Game Theory

Assignment 2

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# Introduction

Game theory is the study of mathematical models of strategic interaction among rational decision-makers. It has applications in many fields, including but not limited to economics, computer science, biology, political science etc. Being pioneered by John von Neumann and Oskar Morgenstern, the theory was extensively developed starting from 1950s. During those years the main concepts were developed, such as repeated games or Nash equilibrium. Nash equilibrium is of particular importance because it showed existence of consistent solution for significantly wider range of games than it was initially proved by John von Neumann. Game theory studies many different types of games, some of which are cooperative/non-cooperative, symmetric/asymmetric, zero-sum/non-zero-sum, and others. One of the most famous examples of games modelling real-human behavior is “prisoner’s dilemma”, showing how cooperation does might not emerge from rationality of the players.

# Problem definition and statement

The game being examined in this paper is being played by two players, simulating moose behavior competing for food. The game field consists of three regions A, B, C, each having increasing amount of vegetation on it, which is defined by function:

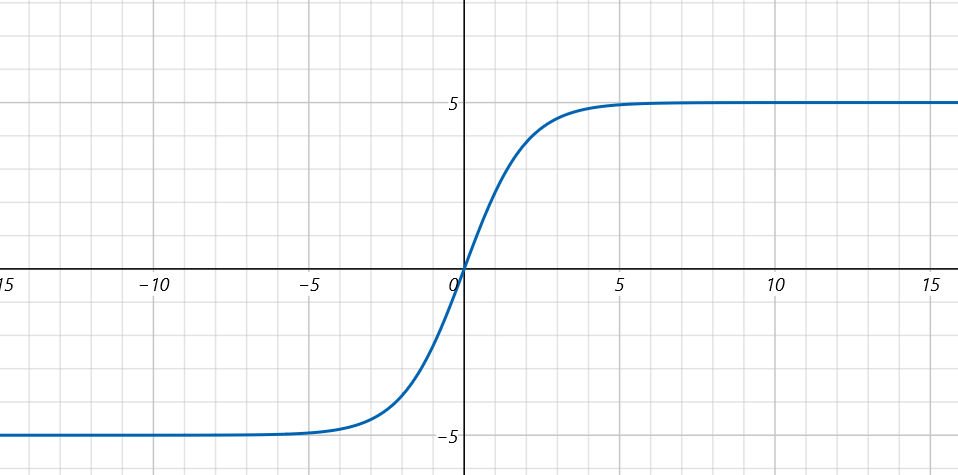
Every field starts with X=1, and increments X in every round, unless there are any players on it, in which case X is being decremented every round to the minimal value of 0.

If a player stands alone on a field, he gains score equal to . However, if multiple players move on the same field, they start to fight and none of them score anything (while still de).

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*Figure 1. Visualization of the regions’ vegetation growth function. Valid x domain is .*

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*Figure 2. Visualization of the players’ reward function. Valid x domain is x≥0.*

# Classification of the game

Examining this game from the point of view of Game theory, several characteristics can be seen. First, this is a non-cooperative game, because there are no external mechanisms for alliance enforcement. Second, it is a symmetric game, since we can change identities of the players and they payoffs would stay the same. Third, it is a non-zero-sum game, as it is possible for both players to profit simultaneously. Then, it is a discrete simultaneous game due to the fact that player’s move simultaneously and one player has no prior knowledge of another player’s move. Finally, it is a 3x3 game because on every round every player has exactly 3 possible moves. Now this gives us sufficient foundation for consideration of various strategies.

# Overview of player strategies

There are several simple strategies that would be useful to establish the performance baseline.

The first one we call Crazy. It simply chooses a random field every turn. Nothing sophisticated, but surprisingly it was performing very well, scoring higher than Alpha and Beta strategies.

The second strategy is Alpha. Choosing the t

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