Agent-Based Systems Tutorial 6

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Q1 Consider the politics in the UK example from the lecture: $\Omega = \{\omega_L, \omega_D, \omega_C\}$, where ω_L represents the Labour Party, ω_D the Liberal Democrats and ω_C the Conservative Party. Voters have the following preferences:

- 43% of $|Ag|$ are left-wing voters: $\omega_L \succ \omega_D \succ \omega_C$
- 12% of $|Ag|$ are centre-left voters: $\omega_D \succ \omega_L \succ \omega_C$
- 45% of $|Ag|$ are right-wing voters: $\omega_C \succ \omega_D \succ \omega_L$

1. Which party will win an election based on the following voting procedures:
   - Plurality
   - Sequential majority elections with $\omega_L, \omega_D, \omega_C$
2. Is it possible to fix the election agenda in favour of any outcome?
3. Assuming that a new fourth party ω_N emerges altering the preferences of the voters to:
   - 38% of $|Ag|$ are left-wing voters: $\omega_L \succ \omega_D \succ \omega_N \succ \omega_C$
   - 11% of $|Ag|$ are centre-left voters: $\omega_D \succ \omega_L \succ \omega_N \succ \omega_C$
   - 39% of $|Ag|$ are right-wing voters: $\omega_C \succ \omega_D \succ \omega_L \succ \omega_N$
   - 12% of $|Ag|$ are voters of the new party: $\omega_N \succ \omega_C \succ \omega_D \succ \omega_L$

   In favour of which party is it possible to fix the election agenda in sequential majority elections?
4. Determine the winner of the election using the following voting procedures:
   - The Borda count
   - The Slater ranking

Q2 Consider the following coalitional games:

- (The glove game) Players have left and right hand gloves and they are trying to form pairs. Players 1 and 2 have right hand gloves whereas player 3 has a left hand glove. The agents have the following value function:

$$v(C) = \begin{cases} 1 & \text{if } C \in \{\{1,3\},\{2,3\},\{1,2,3\}\} \\ 0 & \text{otherwise} \end{cases}$$

- (The treasure of Sierra Madre game) 3 people find a treasure of many gold pieces in the mountains of Sierra Madre. Each piece can be carried by two people but not by a single person. The valuation function of this game is:

$$v(C) = \lfloor \frac{|C|}{2} \rfloor$$

1. Compute the Core
2. Compute the Shapley value for both games.

Q3 Consider the following weighted voting game: $\langle 10; 6, 4, 2 \rangle$.

1. Calculate the Shapley-Shubik power index for all players.
2. How important is the role of player 3 in the game?
3. Suppose we add one more player to the game: $\langle 10; 6, 4, 2, 8 \rangle$. How does this affect the role of player 3?