

# Agent Based Simulation, Negotiation, and Strategy Optimization of Monopoly

Nicholas Loffredo

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The goal of this project is two-fold: to find the best strategy for Monopoly, as well as seeing if reinforcement learning can be effectively implemented. I plan to implement a version of Monopoly that works just like the board game, then add computer agents who traverse the board and make choices based on how aggressive they are in playing, with a value of 1-10. There will be a different aggressive value for each choice type - ranging from buying titles, houses/hotels to negotiating with players for titles.

I have looked at Jon's simulation, which accurately computes the probability of a player landing on a particular property/square. Surprisingly, I was unable to find any simulations of the game of Monopoly to the extent that I am planning to do (including negotiation and machine/agent learning). Fortunately, I was able to find a paper which discusses the use of reinforcement learning in board games. Reinforcement learning is when agents, after taking a series of actions (in my case, playing a game of Monopoly), are either rewarded for correct actions, or punished/not rewarded for incorrect actions. This is basically how agents will be learn in my game.

My program will be written in Java. Because I have added an interface, I can now test the game by having multiple agents move around the board, and seeing if the correct results happen when they buy properties, land on chance, etc. As a benchmark, I will run simulations with multiple agents at the same aggressiveness levels a large number of times, and test the hypothesis that they have an equal probability of winning. My program will have to be able to accurately simulate the game of Monopoly. Moreover, the plan is to allow up to eight agents to play a game, allow each agent to have various aggressiveness levels regarding decision making, and allow agents to interact

with each other in negotiations.

I expect to have a working simulation of Monopoly and probabilities of victory for each level of aggressiveness (player A levels of aggressiveness vs. other players' levels of aggressiveness and the probability of victory for each one), as well as confirming the hypothesis that machine learning can be used for Monopoly agents and if time permits, assess which aggressiveness arrays work best. The final results will be presented in graphs and the analyses will be presented in a paper. I imagine it will perform as a working simulation of Monopoly, as well as having negotiations between computer agents where aggressiveness levels are determined by machine learning - if a computer wins with a particular strategy, it will go further in that direction. The simulation will have to be run hundreds, if not thousands, of times in order to obtain enough data to perform a meaningful analysis.