Tenzi and Threezi

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October 6, 2024

1 Link to problem statement

The link to the problem statement from Zach Wissner-Gross can be found at
https://thefiddler.substack.com/p/how-many-dice-can-you-roll-the-same.

2 Original problem

To start Threezi, the modified form of the game Tenzi with three dice per player, you start by rolling three dice and choosing a "target" number- the number which appears the most often on the three dice.

There are a total of $6^3 = 216$ combinations which can appear on the three dice. Of these combinations, there are six combinations where all three dice show the same number. There are $6 \cdot 5 \cdot 4 = 120$ ways to roll three different numbers on the three dice. All other possible die rolls contain two of one number and one of another number; there are $216 - 6 - 120 = 90$ of these.

This means that the average number of dice you put aside after rolling three dice to start the game is

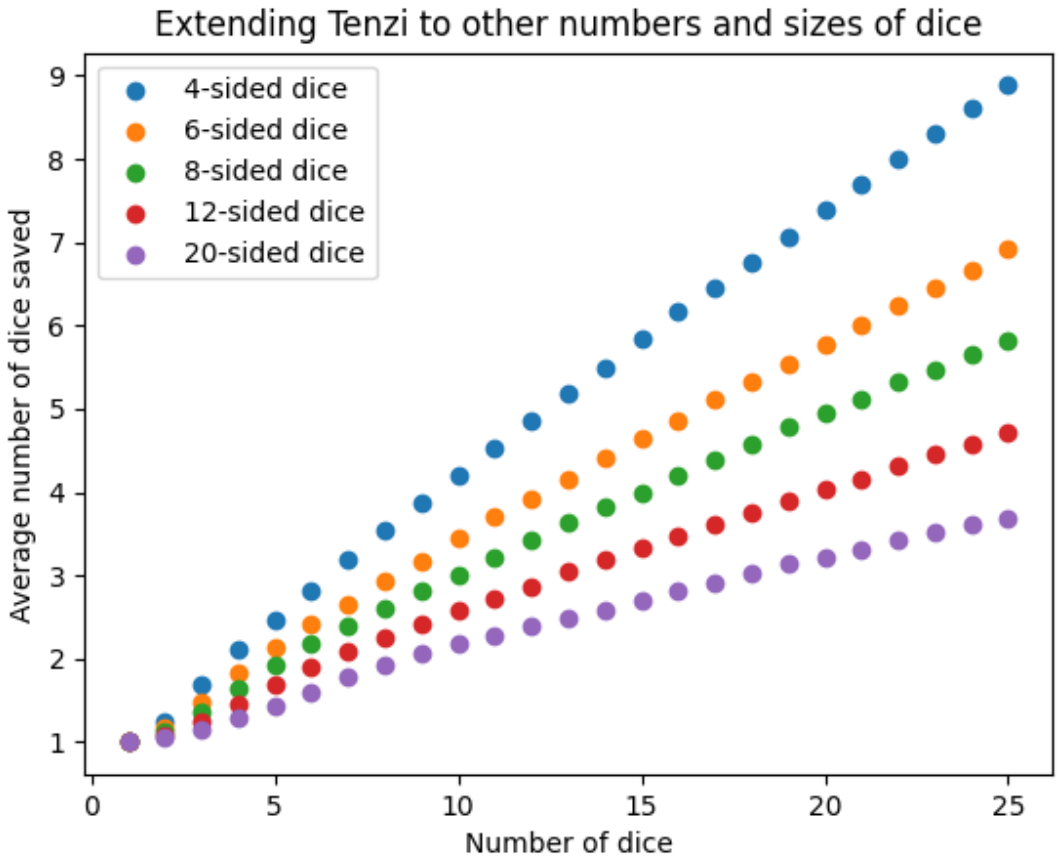
$$\frac{120 + 90 \cdot 2 + 6 \cdot 3}{216} = \frac{53}{36}.$$

3 Extra credit problem

In 10,000,000 trials of the first round of the game Tenzi for one player, the average number of dice saved after the first roll was approximately 3.445. Code can be found in the file TenziSim.py.

4 Extension of work

I decided to extend this problem to dice with 4, 8, 12, and 20 sides (to include all of the Platonic solids), with up to 25 starting dice. A plot of the results, obtained with the code in TenziSimExtension.py, is included here.


Extending Tenzi to other numbers and sizes of dice
4-sided dice
6-sided dice
8-sided dice
12-sided dice
20-sided dice
Average number of dice saved
Number of dice
0
5
10
15
20
25
1
2
3
4
5
6
7
8
9