

Bonus:-

~~For every~~  
The function  $\sum_{i=d-p}^d y_i - 1$  is monotonically increasing wrt.  $p$ .

→ Sort  $x_i$  with merge sort -  $O(d \log d)$

- For every  $p \in \{1, 2, \dots, d\}$  -  $O(d)$

~~Calculate~~  $\sum_{i=d-p}^d y_i = \sum_{i=d-(p-1)}^d y_i + y_{d-p}$

~~DCN~~  $S_p = \sum_{i=d-p}^d y_i = S_{p-1} + y_{d-p}$

- Do binary search on  $p \leftarrow O(\log d)$

\*(i) Calculate  $y/x_i - O(d)$  time as  $\sum_{i=d-p}^d y_i$  is known

Check  $x \in \Delta$ ,  $\sum_{i=1}^d x_i = 1$  and  $x_i \geq 0 \forall i - O(d)$   
if  $x \in \Delta$  return  $x$ .

⇒ Total  $O(d \log d)$  time complexity.