

NON-TRANSITIVE

DICE

STRATEGY

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CASE 1

CASE 2

CASE 3

1st PLAYER	R	1	1	6	6	8	8
2nd PLAYER	G	2	2	4	4	9	9

1st PLAYER	G	2	2	4	4	9	9
2nd PLAYER	B	3	3	5	5	7	7

1st PLAYER	B	3	3	5	5	7	7
2nd PLAYER	R	1	1	6	6	8	8

Why: For R

$$P(1) = \frac{2}{6} = \frac{1}{3}$$

$$P(6) = \frac{2}{6} = \frac{1}{3}$$

$$P(8) = \frac{2}{6} = \frac{1}{3}$$

For 2nd player

$$P(G > R) = P(2 > 1) + P(9 > 8)$$

$$= \frac{1}{3} + \frac{1}{3}$$

$$= \frac{2}{3}$$

For 1st player: $P(R > G) = P(6 > 4)$
 \therefore 2nd player has a winning advantage $= \frac{1}{3}$
 $\therefore \frac{2}{3} > \frac{1}{3}$

For G:

$$P(2) = \frac{2}{6} = \frac{1}{3}$$

$$P(4) = \frac{2}{6} = \frac{1}{3}$$

$$P(9) = \frac{2}{6} = \frac{1}{3}$$

For 2nd player

$$P(B > G) = P(3 > 2) + P(5 > 4)$$

$$= \frac{1}{3} + \frac{1}{3}$$

$$= \frac{2}{3}$$

For 1st player: $P(G > B) = P(2 > 3) + P(9 > 7)$
 \therefore 2nd player has a winning advantage $= \frac{1}{3}$
 $\therefore \frac{2}{3} > \frac{1}{3}$

For B:

$$P(3) = \frac{2}{6} = \frac{1}{3}$$

$$P(5) = \frac{2}{6} = \frac{1}{3}$$

$$P(7) = \frac{2}{6} = \frac{1}{3}$$

For 2nd player

$$P(R > B) = P(6 > 5) + P(8 > 7)$$

$$= \frac{1}{3} + \frac{1}{3}$$

$$= \frac{2}{3}$$

For 1st player: $P(B > R) = P(3 > 1)$
 $= \frac{1}{3}$
 \therefore 2nd player has winning advantage $\therefore \frac{2}{3} > \frac{1}{3}$