Note Title 07-06-2019

Range Query KD Tree

$O(\sqrt{n} + k)$

$P = \{p_1, p_2, \ldots, p_n\}$ → preprocess P

s.t. one can report the points $p_i \in P$ that lies inside the query rect. Q

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Reporting query — $O(\sqrt{n} + k)$

Counting query — $O(\sqrt{n}) \rightarrow$ Ex

$\rightarrow O(n^{1-\frac{1}{d}} + k)$ $\quad T(n) \leq 2T\left(\frac{n}{2}\right) + \cdots$

$\leftarrow d$

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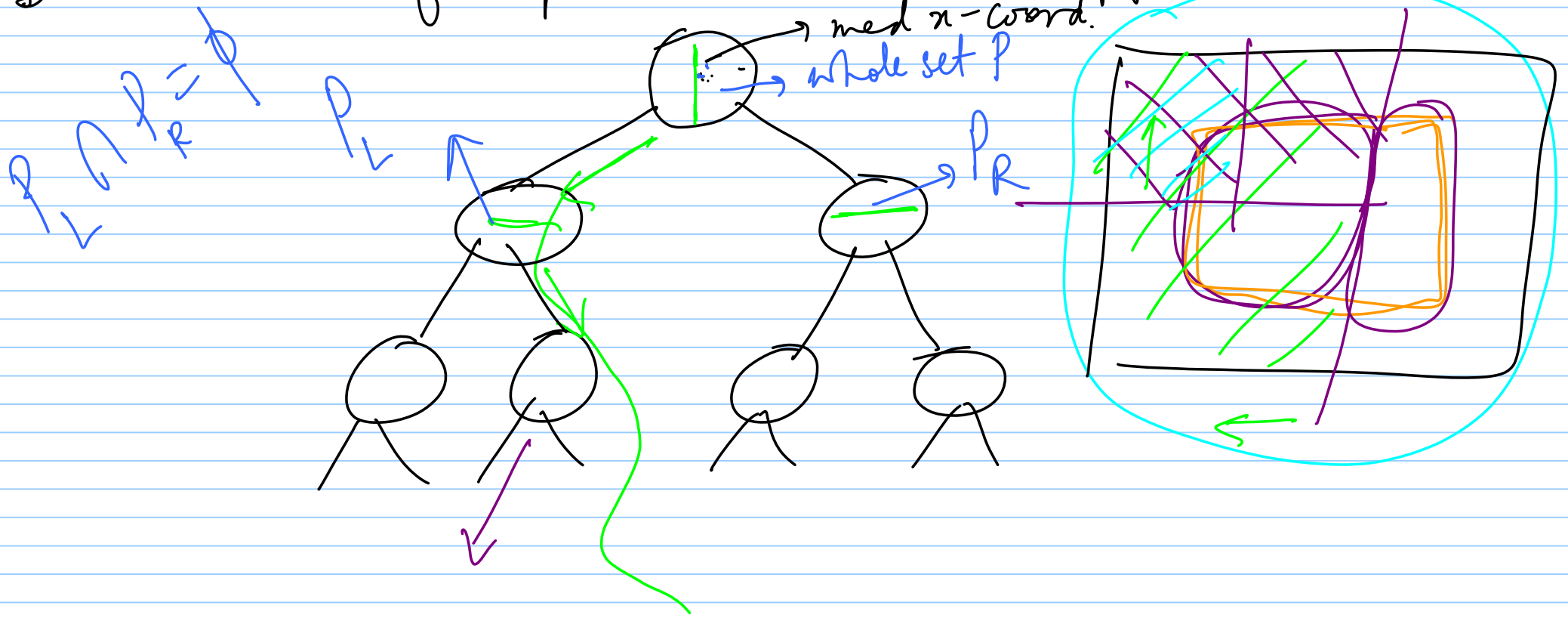
kd-tree

$O(\sqrt{n} + k)$ $\Longrightarrow$ Range tree $O(\log^2 n + k)$

Layered range tree $O(\log n + k)$ Fractional Cascading

Note Title 07-06-2019

Basic idea of any data str. that supports range queries:



