

Mathematical Games

1. **One, Two, Three, Four, Takeaway**

- (a) There are 25 pennies on a table. On each turn, a player can take any number of pennies between 1 and 4. A player loses if he or she unable to move (because there are no pennies left).
- (b) Same game as above but it starts with 24 pennies.
- (c) Try other starting numbers of pennies.

2. **One, Two, Four Takeaway** There are 25 pennies in a pile. A player can take 1, 2, or 4 pennies on each turn. A player loses if he or she cannot continue (no more pennies left). Try other starting numbers of pennies.

3. **Lame Rook** On the top right square of an 8 by 8 chessboard there is a rook that can move either to the left or down through any number of squares. Players take turns moving the rook. A player loses if he or she is unable to move the rook (because it is already on the bottom left square). Consider various other initial positions of the rook.

4. **Two Pile Nim.**

- (a) Now there are two piles of pennies, one pile with 10 pennies and another one with 7. On each turn, a player can take any number of pennies from either one of the two piles. The player unable to move (no pennies left) loses.
- (b) What about if the numbers of pennies in the piles are m and n ?

5. **Lame Queen** On the top right square of an 8 by 8 chessboard there is a *queen* that can move any number of squares to the left, or down, or along a diagonal to the left and downwards. Players take turns moving the queen. A player loses if he or she is unable to move the queen. Consider various other initial positions of the queen.