**Problem:** You are given a set of reef points and a list of navigation segments, each of the form \{N,S,E,W\} + distance. After each segment the ship may drift in any direction or not at all.

**Example:** [N 3], [E 2], [S 5], [S 2]
**Approach**

**Hardest**: Simulate the motion of the ship, and use backtracking to generate **all possible drifts**. (This will take way too long!)

**Easier**: Construct a 2-dimensional array representing the ocean. Place a **marker** in each place at each **possible** location of the ship. Move all the markers to simulate the ship motion.

To simulate drift, at the end of each segment, copy each marker location to its **4 surrounding neighbors**.

**Easiest**: Keep track of the nominal position of the ship (without drifting). When processing the s-th segment, check whether there are **any reefs within distance s-1**, where “distance” is defined as follows:

\[
\text{dist}(p, q) = |p_x - q_x| + |p_y - q_y|
\]

This is called the **L₁ distance**.
Example: [N 3], [E 2], [S 5], [S 2]
The diamond shape indicates the points within the space.

Collision with reef 2, which is within distance 4 of the final position.
Pseudo-code

\[
\begin{align*}
x & \leftarrow y \leftarrow 0 \\
\text{for } (s \leftarrow 1 \text{ to } n\text{Segs}) \{ & \quad \text{// process a segment} \\
\quad \text{for } (j \leftarrow 0 \text{ to } \text{segLength}[s]) \{ & \quad \text{// check for collision} \\
\quad \quad \text{for } (i \leftarrow 1 \text{ to } n\text{Reefs}) \{ & \quad \text{// check for collision} \\
\quad \quad \quad \text{distToReef} \leftarrow |x - \text{reefX}[i]| + |y - \text{reefY}[i]|; & \quad \text{// within drift distance?} \\
\quad \quad \quad \text{if } (\text{distToReef} \leq s) & \quad \text{// ...yes, return collision} \\
\quad \quad \quad \quad \text{return } i; & \quad \text{// update location} \\
\quad \quad \text{if } (j < \text{segLength}[s]) \{ & \quad \text{// stop at segment end} \\
\quad \quad \quad x += (\text{value based on segmentDirection}[s]); & \\
\quad \quad \quad y += (\text{value based on segmentDirection}[s]); & \\
\quad \} & \\
\} & \\
\} & \\
\} & \quad \text{// no collision detected}
\end{align*}
\]