Bitmask DP

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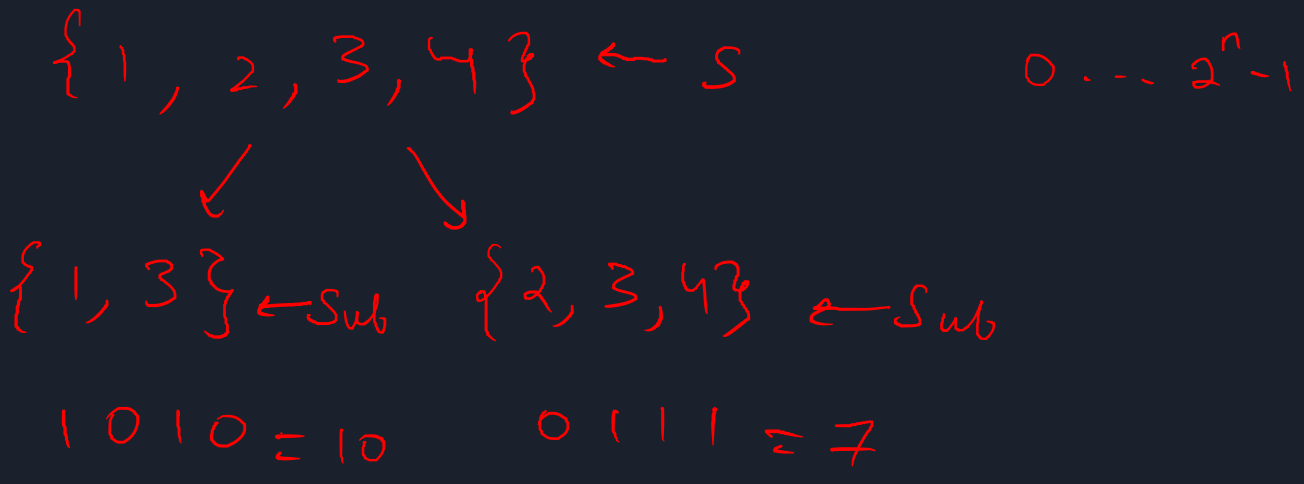
5 ⭐ on CodeChef

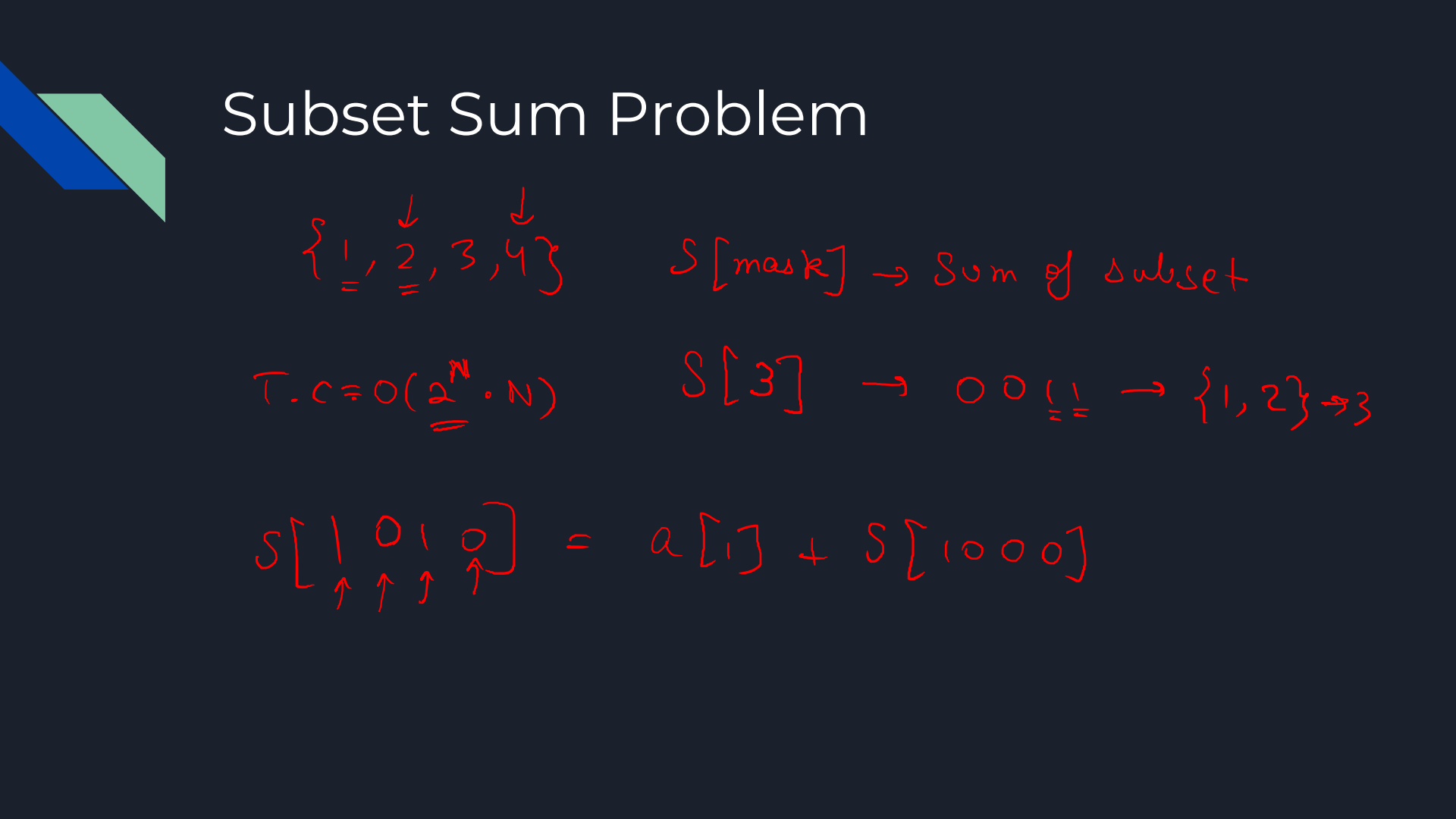
Today’s plan :