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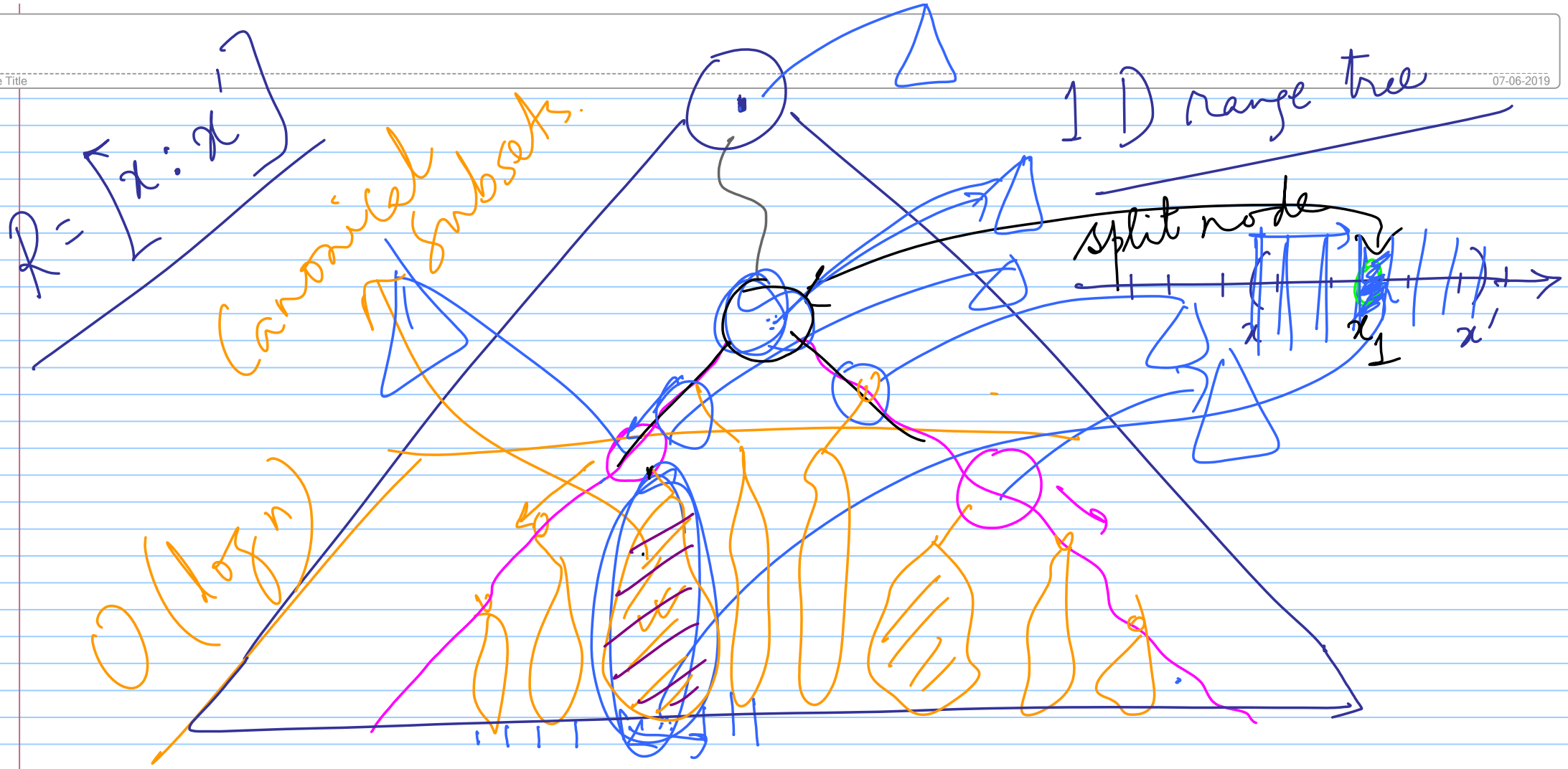

