14 Nov 2014
Math 181

The following table compares the four main voting systems discussed in Chapter 9 and compares them to four "fairness" properties. A "Yes" means that the voting system will satisfy that property no matter what the ballots are. A "No" means that there are sets of ballots for which the property will fail. The two "?" boxes are your homework for Wednesday. Determine whether the answer is yes or no, and show *why*.

	CWC	IIA	Pareto	Mono
Plurality	No	No	Yes	Yes
Borda	No	No	Yes	Yes
Seq. Pairwise	?	No	No	Yes
Hare	?	No	Yes	No

Arrow's Impossibility Theorem states that any voting system using preference lists cannot satisfy the following three conditions:

1. No dictator

2. Independence for Irrelevant Alternatives (IIA)

3. Pareto condition

In game theory (Chapter 15), when we consider an *ordinal game*, where outcomes are listed best to worst for each player, we cannot consider mixed strategies. The problem is that ranked outcomes do not represent the *value* to each player with enough precision. For example, if I have payoffs of $1,000,000, $100, $10, or $1, then ranking them using numbers 1, 2, 3, and 4 does not accurately show that the first payoff is WAAAAAY better than all of the others.

In fair division (Chapter 13), when two players give preference lists for items and use the bottom-up strategy, they can achieve an outcome that is not proportional, not equitable, not envy-free, and not Pareto-optimal. If instead each person assigns points to each item and uses the Adjusted Winner Procedure, all four properties will always be satisfied.

The point is that using preference lists throws away a lot of information about how much more each candidate is favored to another. By using a different system, such as *Range Voting*. In Range Voting, each voter assigns to each candidate a value between 0 and 100 based on how strongly that candidate is favored. Range voting satisfies the IIA, the Parerto condition, and doesn't have a dictator.

Homework: As listed above, Wednesday's homework is to give examples for the failure of CWC for sequential pairwise voting and for Hare's system.

For Monday, finish reading the chapter. Note that Approval voting is a special case of Range voting where the range is 0 to 1 instead of 0 to 100.