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Nash Equilibrium Solver

Of the many topics of game theory, Nash equilibrium is one of the most important. Given a matrix of payoffs for a number of players, a pure-strategy Nash equilibrium is defined as list of strategies, one for each player, such that no player can receive a better payoff by unilaterally deviating from his/her strategy. In other words, a game is in Nash equilibrium when every player is playing his/her best response. However, not all games have pure strategy Nash equilibria. In this case, mixed strategy Nash equilibria can be found to calculate the probabilities at which each player should choose his/her moves to maximize his/her average payoff.

Finding the pure and mixed strategy Nash equilibria for small games can be done by hand but requires one to perform some difficult calculations. As games get larger, calculations become even more complicated and take significantly longer time to perform. As a result, several algorithms have been developed to solve this problem. One such algorithm is the Lemke-Howson algorithm, which is considered to be the best known combinatorial algorithm for finding Nash equilibria.[[1]](#footnote-0) This algorithm is capable of finding the Nash equilibria of any *m* x *n* game using a geometric form called a polytope. Although this may be the most efficient algorithm for calculating Nash equilibria, it is extremely complicated to implement and is not required for calculating just 2 x 2 games, which was the goal of our project.

For our Nash equilibrium solver, we decided to create payoff and best response functions for each player and use this information to decide what the pure and mixed strategy Nash equilibria are for 2 x 2 games.

1. [Nisan, Noam](https://en.wikipedia.org/wiki/Noam_Nisan); Roughgarden, Tim; [Tardos, Éva](https://en.wikipedia.org/wiki/%C3%89va_Tardos); [Vazirani, Vijay V.](https://en.wikipedia.org/wiki/Vijay_Vazirani) (2007). [Algorithmic Game Theor](http://www.cambridge.org/journals/nisan/downloads/Nisan_Non-printable.pdf)y. Cambridge, UK: Cambridge University Press. p. 33. [↑](#footnote-ref-0)