Game Theory

Themes

1. Introduction to Game Theory
2. Sequential Games
3. Simultaneous Games
4. Conclusion

Introduction to Game Theory

Game theory is the branch of decision theory concerned with interdependent decisions.

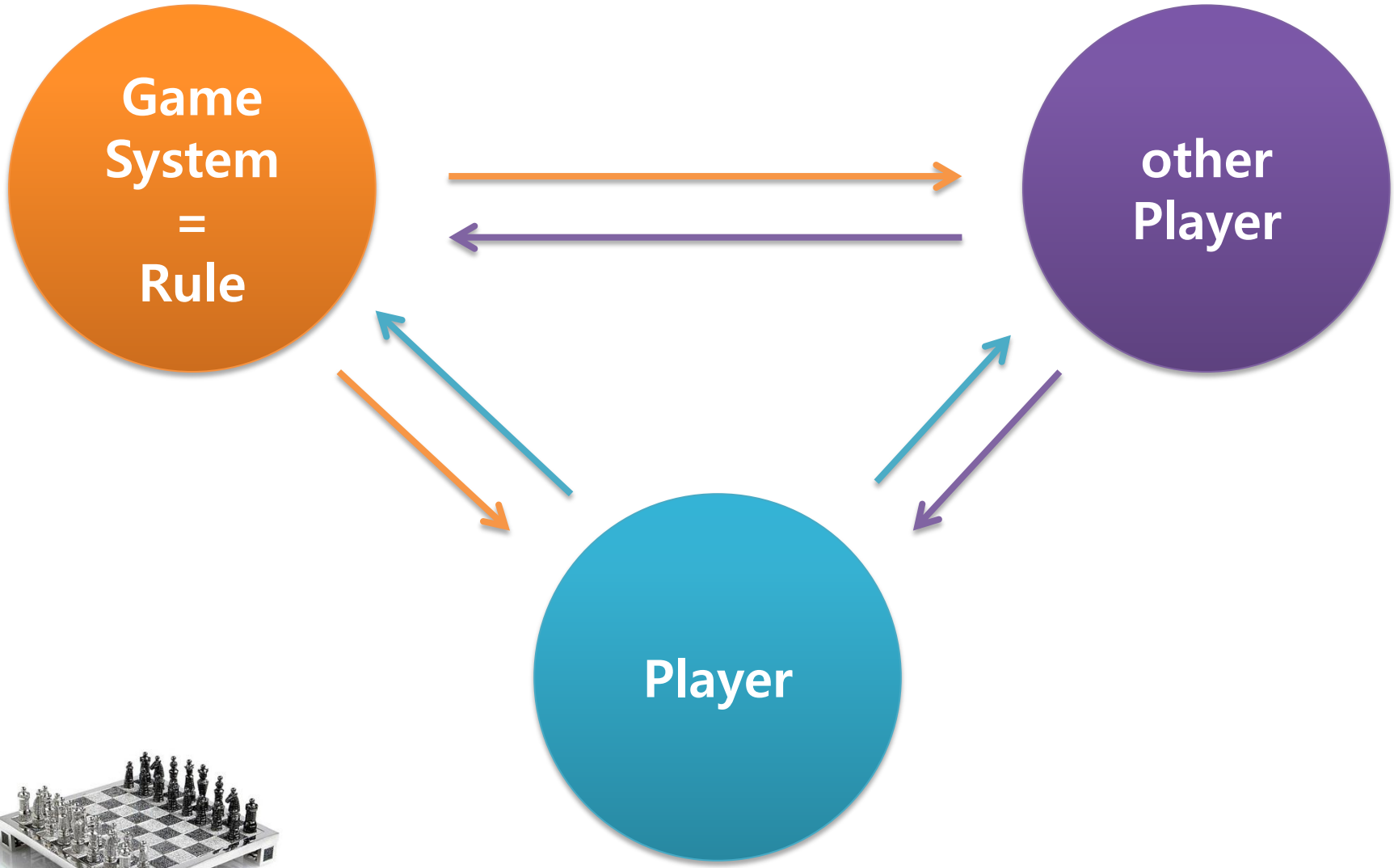
In short, game theory deals with any problem in which each player's strategy depends on what the other players do.

p.1

게임 이론: 게임 이론은 상호작용하는 합리적인 개인들에 의한 전략의 선택을 연구하는 것, 다시 말해 쌍방결정이론(Interactive decision theory=interdependent decision)이다.

