1. What is the maximum number of regions that 2010 lines can create on a plane? Prove your answer. (For example 3 lines can create at most 7 regions.)

2. Is there any open knight’s tour for a 4x4 chessboard? Prove your answer.

3. Consider a tennis tournament in which every player encountered every other player exactly once. Prove that there is a player A such that for every other player B, either A won over B, or A won over some player C and C won over B. (note that there is no draw in tennis.)

4. There are two pots of pins. A and B play the following game. They take turns and at each step, they pick an arbitrary number of pins from one pot or the same number of pins from both pots. The player who does not have a pin left during his/her turn loses. Given that A starts the game, who has the winning strategy, A or B? Give a rigorous proof for your answer. (For example, if there are an equal number (greater than 0) of pins in both pots, A wins the game by picking all the pins from both pots at the first step. In case that there is 1 pin in one pot and 2 pins in the other, no matter how A plays, B can pick all the remaining pins at his/her first step, and win the game.)

5. 1000 people each pay some money in exact dollars as a donation. Prove that there is a subset of these people for whom the sum of the donations paid is an exact number of grand (i.e. $1000, $2000, etc.).