

Lecture 2b: Trembling-Hand Perfection for Extensive Games

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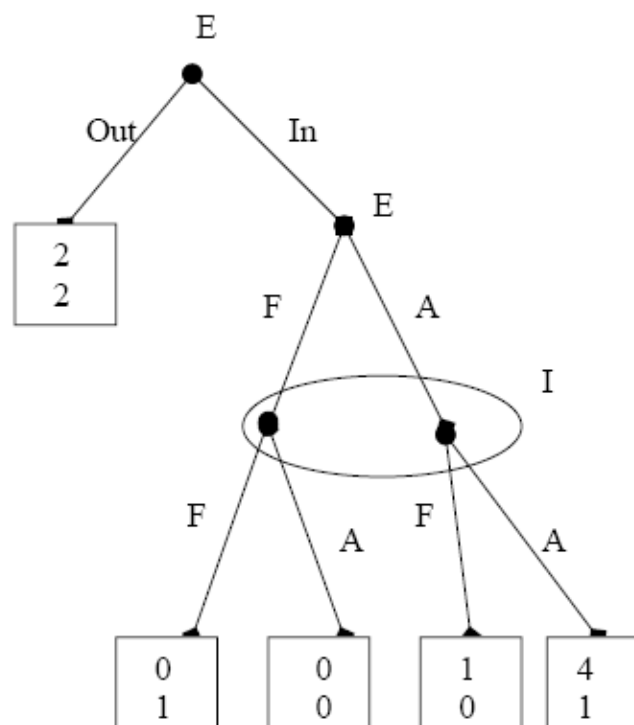
May 2006

Trembling-Hand Again

- Motivation: No need to think about off-equilibrium path beliefs if players make mistakes at all information sets
 - Problem: (normal form) trembling-hand perfect equilibria (NFTHP) may not be SPNE
 - Refinement: extensive form trembling-hand perfection (EFTHP)
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Example

- Entry game again:



- Normal form:

$E \setminus I$	A if In	F if In
Out, A if In	2,2	2,2
Out, F if In	2,2	2,2
In, A if In	4,1	1,0
In, F if In	0,0	0,1

- NE: $(In, A \text{ if } In, A \text{ if } In)$, $(Out, A \text{ if } In, F \text{ if } In)$, $(Out, F \text{ if } In, F \text{ if } In)$
SPNE: only the first
- Recall that in 2-player games NFTHP is equivalent to NE with non-weakly dominated strategies
- In this example: no player has a weakly dominant strategy. NFTHP: all three NE
- Non-SPNE can survive NFTHP because trembles may place more weight on $(In, F \text{ if } In)$ than on $(In, A \text{ if } In)$
- Does this make sense? Given In , A should be better than F for E

Extensive form trembling-hand perfection

- Idea: players tremble independently among all actions at each info set
- Definition: the *agent normal form* is obtained by selecting a different agent to make decisions at each info set, and these agents have the same payoffs as the original player
- Example: (1a chooses rows, 1b chooses columns, 2 chooses boxes)

	1a/1b	A if I_n	F if I_n		1a/1b	A if I_n	F if I_n
(a) A if I_n	I_n	4,4,1	0,0,0	(b) F if I_n	I_n	1,1,0	0,0,1
	Out	2,2,2	2,2,2		Out	2,2,2	2,2,2

- Definition: a NE is *extensive-form trembling hand perfect* (EFTHP) if it the agent-normal form is trembling hand perfect
- EFTHP in example: (I_n , A if I_n , A if I_n)
If 1a plays I_n with $prob > 0$ then 1b will prefer A if I_n to F if I_n

Relation between EFTHP and SE

- Both use trembles in the extensive form to derive beliefs out of equilibrium path
 - SE easier to compute because it only requires to think about best responses to the limiting strategies
 - SE entails a specific treatment of beliefs
 - $\{EFTHP\} \subset \{SE\}$
 - But in *generic games*, $\{EFTHP\} = \{SE\}$ (see Fudenberg Tirole)
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