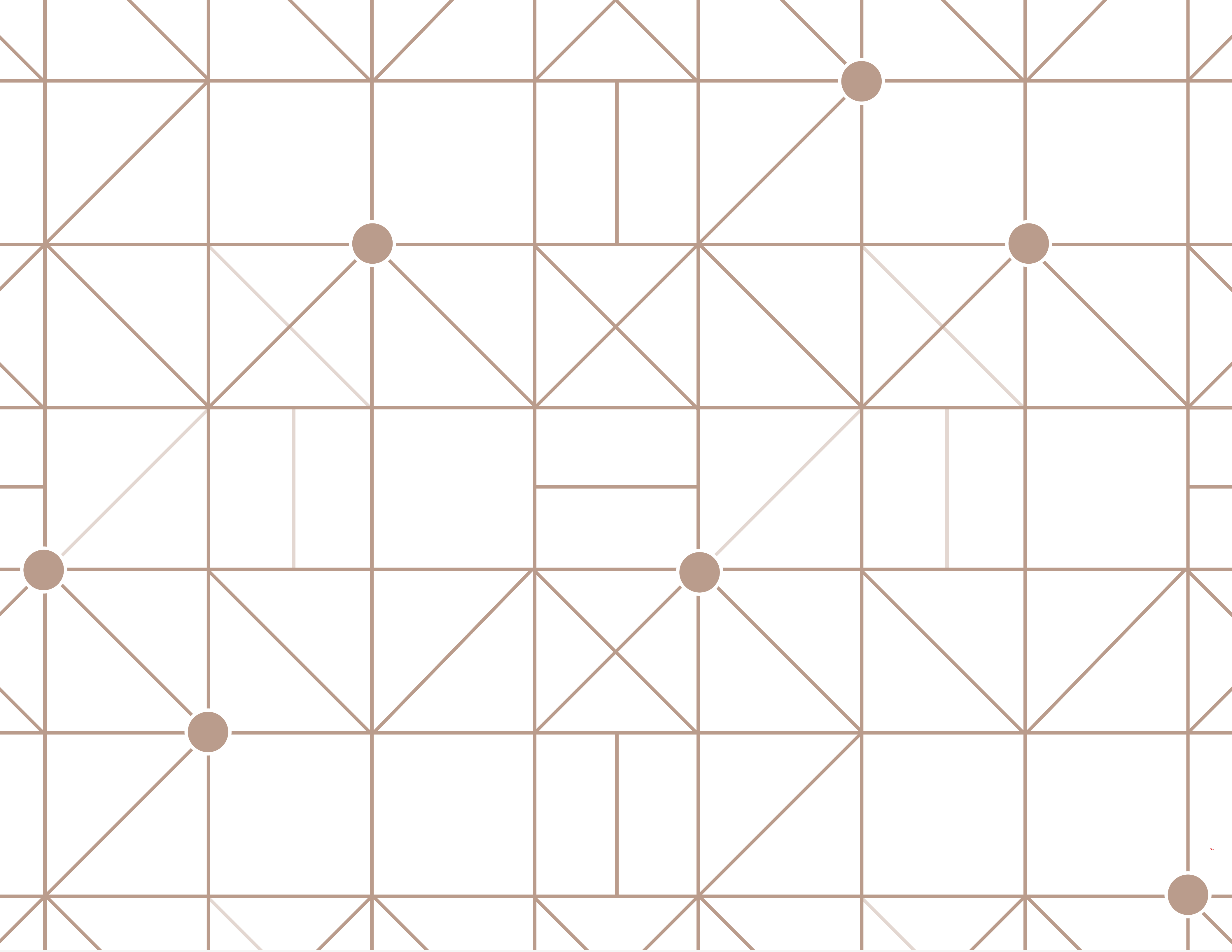


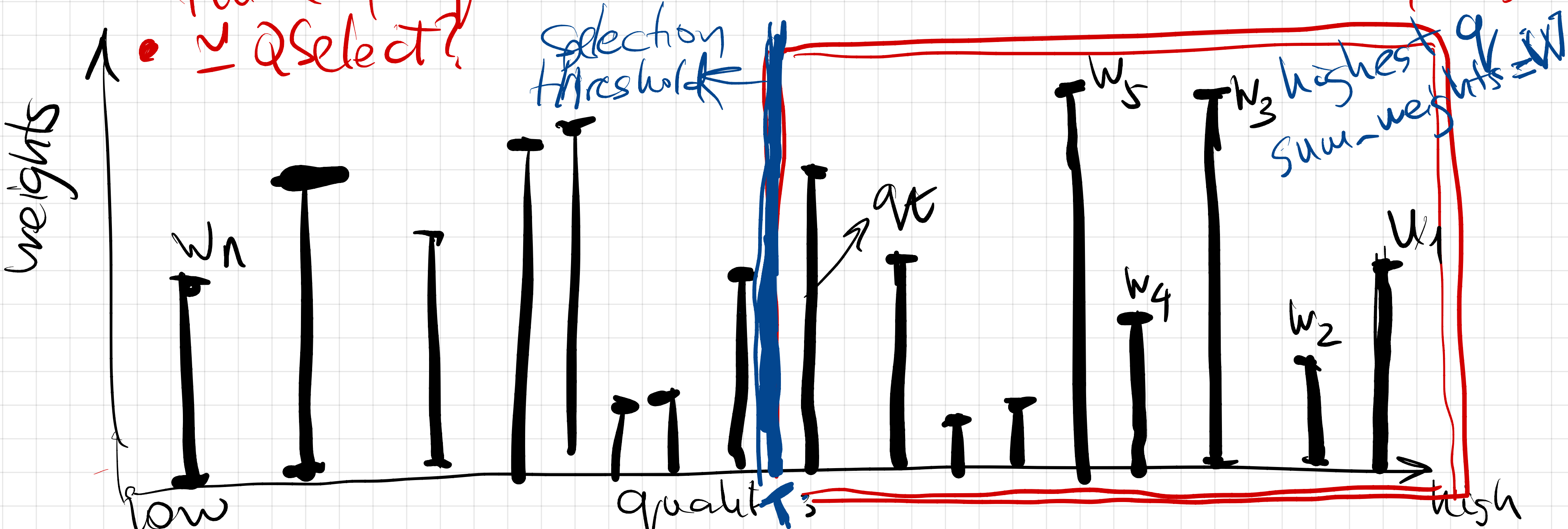
OH Sat 10/9 5pm

16.2-6 How to do it without sorting by quality

$q_i = \frac{val_i}{weight_i}$ $\quad q_1 \geq q_2 \geq \cdots \geq q_n$ → rational/real values

- pick highest qual avail → the whole weight or knapsack full.
- repeat

HINT
- create array of qualities q_i not sorted.