- Bitmasking Revision
- Subset Sum Problem
- Task Assignment Problem
- Other Tips & Stuff

Revision Time

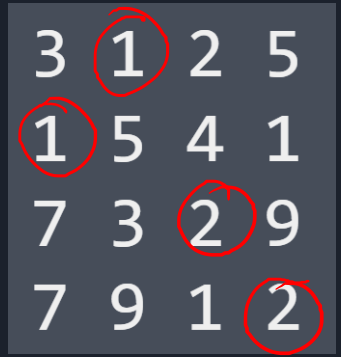


Subset Sum Problem

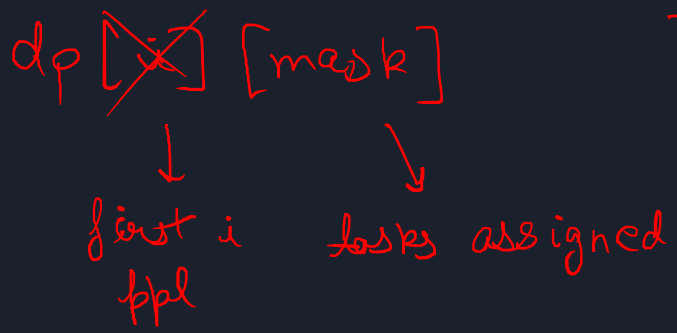


Min Cost Task Assignment Problem

There are N persons and N tasks, each task is to be alloted to a single person. We are also given a matrix $cost$ of size $N \times N$, where $cost[i][j]$ denotes, how much person i is going to charge for task j. Now we need to assign each task to a person in such a way that the total cost is minimum. Note that each task is to be alloted to a single person, and each person will be alloted only one task.



Min Cost Task Assignment Problem



$dp[i-1][\text{mask with } j^{th} \text{ bit set}]$

$= (dp[i][mask] + cost[i+1][j])_{min}$

Min Cost Task Assignment Problem

```
assign(N, cost)
    for i = 0 to power(2,N)
        dp[i] = INFINITY
    dp[0] = 0
    for mask = 0 to power(2, N)
        x = count_set_bits(mask)
        for j = 0 to N
            if jth bit is not set in i
                dp[mask|(1<<j)] = min(dp[mask|(1<<j)],
dp[mask]+cost[x][j])
    return dp[power(2,N)-1]
```

-- builtin - popcount(mask)

task not assigned yet

all tasks assigned

Submasks of Masks

for mask : $[0, 2^n - 1]$

for sub $\subseteq$ mask :

// code

01010
01110
} OR

#masks : k set bits
$= {}^nC_k$

$\sum {}^nC_k \cdot 2^k = (1+2)^n$

T.C. $O(3^n)$