ASHER RUDOLPH & ROBERT MONAHAN, Dept of Computer Science, Mathematics, and Engineering, Shepherd University, Shepherdstown, WV 25443. Cooperation, temptation, and escalation in iterated prisoner's dilemma tournaments.

This study investigates the emergence, stability, and breakdown of cooperation in repeated strategic interactions using a series of custom Iterated Prisoner's Dilemma (IPD) tournaments. Building on the foundational work of Robert Axelrod, nine original strategies, including Tit for Tat, Generous Tit for Tat, Grim Trigger, and Always Cooperate, were evaluated under multiple rule variations designed to model real world incentives such as compounding rewards, random errors, early mistrust, and escalating temptation.

Each tournament was implemented as an AI powered computational simulation through OpenAI's ChatGPT-5 in a python execution environment, consisting of 200 round round-robin matches using Axelrod's classic payoff structure. Under a dynamic reward structure in which cooperation increased the reward payoff, Always Cooperate achieved the highest cumulative score (46,398.5), followed closely by forgiving reciprocal strategies. Introducing execution noise (7.5% random move errors) reduced the performance of strict retaliators, while Tit for Two Tats ranked first with a total score of 29,856.3. When temptation payoffs increased beyond a threshold, cooperative strategies still outperformed defect-oriented strategies, though overall score variance declined. In a final tournament with uniformly increasing payoffs and a rule forcing defection whenever it yielded a relative advantage, all nine strategies converged to identical cumulative scores (51,750), demonstrating an arms-race dynamic in which escalation eliminated strategic differentiation. These results show that cooperation is highly sensitive to incentive design and that excessive temptation undermines relative advantage. This research was conducted as part of the 2025Summer Undergraduate Research Experience project at Shepherd University.