- Think of qualities in sorted order cummulatu by weight
- ~ QSelect?



We want quality threshold T such that $t \in \mathbb{Z}$ → index$_t$ of quality that $q_t = T$

$q_i \geq T$ are selected

$q_j < T$ not selected

$\sum$ selected quality-items $= W$

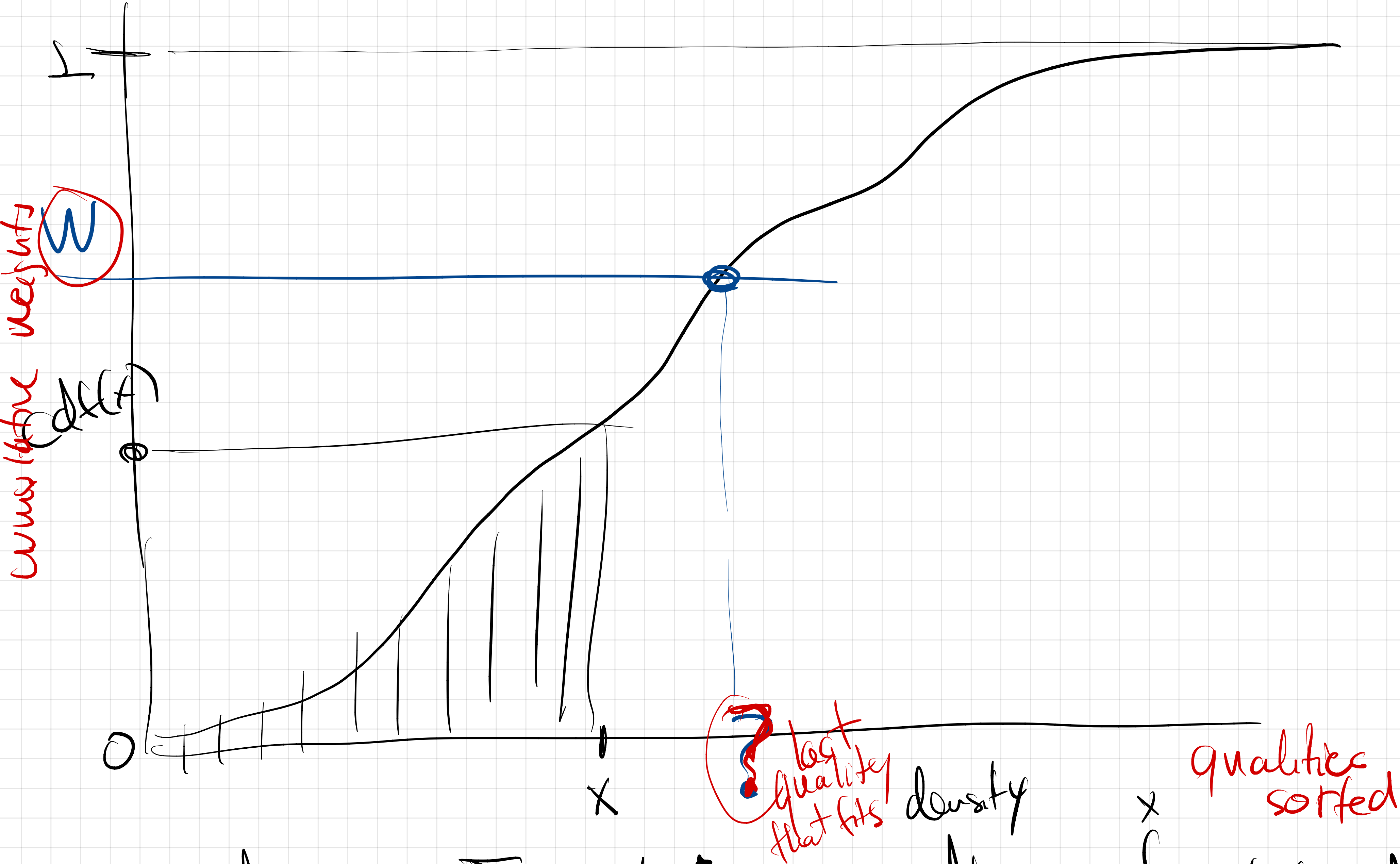
$\mathbb{R} \ni W$ = acts kind of like a rank on q-cumul array → use QSelect modified?
for cumulative weights

