**PLEASE NOTE: NO LATE ASSIGNMENTS WILL BE ACCEPTED**

Conducting Experiments with the Axelrod Tournament Demo

Tremendous attention has been focused on the Prisoner’s Dilemma (PD) game since Merrill Flood and Melvin Dresher first explored the game at the Rand Corporation in the early 1950s. While the properties of the one-shot PD game are now well understood, the properties of the game that results when two players repeatedly engage in PD game play - the so-called Iterated Prisoner’s Dilemma (IPD) game - are far more complicated.

In 1979, Robert Axelrod (University of Michigan) posed an intriguing question about the IPD game: What type of strategy (if any) ensures good individual performance over the long haul when one is engaging in repeated PD game play in round-robin fashion with multiple “strangers” whose strategies are not known in advance? As discussed in Team Exercise 3, Axelrod decided to explore this question by running a computer tournament. Various professional game theorists were solicited for IPD strategies in the form of computer algorithms, and the submitted strategies were then pitted against each other in repeated round-robin PD game play.

The Axelrod Tournament Demo currently under construction by Chris Cook attempts to capture the salient aspects of Axelrod’s 1979 tournament. Team Exercise 3 asked you to critique the basic design features of a beta version (1.0) of this demo. In the meanwhile, Chris has updated this demo with additional capabilities (e.g., graphics); automatic installation software for downloading this updated version is now available at the Axelrod Tournament Demo home page at

http://www.econ.iastate.edu/tesfatsi/demos/axelrod/axelrodt.htm

In addition, the updated version will also be installed on the pcs in the first three rows in the Computer Lab (Heady 68) during the next couple of days. Recall that the Computer Lab in Heady Hall 68 is open to all students M-F, 8:00am-8:00pm.

The Axelrod Tournament Demo (both in beta and updated form) permits a user to specify as treatment factors the number of tournament iterations, the total number of strategies comprising the initial population of strategies, the types of strategies in this population (selected from a list), and the possible payoffs that can be earned by each player in each pairwise game play under the four possible situations (CC,CD,DC,DD). The user can then observe how well each type of strategy fares over time as the population of strategies participates in repeated round-robin game play.

This team exercise asks each team to use the updated Axelrod Tournament Demo to experimentally explore the extent to which the initial specification of the treatment factors affects which strategy type “wins” the tournament in the sense of accumulating the largest average individual payoff per round, where round = one complete round-robin of game play.
References for Team Exercise 4:

[1] ** Chris Cook, Axelrod Tournament Demo, updated version. Automatic installation software is available for downloading ON-LINE at

http://www.econ.iastate.edu/tesfatsi/demos/axelrod/axelrodt.htm

The updated version of the demo will also be installed on the pcs in the first three rows of the COMPUTER LAB (Heady 68)

[2] ** Leigh Tesfatsion, “Experimental Design: Basic Concepts and Terminology,” ON-LINE (Syllabus Section I.B)/HAND-OUT (for Team Exercise 2)


Part A (3 Points): Formulate an Interesting Hypothesis

Referring to reading [2] above, carefully formulate an hypothesis (conjecture) that your team judges to be interesting and substantial regarding how a systematic change in some chosen treatment factor for the Axelrod Tournament Demo will affect which strategy type(s) in your initial strategy population “win” the tournament.

IMPORTANT QUALIFICATIONS: Recall that the seed value for the pseudo-random number generator CANNOT be considered a “treatment factor” - these seed values are to be used to generate sample runs for each particular treatment specification you wish to test. Also, however else you set the payoffs, please choose the SYMMETRIC payoff case. This means that each player has the SAME four possible payoffs (mutual defection, mutual cooperation, temptation, and sucker payoffs) as any other player. Although the nonsymmetric payoff case is an interesting addition to Chris’s demo, he has not yet completed this aspect of the demo; he still needs to add in the ability of the user to associate a particular payoff matrix with each specified strategy in the initial strategy population.
Part B (6 Points): Test Your Hypothesis within an Experimental Design

Use the Axelrod Tournament Demo to experimentally test the hypothesis you proposed in Part A. Specifically:

1. Choose a range of values (at least three) to be tested for your chosen treatment factor in Part A, and report these values.

2. Set fixed values for all OTHER structural features of the Axelrod Tournament demo, to be retained throughout all experimental runs, and report these fixed values.

3. For each value of your treatment factor to be tested, conduct $N$ experimental runs ($N \geq 10$) of the Axelrod Tournament Demo using $N$ distinct initial seed values for the pseudo-random number generator.

4. For each value of your treatment factor to be tested, and for each run $n = 1, ..., N$ conducted for this treatment factor value, report:
   
   (a) the value of the treatment factor that is being tested;
   
   (b) the pseudo-random number seed value (the identifier for the run);
   
   (c) which strategy type(s) “won” the tournament in the sense of accumulating the largest average individual payoff per round averaged across the $N$ runs. (NOTE: The Axelrod Tournament Demo automatically calculates and reports this information for you; see the GUI menu screen labelled “Agent Stats.”)

5. For each tested treatment factor value, be sure also to examine the variation across the $N$ runs in the average individual payoff per round attained by each strategy type by clicking the “expand” feature on the GUI menu screen labelled “graph.” Report on any interesting observations here as well.

Part C (3 Points): Analysis of Findings

As best you can, provide an explanation and interpretation for the experimental findings you reported in Part B. Do these findings provide any support for the hypothesis you proposed in Part A? Or does your hypothesis in Part A appear to be inconsistent with these findings? Explain carefully.