

# PS 3: Sections 110 111

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# For today

- 1 Necessary and sufficient conditions.
- 2 Game theory.
  - Nash equilibrium
  - Finding equilibria using the circle method.

# Necessary and Sufficient Conditions

- Used to specify a relationship between statements.
- **Necessary Condition** - Something (X) that MUST occur for something else (Y) to occur.
  - $X \rightarrow Y$
  - $\neg X \rightarrow \neg Y$
  - Examples
- **Sufficient Condition** - Something (X), that if it occurs, is enough to guarantee that something else (Y) occurs

# Necessary and Sufficient Conditions: Examples

Are the following necessary, sufficient or both if one wants to become a lawyer:

- Going to law school.
- Having a high IQ.
- Passing the bar.

# Game theory: Basics

- Study of strategic behavior between rational, self-interested individuals or groups and their outcomes.
- Basically the study of “games.”
- What is a game?
  - 1 Players
  - 2 Actions
  - 3 Payoffs
- Different types of games reflect kinds of strategic situations. Prisoner’s Dilemma, Stag Hunt etc etc.

# Game theory: Nash equilibrium

- Game theory mostly concerned with predicting outcomes resulting from strategic interactions.
- **Nash equilibrium** - “a strategy profile in which each player plays a best-response to the strategies of other players.”
- Nash showed that at least one Nash equilibrium exists for every game.
- Assumption here is that, given a payoff structure, agents behave *rationally*.
- **Strategy profile:** set of actions for two (or more) players. The outcome of a game.

# Nash equilibrium, example.

- Kyoto Protocol - Stag hunt
- Nuclear arms race - Prisoner's Dilemma.