• cumulative weights $\overline{W_i} = \sum_{j=1}^{i} w_i$

$\underbrace{\overline{W_1}, \overline{w_1 + w_2}, \overline{w_1 + w_2 + w_3}}_{\text{Selected items}}$ - - - - - $\overline{w_1 + w_2 + \dots + w_n}$

W = knapsack total weight

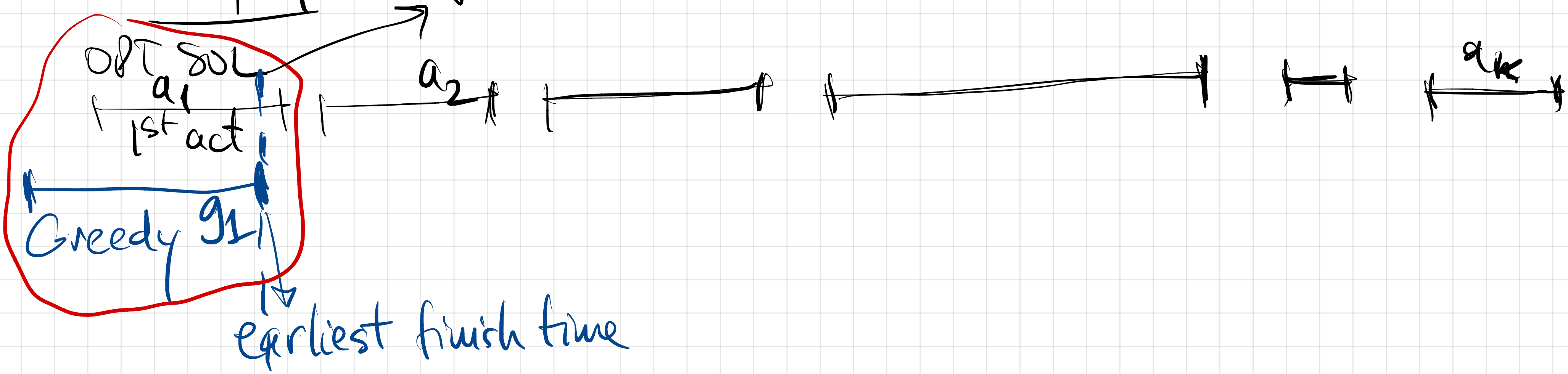
cummulative distrib function



$$cdf(x) = \sum_{i \le x} prob(i)$$

$$cdf(x) = \int_{t=0}^{x} prob(t)\, dt$$

Th 16.1



exchange

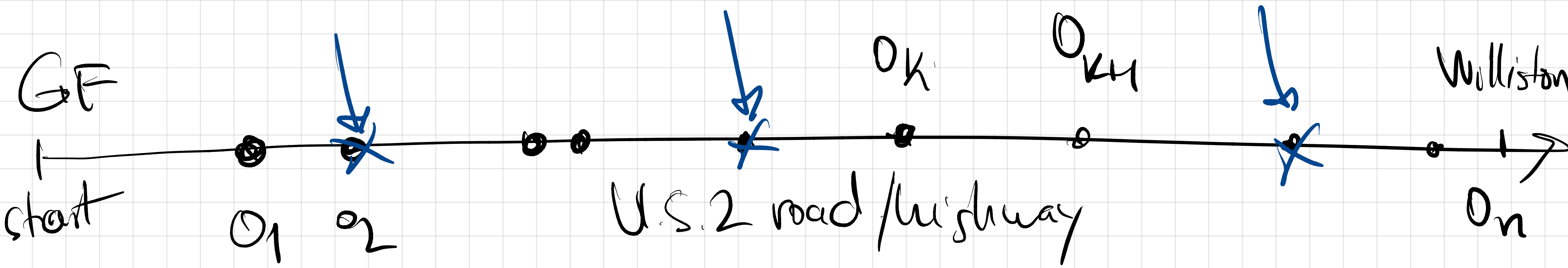
OPTSOL: ~~replace~~ its first activity a_1 with the greedy choice g_1

$\Rightarrow$ still optimal solution $\Rightarrow$ greedy works

OBJ $= k$

still valid (no overlap)

16.2-4



map ⇒ Sorted in direction of travel

$|O_{k+1} - O_k| < \boxed{m}$ miles to go on bottled water.

$\Theta(n)$ time if locations are sorted

- frog's jump as far as possible (works) in class
- have to output the location used

16-2-3.

$w_1 \leq w_2 \leq w_3 \ldots \leq w_n$

$v_1 \geq v_2 \geq v_3 \ldots \geq v_n$

$q_1 \geq q_2 \ldots \geq q_n$

Z = knapsack total weight

ind step: if the first k greedy choices are part of OPTSOL