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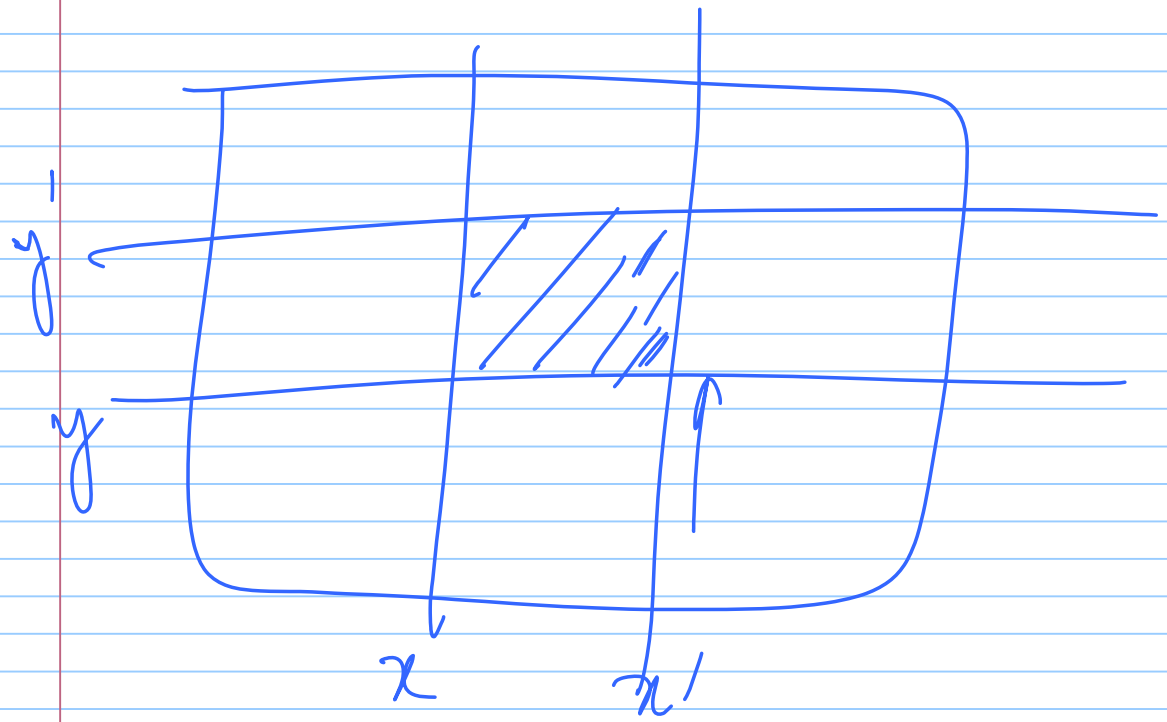
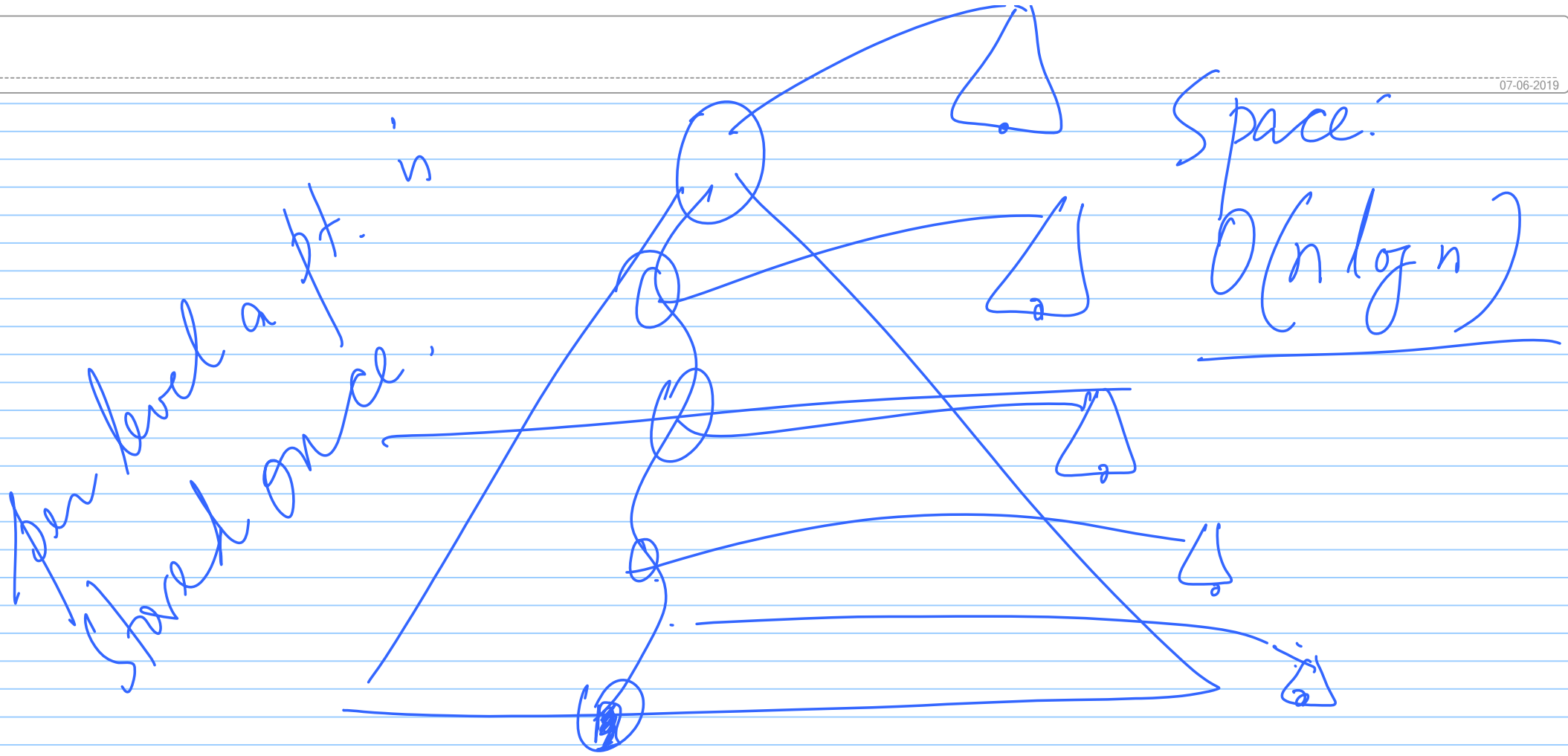
$R = [x : x'] \times [y : y']$



