Game Theory: An Application in Behavioral Simulation

Arman Luthra, Abdul Basit Tonmoy and Walid Kasab

1 Introduction

We are planning to develop a simulation based on principles of game theory, exploring behavioral changes between three competing strategies within a population. Inspired by a model where creatures (blobs) forage for food, our simulation will introduce variations to the existing model to improve understanding of strategy equilibrium and population changes over time. In addition to that base model, we are planning to add another species with behaviour that changes from time to time (We will do this by using random variables).

2 Underlying Assumptions

- **Food Availability**: Food appears daily in pairs, and each blob must choose a pair to forage from.
- **Survival and Reproduction**: Consuming one piece of food allows survival, while two pieces allow both survival and reproduction.
- **Behavioral Strategies**: Initial strategies include "Dove" (sharing food) and "Hawk" (aggressive food acquisition). We assume blobs can only adopt one strategy at a time but can switch based on evolving game dynamics. As mentioned before, we will be implementing another kind of blob that changes behaviour over time.
- **Energy and Conflict Costs**: Engagements between two Hawks lead to high energy expenditure, affecting survival negatively despite food intake.

3 Objectives and Questions

Our simulation aims to answer the following questions:

1. What percentage of of the different blob species leads to a stable population equilibrium?
2. How does changing the payoff matrix (e.g., reducing the cost of conflict for Hawks) alter the equilibrium strategy?
3. Can introducing variable strategy thresholds (e.g., a Hawk strategy adopted only when fewer than 50% of blobs are Hawks) stabilize or destabilize the population?

4 Work Split

- Walid Kasab will be answering and simulating question 1.
- Arman Luthra will be answering and simulating question 2.
- Abdul Basit Tonmoy will be answering and simulating question 3.