Qn Given a list of calorific values of n food items, you can eat the foods in any order such that the following expression is minimized.

Cakewalk

$$\sum C_i \times 2^j$$

$C_i \rightarrow$ calorific value of ith item

j = (no of elements eaten till now)

$$C_0 \times 2^0 + C_1 2^1 + C_2 2^2 \ldots\ldots$$

Knapsack → $\boxed{0\text{-}1}$ →

0 ↓ complete not pick

1 ↓ complete pick

bag → MaxWeight

Robber

profit is max

items → weight → $w_0 \quad w_1 \quad w_2 \; .... \; w_{n-1}$

value → $v_0 \quad v_1 \quad v_2 \; ---- \; v_{n-1}$

n items

Fractional Knapsack

↳ partial picking is allowed

↓

calc max profit

↳ we sort the items in the ratio $\underline{\underline{v/w}}$ in decreasing $\underline{\underline{\text{order}}}$.

$\Rightarrow$ W is the max capacity of the knapsack.

This knapsack is optimally packed by item a_1 a_2 ----- a_n with values v_1 v_2 v_3 -- v_n and weight w_1 w_2 . ---- w_n

Now we get a new item to choose i.e a_{n+1} with value / weight $\Rightarrow$ $\frac{v_{n+1}}{w_{n+1}}$ and $\frac{v_{n+1}}{w_{n+1}} > \frac{v_i}{w_i}$

$\forall\, i \in [1, n]$

Let j be an index, such that $v_j/w_j < v_i/w_i$

$\forall\, i \in [1, n]$ and $i \neq j$

Replace a_j with a_{n+1}

Change in value/weight $\rightarrow$ $\dfrac{v_{n+1}}{w_{n+1}} - \dfrac{v_j}{w_j}$

$$\sum w_i \leq W$$

→ Consider n items $\{1, 2 \ldots\ldots n\}$

$\frac{v}{w}$ → sorted $\quad \frac{v_1}{w_1} > \frac{v_2}{w_2} \ldots\ldots \frac{v_n}{w_n}$

Assume → greedy solⁿ $G \rightarrow \{x_1 \; x_2 \ldots\ldots x_n\}$

x_i denotes fraction of item i taken

Optimal solⁿ $O \rightarrow \{y_1 \; y_2 \ldots\ldots y_n\}$

y_i denotes fraction of i^{th} item in O.

$$\sum_{i=1}^{n} x_i w_i = \sum_{i=1}^{n} y_i w_i = W$$

Consider the first item 'i' where the 2 sol^n differ

$$|G| \geq |O|$$

assume → $x_i = x_i - y_i$

assume a new sol^n O' from O,

$\forall j < i,\ y_j' = y_j$

at $j == i$, set $y_i' = x_i$

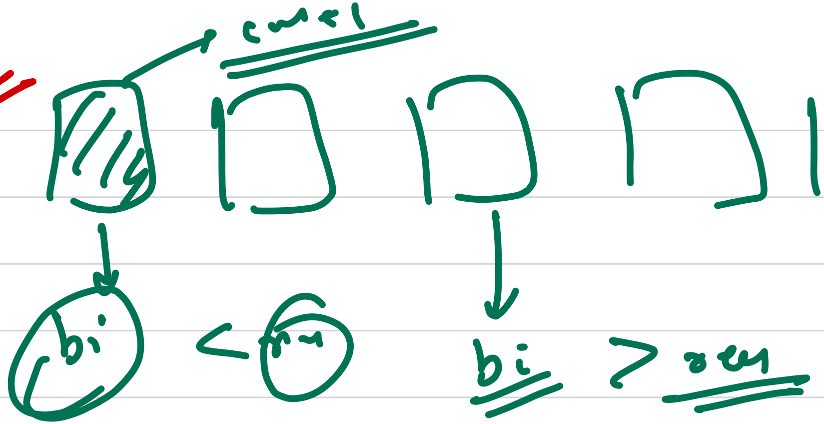
In sol^n O, remove items of total weight $x_i w_i$ from $i+1$ to n

$$\underbrace{|O'| = |O|}$$

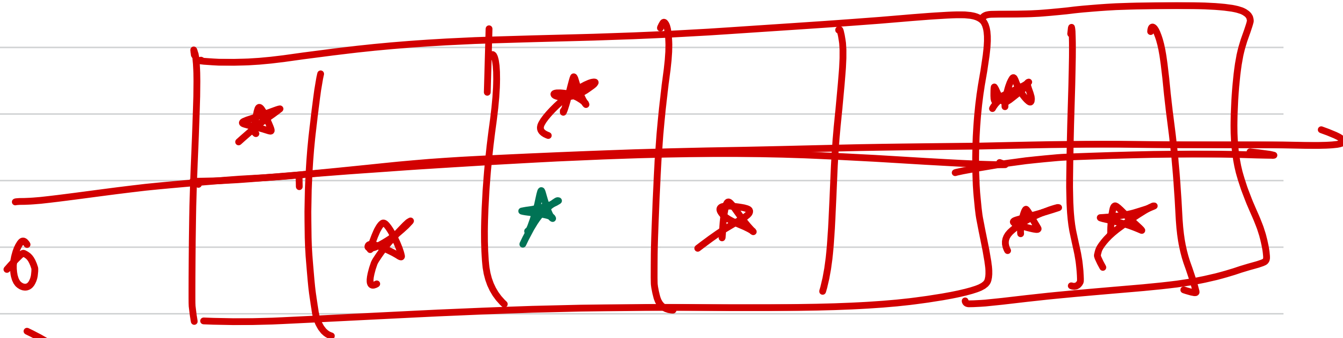
$$O' \longrightarrow O'' \longrightarrow O''' \; - - \quad - \; - \; G$$

~~keep scanning~~

greedy



Ans = ~~1~~ ~~2~~ 3



$C_0 \to 0$

$C_1 \to 0$