Intermediate Math Circles
Addition Magician
Problem Set

NOTE: The first 4 exercises refer to variations of the Addition Magician game.

Exercise 1: What would a winning strategy be if the game is played to a total of 55?

Exercise 2: What would a winning strategy be if the players could chose from 1 to 15 and play to a total of 300?

Exercise 3: What would a winning strategy be if the players are allowed to use the numbers from 1 to n, with $n > 1$, but must play to a total of T where T is some positive integer larger than $3n$?

Exercise 4: Another variation: Start at 52 and on your turn you can subtract 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10. The first person to 0 wins the game. What be a winning strategy now?

Exercise 5: Here is a similar game

Careful Clipping

You Will Need:

- Two players

- 10 paper clips
  (or other small objects)

How to Play:

1. Start with a pile of 10 paper clips.

2. Players alternate turns.

3. On your turn, you can remove 1, 2 or 3 paper clips from the pile.

4. The player who removes the last paper clip, *loses*.

Can you determine a winning strategy for this game?

Exercise 6: Here is a variation of Careful Clipping:
- The game is won (instead of lost) by the player who removes the last paper clip.
- Each player can take 1, 3 or 4 paper clips.

Can you determine a winning strategy for this game?

Exercise 7: Here is a second variation of Careful Clipping:
- The game is played with 14 paper clips.
- The game is won (instead of lost) by the player who removes the last paper clip.
- Each player can take 1, 3 or 4 paper clips.

Can you determine a winning strategy for this game?