Matching Pennies

Matching Pennies is a basic game theory example that demonstrates how rational decision-makers seek to maximize their payoffs. Matching Pennies involves two players simultaneously placing a penny on the table, with the payoff depending on whether the pennies match. If both pennies are heads or tails, the first player wins and keeps the other's penny; if they do not match, the second player wins and keeps the other's penny. Matching Pennies is a zero-sum game in that one player's gain is the other's loss. Since each player has an equal probability of choosing heads or tails and does so at random, there is a Nash Equilibrium in this situation; in other words, neither player has an incentive to try a different strategy.

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- The same game can also be played with payoffs to the players that are not the same.

Matching Pennies is conceptually similar to the popular "Rock, Paper, Scissors," as well as the "odds and evens" game, where two players concurrently show one or two fingers and the winner is determined by whether the fingers match.

Consider the following example to demonstrate the Matching Pennies concept. Adam and Bob are the two players in this case, and the table below shows their payoff matrix. Of the four sets of numerals shown in the cells marked (a) through (d), the first numeral represents Adam's payoff, while the second entry represents Bob's payoff. +1 means that the player wins a penny, while -1 means that the player loses a penny.

If Adam and Bob both play "Heads," the payoff is as shown in cell (a)—Adam gets Bob's penny. If Adam plays "Heads" and Bob plays "Tails," then the payoff is reversed; as shown in cell (b), it would now be -1, +1, which means that Adam loses a penny and Bob gains a penny. Likewise, if Adam plays "Tails" and Bob plays "Heads," the payoff as shown in cell (c) is -1, +1. If both play "Tails," the payoff as shown in cell (d) is +1, -1.

Adam / Bob	**Heads**	**Tails**
Heads	(a) +1, -1	(b) -1, +1
Tails	(c) -1, +1	(d) +1, -1

Asymmetric Payoffs

The same game can also be played with payoffs to the players that are not the same. Changing the payoffs also changes the optimal strategy for the players. For example, if every time both players choose "Heads" Adam receives a nickel instead of a penny, then Adam has a greater expected payoff when playing "Heads" compared to "Tails."

Adam / Bob	**Heads**	**Tails**
Heads	(a) +5, -1	(b) -1, +1
Tails	(c) -1, +1	(d) +1, -1

In order to maximize his expected payoff, Bob will now choose "Tails" more often. Because this is a zero-sum game, where Adam's gain is Bob's loss, by choosing "Tails" Bob offsets Adam's greater payoff from a matching "Heads" outcome. Adam will continue to play "Heads," because his greater payoff from matching "Heads" is now offset by the greater probability that Bob will choose "Tails."