items selected so far

$1, 2, \ldots k$ in order

$w_1 + w_2 + \ldots w_k \leq Z$

OPTSOL contains items $1:k$

$\Longrightarrow$ the next greedy selection $k+1$ is also part of OPTSOL

$1, 2, \ldots k$ items from before

add item $k+1$ ~~whole OR fill knapsack~~

if w_{k+1} fits whole still OPTSOL.

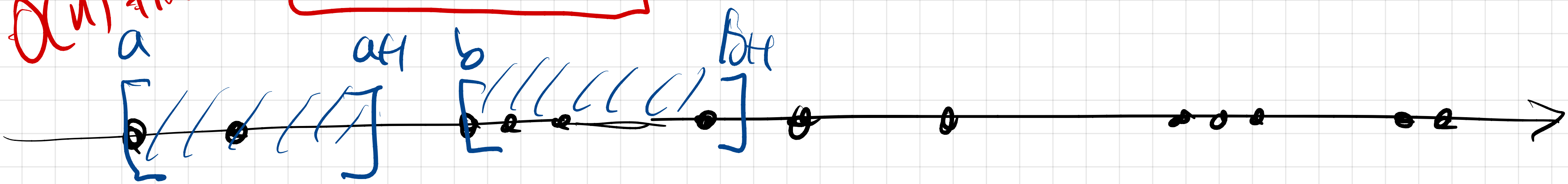
16-2-5

$\{x_1, x_2, \dots, x_n\}$ points on real line.

assume sorted $O(n)$ time

Sorted? $x_1 \le x_2 \le x_3 \dots \le x_n$

Not-sorted? what then $O(n \log n)$



Want coverage with unit intervals $[a \quad a+1]$

16-1 a) US denom = $\{1, 5, 10, 25\}$ greedy: biggest coin.

n cents **Proof**: $n \geq 25 \Rightarrow$ add $25 \in$ OPTSOL

$25 > n \geq 10 \Rightarrow$ add $10 \in$ OPTSOL

$10 > n \geq 5 \Rightarrow$ add $5 \in$ OPTSOL

b) Same proof denom = $\{c^0 = 1, c, c^2, \dots c^k\}$

Proof

$\forall t$ $c^{t+1} > n \geq c^t \Rightarrow$ add $c^t \in$ OPTSOL

ex $n = 8792$

coins denom = $\{10^0, 10^1, 10^2, 10^3 \dots\}$ $c = 10$

$8 \cdot 10^3 + 7 \cdot 10^2 + 9 \cdot 10^1 + 2 \cdot 10^0$