Note Title 07-06-2019



$$\sum_{\log n}^{\log n} O(\log n + K_v) \simeq O(\log^2 n + K)$$

$d-1$

Space: $O(n \log n)$

Query time: $O(\log^2 n)$

Ex:

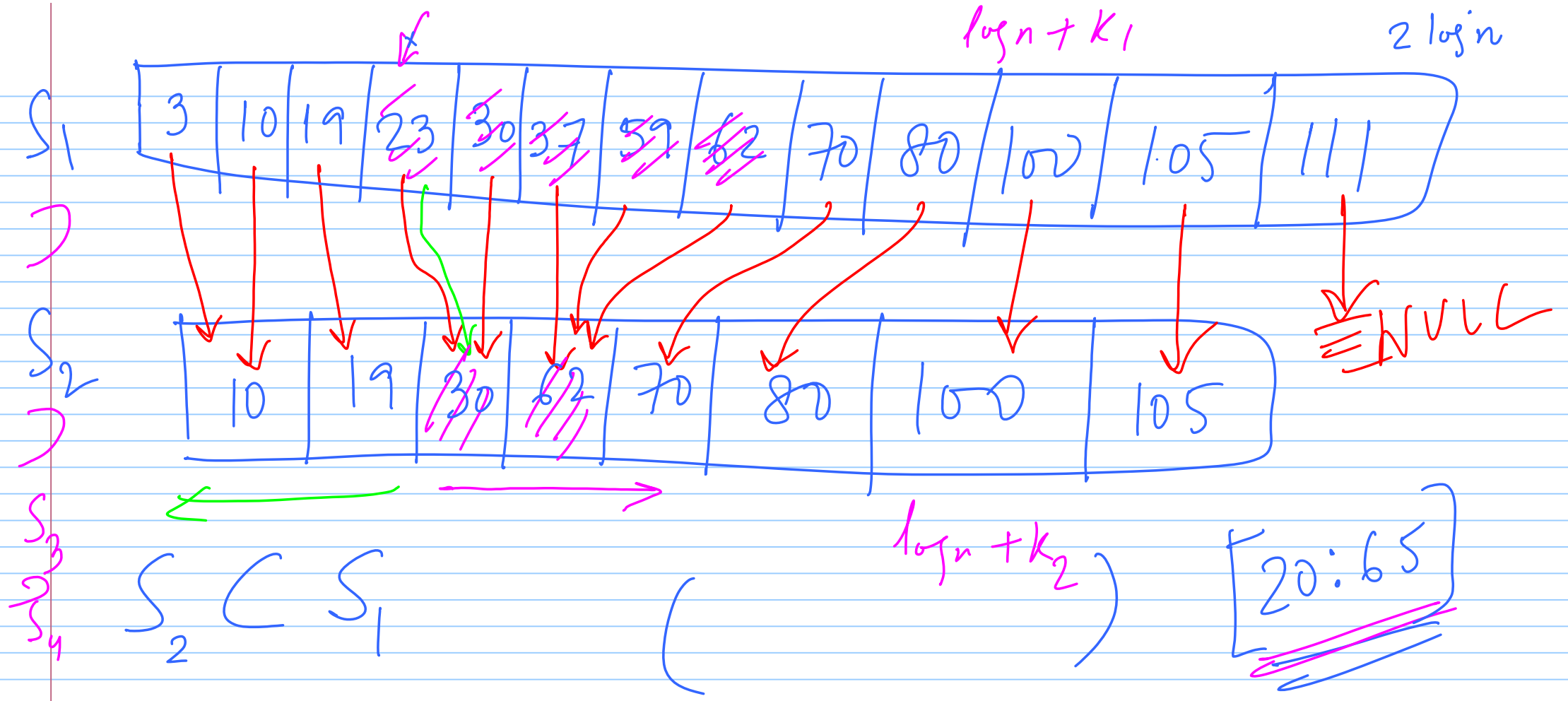
Generalize this to $\mathbb{R}^d$ // use a recurrence

$$O(\log^2 n + k) \longrightarrow O(\log n + k)$$

$$\updownarrow \qquad\qquad \updownarrow$$

$$\sum_{v \in \log n} O(\log n + k_v) \longrightarrow \sum_{v \in \log n} O(1 + k_v)$$

$$O(\log^d n) \longrightarrow O(\log^{d-1} n)$$


$\log n + k_1$
$2 \log n$
S_1
3 10 19 23 30 37 59 62 70 80 100 105 111
NULL
S_2
10 19 30 62 70 80 100 105
S_3
S_4
$S_2 \subset S_1$
$\log n + k_2$
[20:65]