This assignment is due at the beginning of class on Wednesday, February 19. Please bring a neat, legible hard copy of your work with you to class. If your homework is multiple pages long, please staple the pages in the correct order.

Problem set guidelines: While you are welcome to discuss the problems with your classmates and you are strongly encouraged to seek help from me, after discussing the problems with others, your must write your own solutions. On work you turn in, you should acknowledge your collaborators by writing their names next to any problems you discussed with them. Write clearly and neatly (or type), giving thorough solutions that could be understood well by your classmates. Note that carefully communicating a solution is one of the most important parts of mathematics: if we can't convince others that our solution is correct, then our solution will not be accepted by the mathematical community.

After each solution, write a few sentences about your solution process: what was clear to you from the beginning, what did you have to think about more, what approaches did you take, what virtues of the ones we've discussed in *Math for Human Flourishing* did you feel were cultivated as you thought the problem and wrote your solution, etc. You do not need to answer all of these questions, but you should give a thoughtful explanation. **Solutions without a sufficient reflection will earn an R.**

1. Consider the version of Countdown in which a player can take either 1 or 2 tokens on their turn.
   (a) For which numbers of starting tokens does Player 1 have a winning strategy? Describe the winning strategy in those cases.
   (b) For which numbers of starting tokens does Player 2 have a winning strategy? Describe the winning strategy in those cases.
2. Consider a version of Countdown in which a player can take 1, 3, or 4 tokens on their turn.
   (a) For which numbers of starting tokens does Player 1 have a winning strategy? Describe the winning strategy in those cases.
   (b) For which numbers of starting tokens does Player 2 have a winning strategy? Describe the winning strategy in those cases.
3. Exploratory Exercise: do as much as you can with this problem. Describe your process, include dead ends, and explain what you think you need to know/figure out in order to get unstuck anywhere you get stuck. Your reflection for this kind of exercise should focus on virtues and desires discussed in *Math for Human Flourishing* as the other questions listed in the reflection description are already included in the exercise solution itself. To earn an M on an Exploratory Exercise, you do not need to get everything correct, but you need to engage deeply with the question and reflect carefully on what you're doing.

   For this Exploratory Exercise, design your own version of countdown: choose a set of numbers of tokens that a player is allowed to take on their turn (e.g., a player could take 1, 2, 4, or 8 tokens). Note that if 1 is not in your starting set, then it's possible that you may get down to a point where no one can take any tokens; in that case, the winner is the player who was last able to take tokens. Explore your game, choosing a starting number of tokens for your pile and finding a strategy in that case and then consider what happens if you change the starting number.