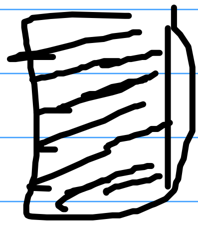
~~2448H~~

1 3 5 2 1 2 3 5

2 3 1 14

Binary Search on

$1235 = \frac{11}{4}$



$1 \leftarrow 2 \rightarrow 5$

1 3 5 2

func to minimize

$$f(x) = \sum_{j=0} |arr[j] - x| * cost[j]$$

find x that minimizes

$$f(x) = \sum_{i=0}^{n} \underbrace{|arr[i] - x|}_{\Delta} \cdot \underbrace{cost[i]}_{\text{cost eachstep}}$$

Some cases ?

- Same nums With diffrent costs
- diffrent nums with same costs

Brute force ?

$$\sum_{i}^{n} arr[i] * cost[i] - cost[i]$$

wrong

X X

$$abs\left(\sum arr[i] * cost[i] - x \sum cost[i] \right)$$

wrong
XX

$$\sum |arr[j] - X| \cdot cost[j]$$

$\Downarrow$

cannot distribute like that

$$\sum_j |arr[j] * cost[j] - X * cost[j]|$$

$\Downarrow$

But we can split to remove absolute

$$= \sum_{\substack{\text{less than } X \\ j = \dots}}^{M} (X - arr[j]) \cdot cost[j] + \sum_{\substack{\text{more than } X \\ j = \dots}}^{N} (arr[j] - X) \cdot cost[j]$$

$$= \sum_j X \cdot cost[j] - arr[j] \cdot cost[j]$$

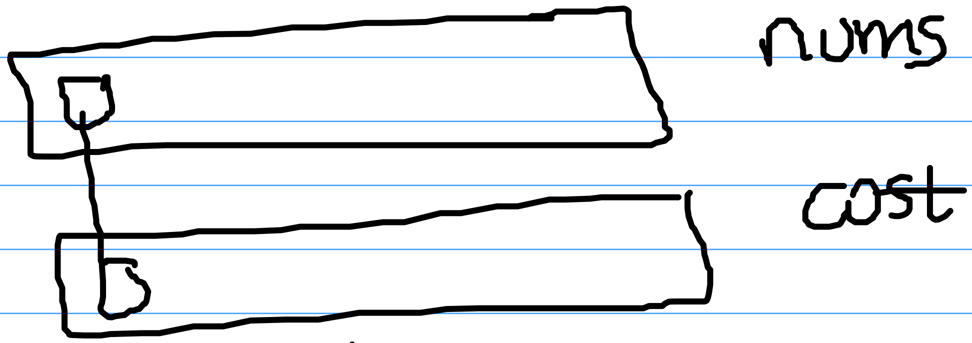
$$= \sum X \cdot cost[j] - \sum arr[j] \cdot cost[j]$$

$$= \underbrace{\left(X \cdot \sum cost[j]\right) - \left(\sum arr[j] * cost[j]\right)}_{\text{all nums below / equal } X}$$

$$\sum_j (arr[j] \cdot cost[j]) - (X \cdot cost[j])$$

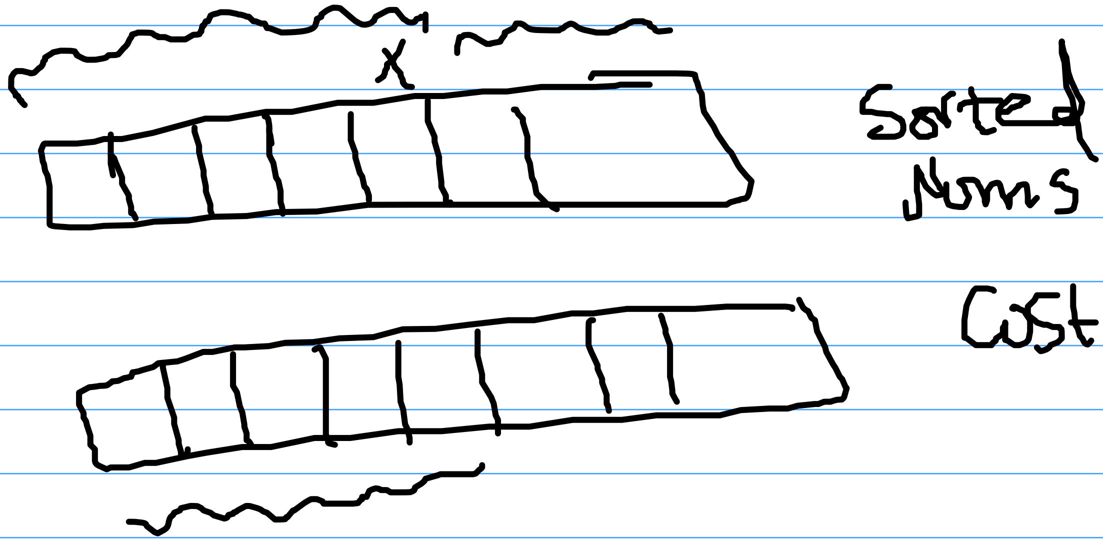
$$= \sum_j arr[j] \cdot cost[j] - X \sum cost[j]$$

$$+ \underbrace{\qquad\qquad}_{\text{all nums above } X}$$



$\Downarrow$

sort based on nums



X

at each X

we need

Accepted

$$f(X)_{min} = \left[X \cdot \sum cost[i] - \sum nums[i] \cdot cost[i]\right] + \left[\sum nums[j] \cdot cost[j] - X \cdot \sum cost[j]\right]$$