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COM313 Algorithmic Game Theory

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Project Background

In our project, we wanted to find pure and mixed Nash equilibria and then compare our algorithm to Nashpy’s algorithms. Nashpy is a free to use package that allows for users to find pure and mixed equilibria with three different algorithms. They provide the option to use support enumeration, vertex enumeration, and a Lemke Howson algorithm. An important note here is that the Lemke Howson algorithm only finds one Nash equilibrium based on how Nashpy implemented it. A Nash equilibrium is when given a current strategy, players have no incentive to unilaterally switch their strategy to something else. Going off of this, a pure Nash equilibrium is when players are guaranteed to choose the same strategy based on the other player. A mixed Nash equilibrium is when players will randomize their moves because no pure Nash equilibrium exists. We started by building a Node class to store each node in the matrix, then continued by storing those in a game class, where we perform all of the operations needed. We also look for dominant and dominated strategies. A strategy is dominant if it always provides the best payoff for that player, and if the opposite is true, a strategy is dominated. Now, our process was a little different, as we use a logic based approach for finding pure Nash equilibria, while Nashpy used a very math heavy approach. Both styles have their advantages, but we are afforded one of speed because we search directly for the values as opposed to calculating them, though we are not able to find all mixed Nash equilibria. Overall, the purpose of our project was to create a program to find pure and mixed Nash equilibria, dominant and dominated strategies, and then give this information back to the user in a readable manner.