Using this methodology, whether or not we end up ahead of another player will be of no consequence; our only concern will be whether we have our optimal strategy.

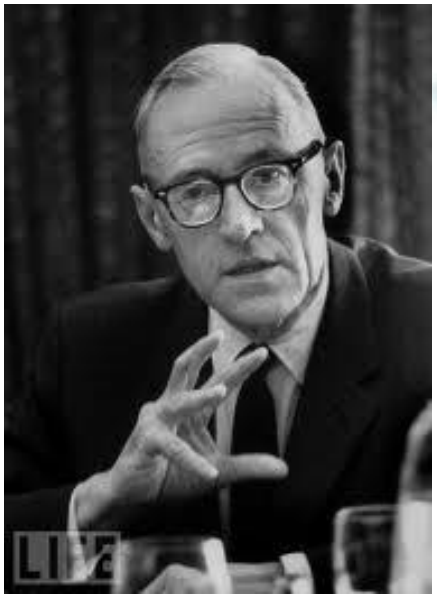
p.2


Game
System
=
Rule
other
Player
Player

Introduction to Game Theory

『게임과 경제 행동의 이론
(The Theory of Games and Economic Behavior)』

John von Neumann, 1903~1957



Oskar Morgenstern, 1902~1977

Sequential Games

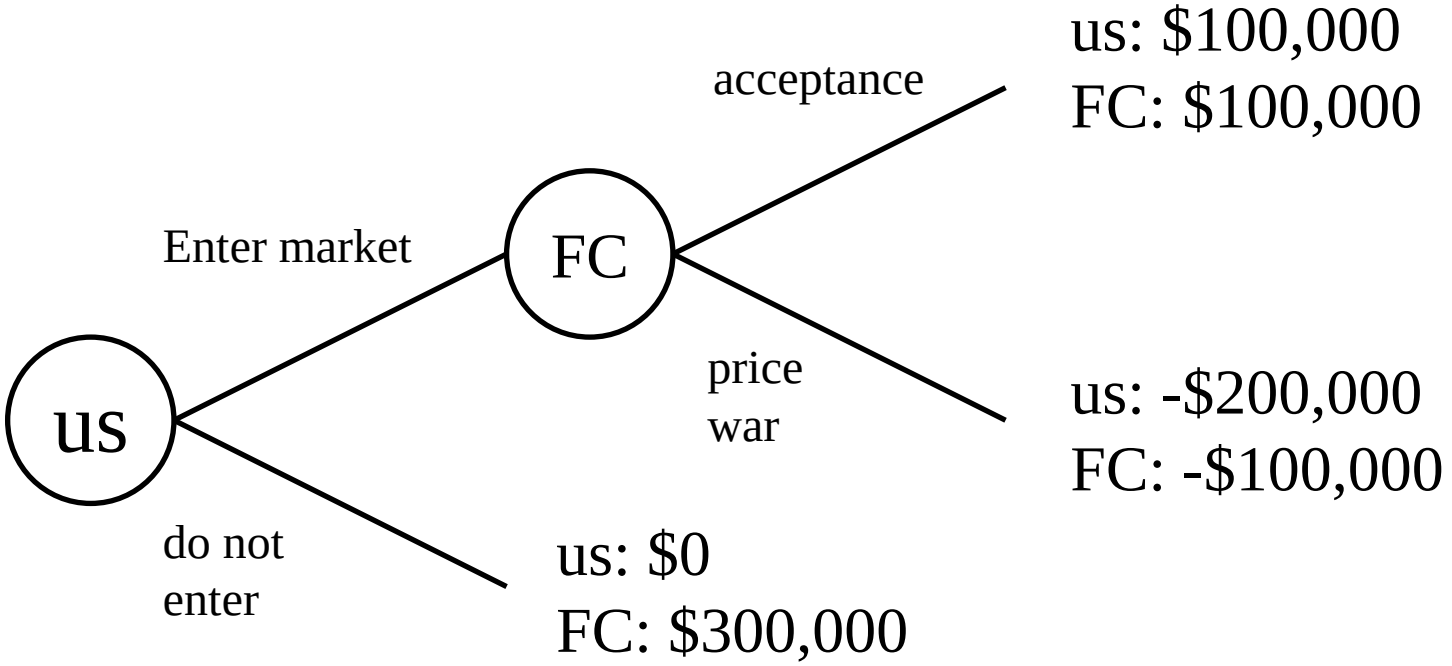
The Basic Strategic Rule: **"Look ahead and reason back"**

