Kai's Binning Problem

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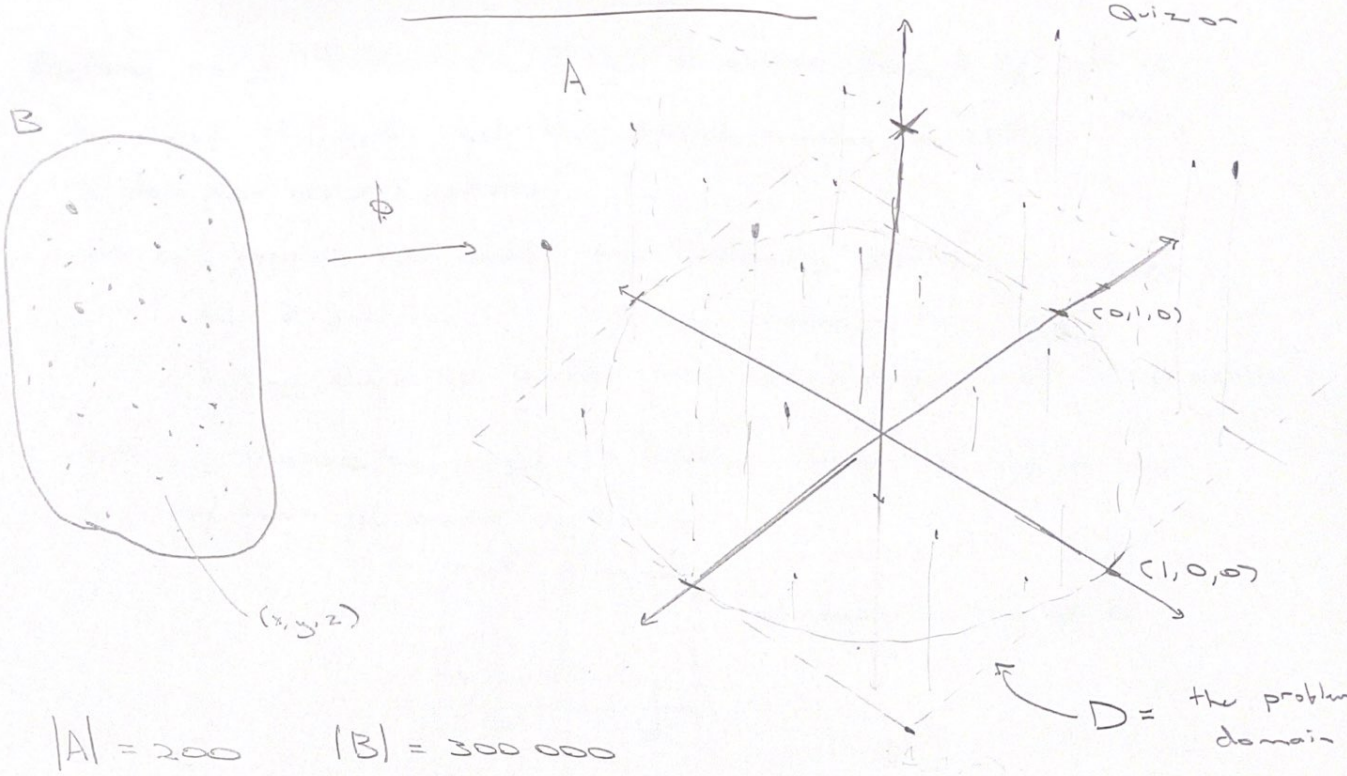


$|A| = 200 \qquad |B| = 300\,000$

$A = \{((x, y, z), t) \mid -1000 \leq x, y \leq 1000,\ 0 \leq z \geq 1000,\ t \text{ is thickness}\}$

$B = \{(x, y, z) \mid \text{"} \}$

$\phi: B \to A$ is defined as $\phi(b) = t_a$ where a is the closest element to b (by Euclidean distance), and $a \in A$, $b \in B$.

For computation purposes

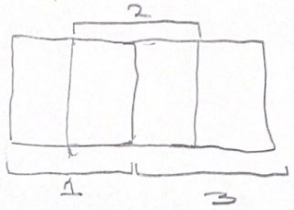
Let $\kappa: A \to \overline{A}$ be a "binning" function that maps $a \in A$ into $\bar{a} \in \overline{A}$, where $\bar{a}$ is the set containing any $a \in A$ within a certain region of D.

These regions of D are size $\frac{1}{d} \times \frac{1}{d} \times \frac{1}{d}$ and labeled using the π function. $d \in \mathbb{Z}^+$.

Before moving further, observe that all elements from A, B can be translated +(1, 1, 0) and the problem remains the same. This is done for easier computation.

→ this assumes that points are randomly distributed across the 2×2×1 box. if distributed randomly but radially, binning should use a polar coordinate method, and not translate

→ to improve accuracy to 100%, increase the size of bins so that the overlap as follows:

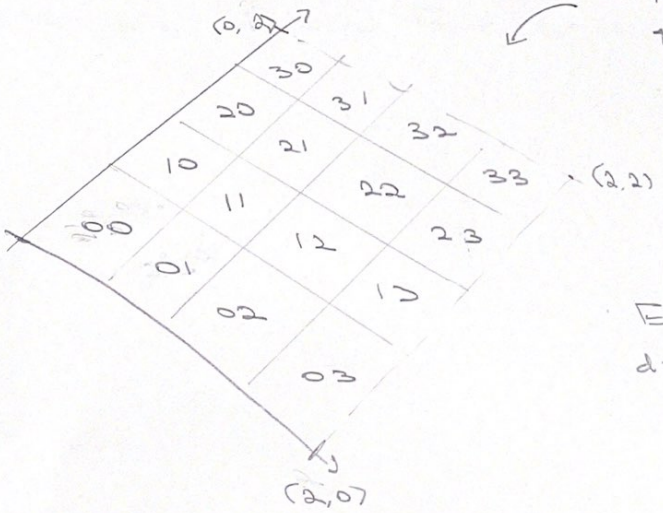


← head on view of a bin

this is done so unions of regions can be done to ensure that the correct point is always in the reduced problem domain, D'

in the interest of time, this is left for the reader

Once the translation has been done, label the regions of D similarly to this example:



This is how the π function works

Expand to more dimensions as needed.

Now we use a computer, algo to

Make the computation $\alpha(a_1)$ for all $a \in A$, and store it using a hashmap of $(\alpha(a_1), \{a \mid a \in \overline{a}\})$ see page 1

Explanation: Due to the size of A, the amount of elements in any $\overline{a}$ will be minimal. With this knowledge, finding the closest a to $b \in B$ is simple since we only have to calculate the Euclidean distance between a few items.

With the above knowledge, iterate through B and perform the following on each $b \in B$.

- Find the $\overline{a}$ that b belongs to (using π)
- With this $\overline{a}$, find the min distance between elements $\overline{a_1} \in \overline{a}$ and b. a_1 is the first element in $\overline{a}$
- With the $\overline{a_1}$ that gives us this distance, grab $\overline{a_2}$ the second element in $\overline{a}$.

$\longrightarrow$ With this, we have found our thickness. Next.