Handout 10
Games, Dominance, and the Prisoner's Dilemma

DECISIONS, GAMES &
RATIONAL CHOICE

Game theory is about *strategic reasoning*. This is reasoning about what to do when the outcomes one cares about depend not only on one's own choices, and impersonal states of the world*, but on the choices of other agents*. The key question for the rest of the course is: what do we need to add or change about decision theory (if anything) when other agents play a role in the outcomes of our choices?

Deja Vu: Dominance

Earlier we represented a choice situation with a table which showed the utilities that resulted from various choices and various states of the world. With two-player games we can use a similar representation with two changes. We replace states with choices of a second agent, and in addition to the utilities of the first agent at each pair of choices, we add additional numbers to represent the utilities the second agent gets from those pairs. E.g.,

Column

Row		A	B
	A	1 1	2 -1
	B	-1 2	0 0

The leftmost choices are of player 1 (who we'll call *Row*), the topmost choices are of player 2 (who we'll call *column*). Now we can essentially import our old notion of dominance from decision theory, with slight amendments.

> A choice C ***strongly dominates*** D for player A just in case no matter how A's opponents choose, A gains strictly more utility from choosing C over D.
>
> A choice C ***weakly dominates*** D for player A just in case no matter how A's opponents choose, A gains at least as much utility from choosing C over D, and sometimes gains more.

Note: now dominance is applied to both players! (So it can apply "horizontally" and "vertically"). As before, a ***strong dominance rule*** instructs us never to choose strongly dominated options. Analogously for the ***weak dominance rule***.

In the game above—a form of the *prisoner's dilemma*—dominance reasoning seems to make the outcome <B,B> unavoidable if Row and Column are rational (and they know it). Moral(?): Bad things can happen to rational people.

Let's change the payoffs a little.

Column

Row	A	B
A	1 1	-1 -3
B	-3 -1	0 0

Now what should one do?

One more...

Column

Row	A	B
A	1 1	2 -3
B	-1 -1	0 0

What should Column do? What should Row do?

This last game illustrates something potentially distinctive about strategic situations (i.e. the subject matter of Game Theory). We may not antecedently have credences in how our opponent plays but merely have credences about whether or not they are rational (or "rational"?). We can use these credences to optimize our choices, *by reasoning as if we were our opponents*.