Noncoop've game theory - the basics

Essence of a game: Individuals involved are aware of strategic interaction

1. small numbers, so individual actions affect payoffs

2. anticipating others' actions may affect own best choices

Classifying games (dimensions)
1. are moves sequential or simultaneous?
- different types of interactive thinking

2. are players' interests in total conflict, or is there some commonality?
- constant sum (zero-sum) vs non zerosum games

3. Duration of game
- once, or repeatedly?
- same or changing players?

4. Do players have full or equal info?

5. Are the rules of the game fixed or manipulable?

6. Are agreements to cooperate enforceable?

Simple examples with economic content:

Ex. 1: Prisoners' dilemma game
- two prisoners ("players")
- questioned independently
- same crime
- confess, deny ("strategies")
- payoffs:
    - if both confess, 5 yrs in prison (each)
    - if both deny, 1 year (each)
    - if one denies, one confesses: denier gets 9yrs, confessor 0

Strategic (normal) form of PD game

		player 2	
		deny	confess
player 1	deny		
	confess		

Ex. 2: Co-ordination games:
a) "battle of sexes"

		Ben	
		word	wordperfect
Alice	word	4,1	-1,-1
	wordperfect	-2,-2	1,4

Interpretation:
Alice prefers word
Ben prefers wordperfect
Both prefer to be together

b) pure coordination game

		Firm B	
		small cars	large cars
firm A	small cars	1,1	-1,-1
	large cars	-1,-1	1,1

(note: what if lower right cell is (2,2)?)

Basic equilibrium concept:
Nash equilibrium

- each player doing best possible, taking as given what other is doing

- focus on *individual* rationality (rather than collective action)

To solve for:
1. determine one player's "best response" to each possible action of other(s);
2. repeat for each player;
3. look for "matches"

Solutions for examples:
1. PD game:
 - "confess" always best response
- NE is (confess, confess)

- notice (deny, deny) yields higher outcomes for *both* - but is not an eq'm

- outcome of PD game is *not efficient*: public goods games, externalities….

2. battle of sexes:
- best response depends on other's choice
- each wants to match
- 2 NE: (word, word)
(wordperfect, wordperfect)
which chosen??

3. Pure coordination:
- similar to battle of sexes
- 2 NE
- identical outcomes - still coordination issue
- if agreement over which one is better, still cannot rule out other NE

Sequential move(dynamic) games:
- not simultaneous
- strict order of play
- possibility of learning, investing…

Simplest case:
- 2 players, one move each
- second mover observes choice of first player prior to own move

- use "extensive form" - game tree

- if multiple NE, use "subgame perfectness" to eliminate one/some

- technique: backward induction
  - work backwards from end
  (also "rollback")

Extensive forms:
Battle of sexes
- "subgame perfect Nash equilibrium (SPNE)

- Here, "first mover advantage"

General results from non-coop've game theory:

1. NE of one-shot game generally not efficient - see PD.

Why?

- Individuals don't take into account effects of own actions on others

- don't "internalize externalities"

- public goods underprovided

2. If game repeated often enough, can generate cooperative outcome with non-cooperative game

- possible to punish deviators