## This Week's Problems

You have 3 boxes labeled "Apples", "Oranges" and "Apples and Oranges". Problem 1) But, you are told that they are each labeled *incorrectly*. In a move, you are allowed select a box and remove one item at random from it (you cannot look or feel inside the closed box). What is the fewest number of moves needed to be able to correctly relabel all of the boxes?

Problem 2) Alice and Bob are players in a 32 player chess tournament. The tournament has a very weird structure. In each round 2 players are chosen uniformly at random. They play and the winner stays in the tournament and the loser is out. Assume that when two players play, each has an equal chance of winning. What is the probability that Alice and Bob will play each-other at some point in the tournament?

Problem 3) Two jets start from two random points and travel in straight lines on an infinite plane, leaving visible trails behind them. The directions of their travel are both random and independent. What is the probability that their trails will intersect at some point?

**Problem 4)** Coding Challenge You are given an array prices where prices[i] represents the price of a given stock on the *i*-th day. Your goal is to maximize your profit by selecting a single day to buy one stock and a different day in the future to sell that stock. Return the maximum profit you can achieve from this transaction. If no profit can be achieved, return 0.

## **EXAMPLE:**

Input: prices = [7,1,5,3,6,4] **Output:** 5

**Explanation:** Buy on day 2 (price = 1) and sell on day 5 (price = 6), profit = 6 - 1 = 5. Note that buying on day 2 and selling on day 1 is not allowed because you must buy before you sell.

**Problem 5)** There are *n* people in a room, each holding two pies. Each person takes aim at two other people in the room and throws their pies at them. What is the fewest number of people n such it is possible that no two people throw pies at each other? Challenge: What if each person had k pies?

## Hints:

You know every label is currently WRONG. 1

You are given the n = 32 case. What about for small n? Can you find a pattern and prove it? 2.

<sup>3.</sup> The locations of the points don't actually matter. Fix them and focus on the directions What about if you sold on day 2? 3? 4? ... what is the best profit you could get?

 $<sup>\</sup>frac{4}{5}$ . Play with small values of n.