Krea - RAM - Maths Circle - Session 3

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1 Overview

Exploration of the Prisoner's Dilemma in two-player games, scaling the dilemma to n players, and examining cooperative strategies like Tit-for-Tat in repeated games.

2 The Prisoner's Dilemma

1. **Spotting the Dilemma:**
   - How do you identify a Prisoner's Dilemma from a payoff matrix?
   - A game is a Prisoner's Dilemma if the Strictly Dominant Strategy Equilibrium (SDSE) makes both players worse off than some other outcome.
2. **Scaling to n players:**
   - How does the dilemma scale when n players contribute to a common pool?
   - How tempting is "free-riding," where a player contributes 0 but still benefits from the multiplied pool?
3. **Repeated Games:**
   - How do you beat an opponent who plays "Tit-for-Tat"?
   - Which sequences of cooperation and defection maximise your score over 5 rounds?
4. **Axelrod's Tournament:**
   - Which rule performs best in a 200-round round-robin tournament?
   - Compare strategies like Always Cooperate, Always Defect, Tit-for-Tat, Grudger, and Random.

3 Challenge

Design a Non-Dilemma: Create a 2×2 game where one strategy dominates.

- The SDSE must ALSO be the best outcome for both players (the exact opposite of a Prisoner's Dilemma).
- Verify the difference between the SDSE payoff structure and a standard Prisoner's Dilemma.