

Math 219: Homework 4

Due: Friday, March 7th

1) Nine counters marked with the digits 1 through 9 are placed on the table. Two players alternately take one counter from the table. The winner is the first player to obtain, amongst his or her counters, three with the sum of exactly 15. Believe it or not, this is a well-known game in disguise. You have almost certainly played this game before. What well-known game is this?

2) There are 1000 lockers numbered 1 to 1000. Suppose you open all of the lockers, then close every other locker. Then, for every third locker, you close each opened locker and open each closed locker. You follow the same pattern for every fourth locker, every fifth locker, and so on up to every thousandth locker. Which locker doors will be open when the process is complete?

3) Imagine that you have three boxes, one containing two black marbles, one containing two white marbles, and a third containing one black marble and one white marble. The boxes were labeled for their contents: BB, WW, and BW. However, someone has switched the labels so that every box is now incorrectly labeled. You are allowed to take only one marble out of a single box. From this one marble, can you determine the contents of all three mislabeled boxes?

4) How long will it take a man to cross a barren and waterless desert one hundred miles wide if he can walk twenty miles a day but can only carry enough food and water for three days? For simplicity assume that the only places where supplies can be safely cached are at the points reached after one or more full days of travel.