1. Look ahead to the very last decision, and assume that if it comes to that point, the deciding player will choose his/her optimal outcome (the highest payoff, or otherwise most desirable result).

2. Back up to the second-to-last decision, and assume the next player would choose his/her best outcome, treating the following decision as fixed (because we have already decided what that player will pick if it should come to that).

3. Continue reasoning back in this way until all decisions have been fixed.

Sequential Games



Sequential Games

Notice that looking ahead and reasoning back determines not just one player's optimal strategy, those for all players. It is called the ***Solution*** to the game.

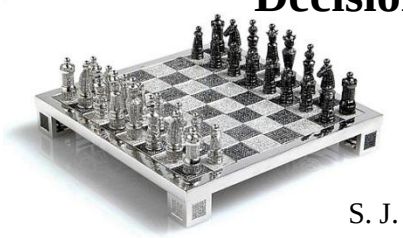
Sequential games are determined, so ultimately, there are only two choices: either the player with the last decision gets his/her best outcome, or the game is not played. Thus, the game tree obviates the need to actually play out the game.

Simultaneous Games

Prisoner's Dilemma

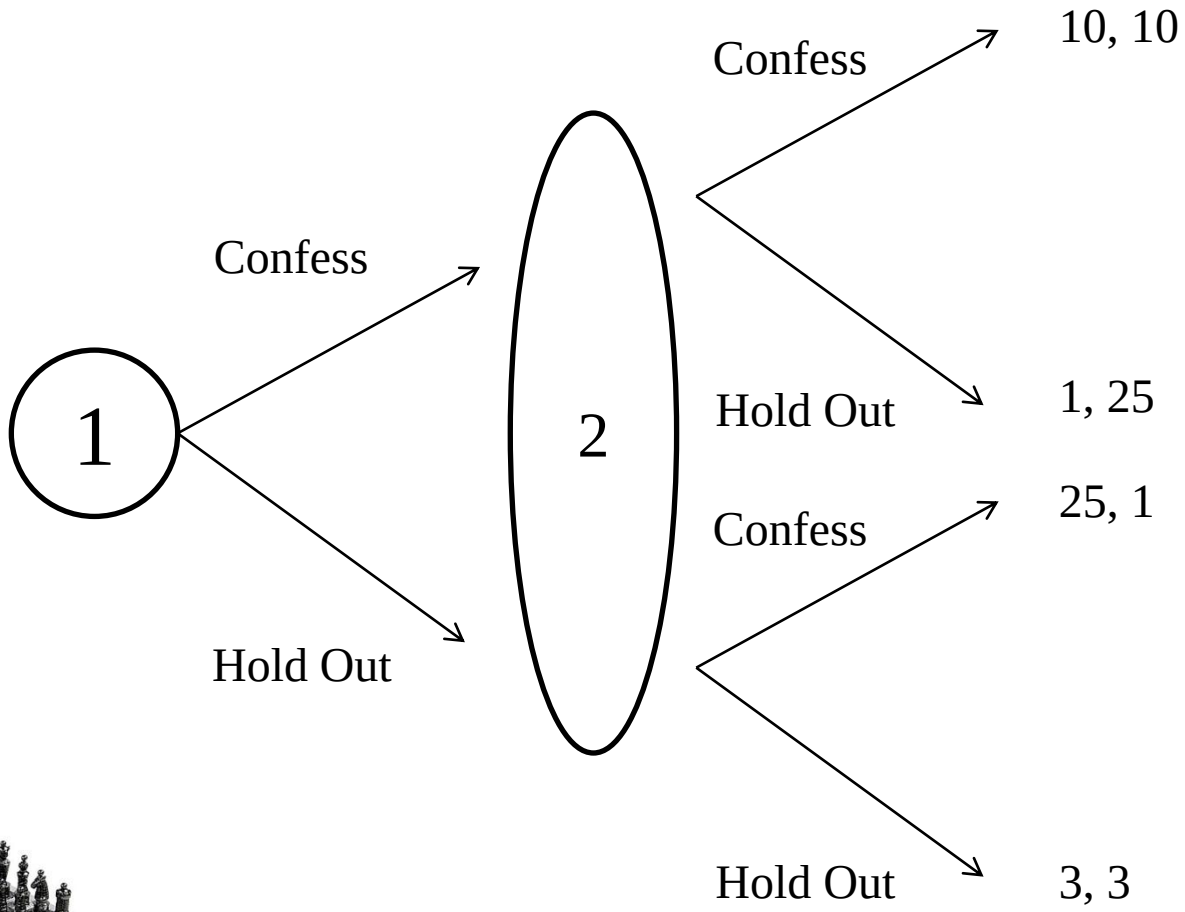
- If you both confess, you will each go to jail for 10 years.
- If only one of you confesses, he gets only 1 year and the other gets 25 years.
- If neither of you confesses, you each get 3 years in jail.

		First Prisoner's Decision	
		Confess	Hold Out
Other Prisoner's Decision	Confess	10 years	25 years
	Hold Out	1 years	3 years



S. J. Hagenmayer(1995), "Albert W. Tucker, 89, Famed mathematician," The Philadelphia Inquirer(Thursday, February 2), p.87

Simultaneous Games



Simultaneous Games

Notable features

Dominant strategies

: **If you have a dominant strategy, use it,** because there is no way to do better.

Dominated strategies

: **Dominated strategies should never be used,** since there is a least one other strategy that will never be worse, and could be better

Maximizing individual welfare does not necessarily aggregate to optimal welfare for a group.

Simultaneous Games

The Groundwork for Developing Strategies for Simultaneous Games

- If you have a dominant strategy, use it
- Otherwise, look for any dominated strategies and eliminate them

