow \\ (0) & (1) & (2) \end{array}$

$$\text{rew}[1][0] + \text{rew}[2][1] + \text{rew}[0][2]$$

Find the maximum reward we can get.

$$N = 4$$

$$(0, 1, 2, 3)$$

$$\text{row} = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 1 & 0 & 3 & 5 \\ 10 & 5 & 0 & 14 \\ 9 & 6 & 7 & 8 \end{bmatrix}$$

$$\text{perm} = [3, 0, 1, 2]$$



$$\text{ans} = 26$$

$$\text{perm} = [0, 3, 1, 2] \Rightarrow 23$$

$$\text{perm} = [1, 2, 3, 0] \Rightarrow 13$$

Intuition

②

[_ _ _ _ _ , _]

$$dp[2^n - 1]$$

$$N=3 \Rightarrow [0, 1, 2]$$

0	0	0
1	0	3
10	5	0

$$\begin{array}{c} +0 \\ \swarrow \\ (0) \end{array}$$

$$f(7) (111)$$

$$\begin{array}{c} +3 \\ \downarrow \\ (1) \end{array}$$

$$f(101) (5)$$

$$\begin{array}{c} +0 \\ \searrow \\ (2) \end{array}$$

$$f(011) 3$$

$$f(6) (110)$$

$$\begin{array}{c} +0 \\ \swarrow \\ (1) \end{array}$$

$$f(4) (100)$$

$$\begin{array}{c} +5 \\ \searrow \\ (2) \end{array}$$

$$f(2) (010)$$

$$\begin{array}{c} +10 \\ \downarrow \end{array}$$

$$f(0) \Rightarrow 0$$

$$\begin{array}{c} +1 \\ \downarrow \end{array}$$

$$f(0) \Rightarrow 0$$

$f(10110) \Rightarrow 3 \text{ numbers}$
 $[1, 2, 4]$

1 at last

+ row[1][2]

dp[10100]

$f(10010)$
 2 at last
 +

dp[10010]

+ row[4][2]

4 at last

dp[00110]

$$f(m)$$

Solution

Let's implement

2. PENS (ICPC Problem)

Intuition

Solution

Let's implement

Thank You!

Reminder: Going to the gym & observing the trainer work out can help you know the right technique, but you'll muscle up only if you lift some weights yourself.

So, PRACTICE, PRACTICE, PRACTICE!