Daily Coding Problem #194

Problem

This problem was asked by Facebook.

Suppose you are given two lists of n points, one list p_1, p_2, ..., p_n on the line y = 0 and the other list q_1, q_2, ..., q_n on the line y = 1. Imagine a set of n line segments connecting each point p_i to q_i. Write an algorithm to determine how many pairs of the line segments intersect.

Solution

We can try each possible line segment with each other, and keep track of which ones intersect. Two line segments intersect if their first x-values are on different sides than their second ones:

```
def intersects(l1, l2):
    # these lines intersect iff l1[0] > l2[0] and l1[1] > l2[1] or vice versa
    return (l1[0] < l2[0] and l1[1] > l2[1]) or \
           (l1[0] > l2[0] and l1[1] < l2[1])


def num_intersections(lst1, lst2):
    line_segments = list(zip(lst1, lst2))
    count = 0
    for i, l1 in enumerate(line_segments):
        for l2 in line_segments[i + 1:]:
            if intersects(l1, l2):
                count += 1
    return count
```

This runs in $O(n^2)$ time and constant space.