Tiebreaker Dice

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Background

In 2012, Eric Harshbarger developed an intriguing set of dice that help players decide who should go first in a game with two to four players. Rather than 1-12 on each die, the numbers 1-48 are distributed across a set of four dice. Largest number wins, and the distribution is determined so that each die has an equal chance of being the winner when all possible outcomes are considered. For more info, see http://www.ericharshbarger.org/dice/#gofirst_4d12

Proposal

Given the idea of Go First Dice, I'd like to introduce the concept of Tiebreaker Dice. The goal is to return the 12-sided dice to their normal numbering, with some additional information to break ties.

The current set of Go First dice has the following numbers on the faces of the dice:

Die A:	1	8	11	14	19	22	27	30	35	38	41	48
Die B:	2	7	10	15	18	23	26	31	34	39	42	47
Die C:	3	6	9	16	20	21	28	29	33	40	44	45
Die D:	4	5	12	13	17	24	25	32	36	37	43	46

Table 1

By performing ((N-1) modulo 4) on Table 1, it produces the following data:

Die A:	0	3	2	1	2	1	2	1	2	1	0	3
Die B:	1	2	1	2	1	2	1	2	1	2	1	2
Die C:	2	1	0	3	3	0	3	0	0	3	3	0
Die D:	3	0	3	0	0	3	0	3	3	0	2	1

Table 2

This code could be used to indicate which die wins in a tie. If the dice are colored Red, Green, Blue, and Yellow, each die could have the numbers one through twelve as normal, with additional dots of the other dice colors. For a given 1-12 value, one

die will have zero colored dots, one die will have a single dot, one die will have two dots, and the last die will have three colored dots.

In the event of a tie, the winner is the die that has the other die's dot color. A die face with zero dots loses all ties, and a face with three dots face wins all ties.

This proposal would work just as well as the 1-48 numbering scheme, but has the added benefit of allowing the dice to be used as regular 1-12 dice.

Repairing an apparent bias

However, with the Go First dice numbering, the Tiebreaker dice notation system appears to be biased. It is not, but this is not visually obvious. The die associated with the second row of Table 2 never wins a four-way tie.

It is possible to rearrange the codes in Table 2 to get the same Go First behavior with dice that also appear to be fair with Tiebreaker notation.

Die A:	0	3	2	1	2	1	3	0	2	1	0	3
Die B:	1	2	3	0	1	2	0	3	1	2	3	0
Die C:	2	1	0	3	3	0	2	1	0	3	2	1
Die D:	3	0	1	2	0	3	1	2	3	0	1	2

Table 3

With the above encoding, each Tiebreaker die has three chances of being first (or second, etc) if all four players roll the same number. This repairs the apparent bias of the previous dice. Of course, these dice have all the other desirable properties of Go First dice; when any two or three of them are used, each die will win an equal amount of ties.

Table 4 provides the dot patterns for each face of a set of Tiebreaker Dice that are Red, Green, Blue, and Yellow (R G B Y).

	R	G	B	Y
1		R	RG	RGB
2	YBG	YB	Y	
3	BY	BYR		B
4	G		GRY	GR
5	YG	Y	YGR	
6	B	BR		BRG
7	GYB		GY	G
8		RBY	R	RB

9	BG	B		BGR
10	Y	YR	YRG	
11		RYB	RY	R
12	GBY		G	GB

Table 4