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# Nash Equilibrium and Coordination Games

iterated strict dominance is a powerful argument if it leads to a conclusion

Battle of the Sexes Game

|           | Opera | Ball Game |
|-----------|-------|-----------|
| Opera     | 1,2   | 0,0       |
| Ball Game | 0,0   | 2,1       |

No strategies are dominated

this is an example of a coordination game

a pure coordination game: meeting in a strange city

|               | Airport | Train Station |
|---------------|---------|---------------|
| Airport       | 1,1     | 0,0           |
| Train Station | 0,0     | 1,1           |

(also: which side of the street to drive on?)

# Nash Equilibrium

Each player plays optimally and correctly guesses what the other player will do

Connection to Best-Response

Connection to dominant strategy equilibrium

|           | Opera | Ball Game |
|-----------|-------|-----------|
| Opera     | 1*,2* | 0,0       |
| Ball Game | 0,0   | 2*,1*     |

Battle of the Sexes has two Nash equilibria at 1,2 and 2,1

## ***Focal Points***

meeting in a strange city

|               | Airport | Train Station |
|---------------|---------|---------------|
| Airport       | 1*,1*   | 0,0           |
| Train Station | 0,0     | 1*,1*         |

## *Pareto Dominance and Coordination*

another coordination game

|   | A     | B     |
|---|-------|-------|
| A | 1*,1* | 0,0   |
| B | 0,0   | 2*,2* |

## *Risk Dominance and Coordination*

|   | A     | B     |
|---|-------|-------|
| A | 2*,2* | -10,0 |
| B | 0,-10 | 1*,1* |



# Why Nash Equilibrium

reasoning versus learning

at a Nash equilibrium, there is nothing further to learn

example of the traffic game

## ***Nash Equilibrium and Dominance***

- Nash equilibria are contained in the set of strategies that remain after iterated strict dominance
- There can be Nash equilibria where players play weakly dominated strategies

|   | L     | R     |
|---|-------|-------|
| U | -1,-1 | 2*,0* |
| D | 1*,1* | 1,1*  |

- L is weakly dominated by R, but D,L is a Nash equilibrium
- The second equilibrium at UR makes more sense

## ***Nash Equilibrium and the Reaction Function***

Nash equilibrium is where the best response functions cross

## *Duopoly Again*

$$p = a - bx$$

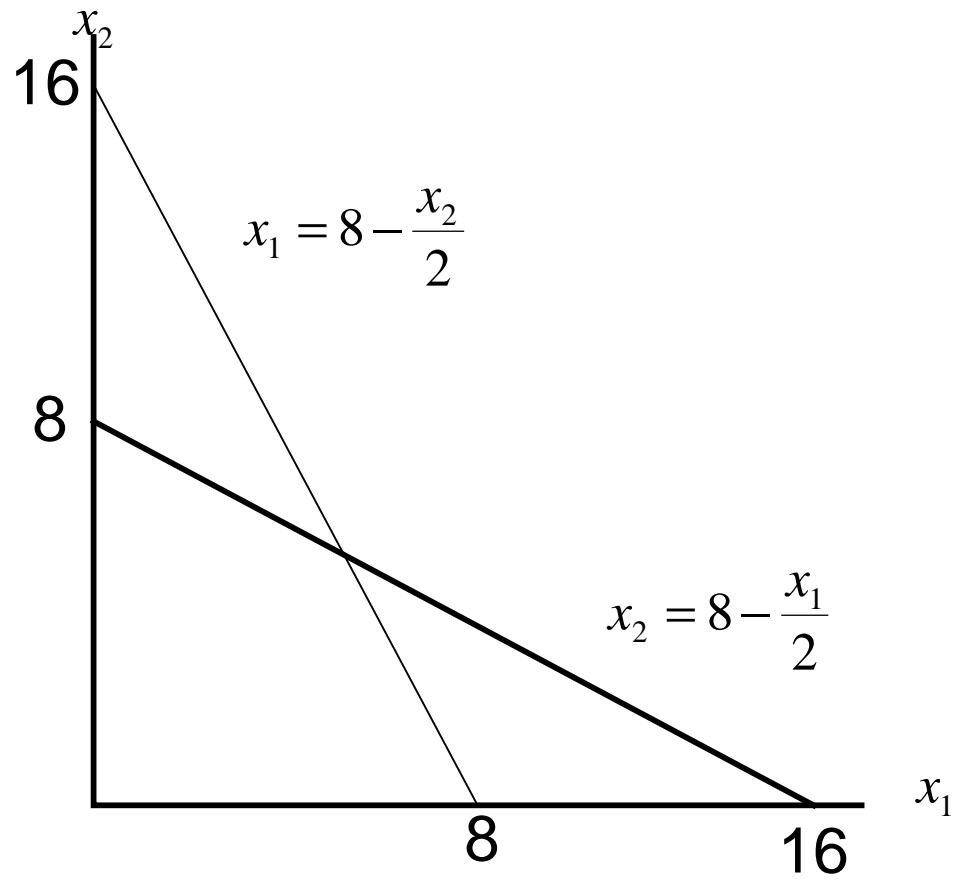
$$a = 17, c = 1, b = 1$$

so that the competitive solution is 16 units of output and the monopoly solution is 8 units of output

$$\text{profits } \pi_i = [17 - (x_i + x_{-i})]x_i - x_i$$

recall that the best-response function is

$$x_i = 8 - \frac{x_{-i}}{2}$$



$$x = \frac{16}{3}$$