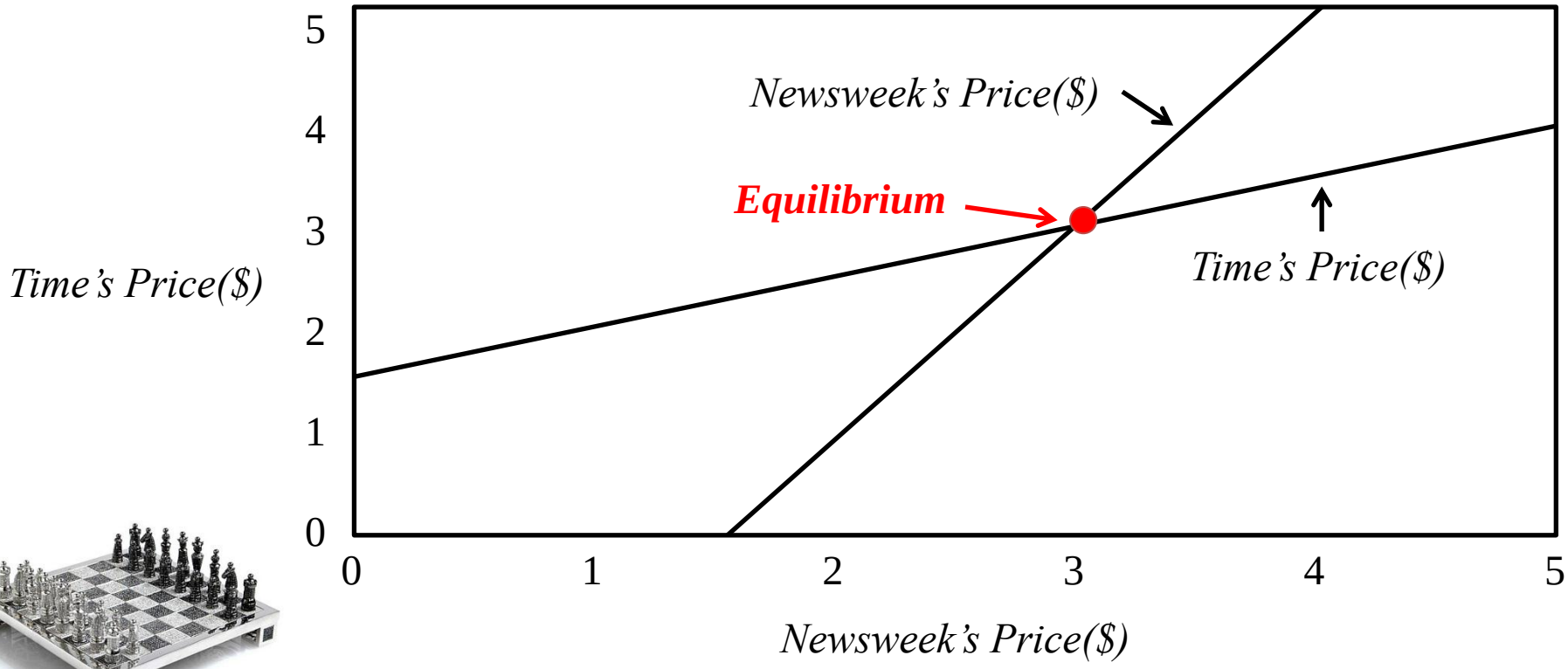
p.6

		***Newsweek* cover Story**	
		AIDS	Budget
***Time* Cover Story**	AIDS	28% 42%	30% 70%
	Budget	70% 30%	12% 18%

Equilibrium(Nash Equilibrium)

An Equilibrium(or Nash Equilibrium) is set of outcomes such that no players have any incentive to change strategy.

내쉬 균형: 정규형 게임*에서 각 플레이어가 목록에 있는 다른 전략들에 대한 최선반응인 1개의 전략을 갖는다면 그러한 전략의 목록이 내쉬 균형이다.



*정규형 게임: 게임을 숫자의 표로 나타낸 것으로, 표의 가장자리에 전략을 적고 표의 각 칸에 참가자에 대한 이득을 적는다.

Equilibrium(Nash Equilibrium)

Professor 1.

Professor 2.	400 page	600 page	800 page
400 page	45 / 45	50 / 15	40 / 10
600 page	15 / 50	40 / 40	45 / 15
800 page	10 / 40	15 / 45	35 / 35

One player strategy	Other player best response
400	600
600	800
800	**800**

Equilibrium

Conclusion

Game theory is exciting because although the principles are simple, the applications are far-reaching.

Game theory can be used to design credible commitments, threats, or promises, or to assess propositions and statements offered by others.

Advanced concepts, such as brinkmanship and inflicting costs, can even be found at the heart of foreign policy and nuclear weapons strategies-some the most important decisions people make