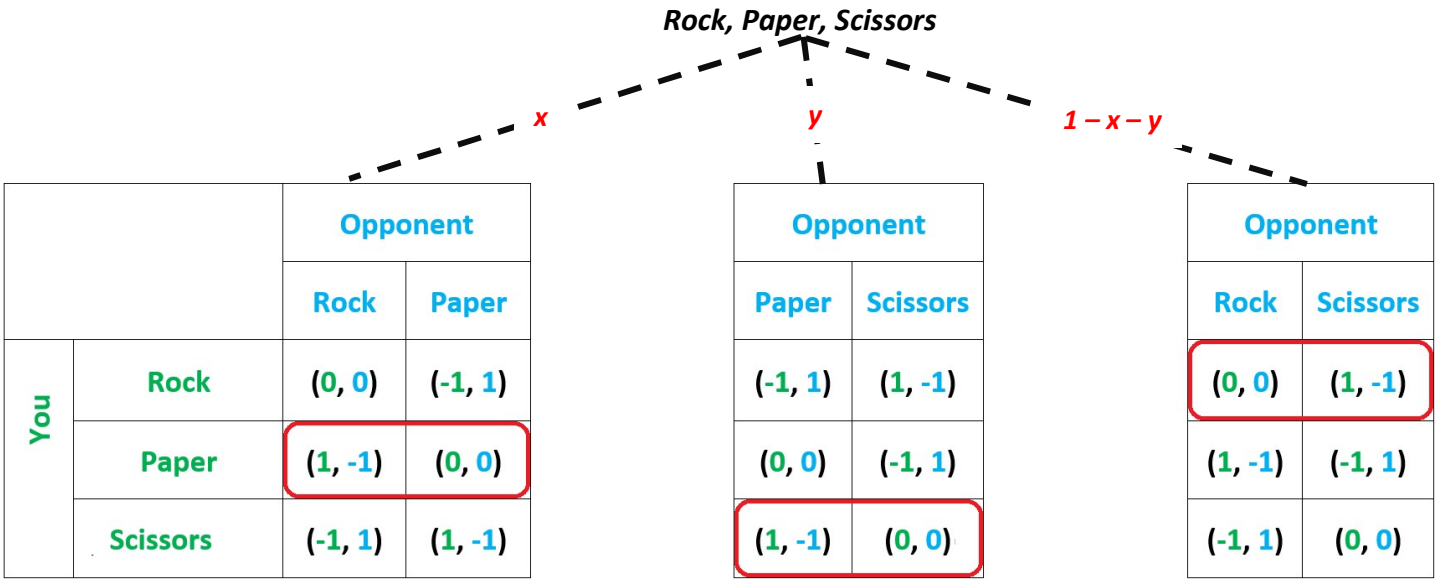
Traditional *Rock, Paper, Scissors* is a symmetric and fair game. Both players have the same strategies, and over many games, the score of each player is zero.

| | | Opponent | | |
|---|---|---|---|---|
| | | Rock | Paper | Scissors |
| You | Rock | (0, 0) | (-1, 1) | (1, -1) |
| | Paper | (1, -1) | (0, 0) | (-1, 1) |
| | Scissors | (-1, 1) | (1, -1) | (0, 0) |

Under the scenario, the game is symmetric, but no longer remains fair.




| | | Opponent | |
|---|---|---|---|
| | | Rock | Paper |
| You | Rock | (0, 0) | (-1, 1) |
| | Paper | (1, -1) | (0, 0) |
| | Scissors | (-1, 1) | (1, -1) |

| Opponent | |
|---|---|
| Paper | Scissors |
| (-1, 1) | (1, -1) |
| (0, 0) | (-1, 1) |
| (1, -1) | (0, 0) |

| Opponent | |
|---|---|
| Rock | Scissors |
| (0, 0) | (1, -1) |
| (1, -1) | (-1, 1) |
| (-1, 1) | (0, 0) |

Note that for each of the three possibilities of observing the opponent's arm, there is an optimal strategy, that is, at best half the time you will win, and at worse, half the time you will tie. Combining all three possibilities for any round,

$$P_{win} = x\left(\frac{1}{2}\right) + y\left(\frac{1}{2}\right) + (1 - x - y)\left(\frac{1}{2}\right) = \frac{1}{2}$$

$$P_{tie} = x\left(\frac{1}{2}\right) + y\left(\frac{1}{2}\right) + (1 - x - y)\left(\frac{1}{2}\right) = \frac{1}{2}$$

This leads to the probability of winning the tournament to be,

$$P_{tournament} = \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \cdots = 1$$

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2020.08.03