Using Game Theory to ModelEvolutionary Changes in a Group of Islands

Introduction
The aim of the project is to use game theory to model and represent a map of islands. These islands consist of two different types of populations. Over time, we will be observing the change in these populations from one type to another, as they change or “evolve” according to their own population and nearby islands.

The Prisoner’s Dilemma
The Prisoner’s Dilemma is an example of the type of game used in game theory. It requires two individuals to play against each other and make a single decision . Each player can choose whether to Cooperate “C” or Defect “D”. Neither player can see what the other will choose. Choosing the selfish option D has the opportunity of getting the best score, however if both players choose the selfish option, they miss out on the better situation of them both co - operating.

Player 2 / Player 1	Cooperate	Defect
Cooperate	+2 / +2	+3 / -1
Defect	-1 / +3	0 / 0

Weight of scores in one game of PD

Language
The project has been created using Java as a programming language. This allows for an object orientated approach for the individuals and the islands as well as representing the results using the Java Graphics class.

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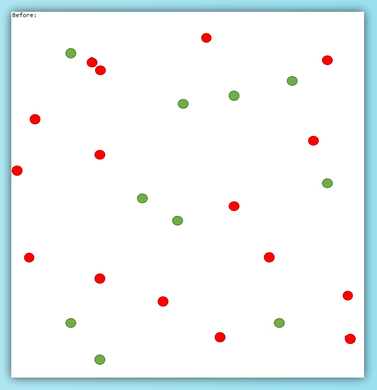
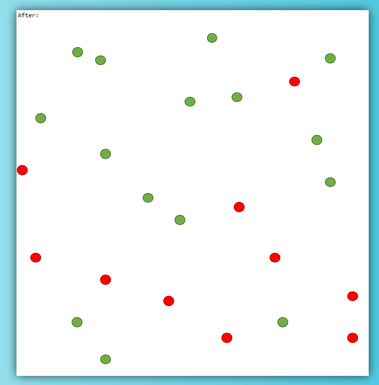
How it works
Each island consists of a population that all start off as one type, either as “Co-operators” C or “Defectors” D. This represents whether that individual will cooperate and pick the ‘unselfish’ option from the Prisoner’s Dilemma, or whether they defect and pick the selfish option. There are 2 stages to the program:

1.
Every generation, everyone in a population will play against all the other members of its own population and generate an average payoff score per individual. This is the score from playing multiple games of the Prisoner’s Dilemma.

2.
Compare payoff scores between individuals within a population with a small chance of mutation that will compare with a neighbouring population instead.



Left: Initial state of all islands



Right: State of islands after 1000 generations

Over many generations we see changes occur in the distribution of islands from the initial state to the currently viewed generation.