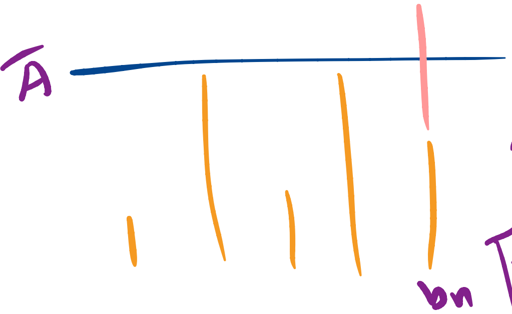


$$x_{unused_{n+1}} = x$$

$$\bar{A} = \frac{\left(\sum_{i=1}^{n} b_i\right) + x}{n}$$

$$x_{unused_n} = x_{unused_{n+1}} - (y_n - b_n)$$

$$y_{usable_n} = \bar{A}$$

$$\boxed{x_{unused_n} = x - (\bar{A} - b_n) = x - \bar{A} + b_n}$$

$$y_{usable_{n-1}} = b_n$$

$$x_{used_{n-1}} = \bar{A} - b_{n-1}$$

$$x_{unused_{n-1}} = x_{unused_n} - x_{used_{n-1}}$$

$$= x - \bar{A} + b_n - \bar{A} + b_{n-1}$$

$$= x - 2\bar{A} + b_n + b_{n-1}$$

$$y_{usable_{n-2}} = y_{usable_{n-1}} - x_{used_{n-1}}$$

$$= b_n - \bar{A} + b_{n-1}$$

$$= b_n + b_{n-1} - \bar{A}$$

$$x_{used_{n-2}} = \bar{A} - b_{n-2}$$

$$y_{usable_{n-3}} = y_{usable_{n-2}} - x_{used_{n-2}}$$

$$x_{unused_{n-2}} = x_{unused_{n-1}} - x_{used_{n-2}}$$

$$= b_n + b_{n-1} - \bar{A} - \bar{A} + b_{n-2}$$

$$= x - 2\bar{A} + b_n + b_{n-1} - \bar{A} + b_{n-2}$$

$$= b_n + b_{n-1} + b_{n-2} - 2\bar{A}$$

$$= x - 3\bar{A} + b_n + b_{n-1} + b_{n-2}$$

⋮

$$x_{unused_{n-c}} = x - (c+1)\bar{A} + \sum_{i=0}^{c} b_{n-i}$$

$$y_{usable_{n-c-1}} = \sum_{i=0}^{i=c} b_{n-i} - c\bar{A}$$

We need that $\underbrace{y\ \text{usable}_{n-c-1}}_{\text{no usable range}} = 0$, $\underbrace{x\ \text{unused}_{n-c}}_{\text{no usable extra battery}} \leq 0$

$$y\ \text{usable}_{n-c-1} = 0$$

$$\Rightarrow \boxed{\sum_{i=0}^{i=c} b_{n-i} - c\bar{A}} = 0$$

$$x\ \text{unused}_{n-c} \leq 0$$

$$\Rightarrow x - (c+1)\bar{A} + \sum_{i=0}^{c} b_{n-i} \leq 0$$

$$\Rightarrow x - \bar{A} \boxed{- c\bar{A} + \sum_{i=0}^{c} b_{n-i}} \leq 0$$

$$\Rightarrow x \leq \bar{A}$$

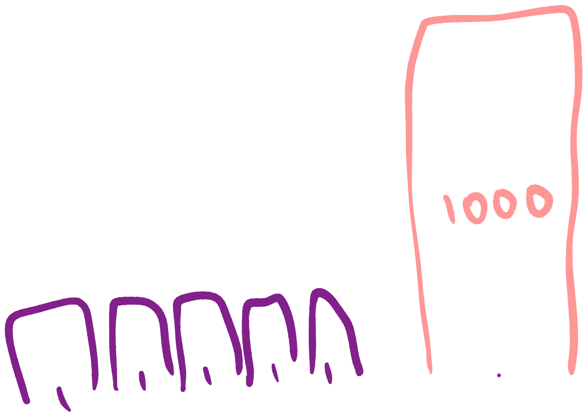
$$\bar{A} = \frac{(\sum_{i=1}^{n} b_i) + x}{n}$$

$$\Rightarrow x \leq \frac{(\sum_{i=1}^{n} b_i) + x}{n}$$

$$\Rightarrow nx \leq \sum_{i=1}^{n} b_i + x$$

$$\Rightarrow (n-1)x \leq \sum_{i=1}^{n} b_i$$

$$\Rightarrow \underbrace{\sum_{i=1}^{n} b_i}_{\text{sum of batteries}} \geq \underbrace{(n-1)}_{(\text{no. of batteries} - 1)} \cdot \underset{\text{Extra battery}}{x}$$



$5 \geq (4) \times 1000$ False

x_i

$b_i \geq x$

when sorted

$$\sum_{i=1}^{n} b_i \geq \sum_{i=1}^{n} x$$

$$\geq nx$$

worst case

$$\sum_{i=1}^{n} b_i = nx$$

put in LHS

$$\Rightarrow \underbrace{\sum_{i=1}^{n} b_i}_{\text{sum of batteries}} \geq \underbrace{(n-1)}_{(\text{no. of batteries } -1)} x$$

. Extra battery

$nx \geq (n-1)x$ TRUE!

every single time