Math 5370 | **GAME THEORY** | Spring 2019

Dr. Duval | **Main Exercises**

due 2pm, Thursday, February 7

1. Carefully prove your assertions about Chomp on a $2 \times n$ bar.

2. The game Splits is played as follows: As with Nim, we start with several piles of chips. But now each turn consists of splitting one pile into two **unequal** smaller piles. For instance, a pile of 7 can be split into $6+1$, $5+2$, or $4+3$, but a pile of 6 can only be split into $5+1$ or $4+2$ (*not* $3+3$ because those two piles are equal). As with Nim, the last player to make a legal move wins.

Decide whether a game of Splits starting with a single pile of 9 chips is a win for the first player or the second player, and prove your answer is correct.

3. The game of Domino Filling is played as follows: We start with a rectangular board of equal sized squares. Each player has a supply of dominoes. Each domino covers exactly two adjacent (vertically or horizontally) squares on the board. Each turn consists of placing a domino on two empty squares of the board. As with Nim, the last player to make a legal move wins.

Decide whether a game of Domino Filling on each of the following boards is a win for the first player or the second player, and prove your answer is correct. Note that symmetry can help reduce the number of possibilities you consider.

(a) 3×3

(b) 3×4