Oligopoly & Monopolistic Competition (Chapter 12) in Pindyck

Oligopoly :
- Market with a few sellers.
- Products may or may not be differentiated. — homogeneous case / heterogeneous case.

When number of competitors is small, their actions become mutually strategic.
- Game theory is employed to study these strategic interactions among firms ($N \geq 2$)

Introduction to Game Theory → EE481, EE441, EE457, ...

Components of a game :

Players (P) : 2 or more players ($N \geq 2$)

Actions (A) : Actions or Strategies available to each player.

Payoffs (P) : Outcomes based on your decision(s) and the decision(s) of others)

Information (I) : Rule of the game : how the game is conducted.

for example : Who moves first ?
The game is played only once or repeatedly ?

P - A - P - I

Types of games

- Simulteneous move game Vs. Sequential move game
- One-shot game Vs. Repeated game
  - finitely repeated game
  - infinitely repeated game
- Non cooperative game (Game in which players do not cooperate.) Vs Cooperative game (ex. coalition game of forming goverment by many political parties.

Game Representation
- Payoff matrix
- Game tree

Player 2 (column player)

Player 1 (Row Player)	LEFT	RIGHT
UP	(10, 2)	(8, 3)

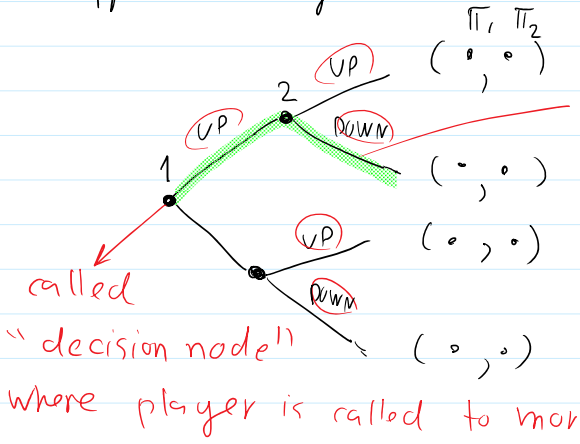
- The first number in each cell determines the pay off for

Player 1 (Row Player)		
DOWN	(12, 4)	(10, 1)

- the pay off for player 1.
- The second number determines the payoff for player 2

Game tree

Suppose Player 1 moves first and Player 2 moves second.



Solving a game

Advertising Game

- Consider 2 players : Firm A Vs. Firm B
- Actions by each firm : Advertise , Do not advertise
- Simultaneous move game.

π : million baht

FIRM A \ FIRM B	ADV	DO NOT ADV
ADV	10, 5	15, 0
DO NOT ADV	6, 8	10, 2

Q : What will be the outcome of the game ?

A : $(s_A^*, s_B^*) = (\text{ADV}, \text{ADV})$

$(\pi_A(s_A^*, s_B^*), \pi(s_A^*, s_B^*)) = (10, 5)$

Firm A has a dominant strategy : ADV
Firm B 〃 〃 : adv.

If a firm has a dominant strategy, it will use that strategy to play, always

This process or algoritym is so called
"Elemination of dominated strategies"

10.11.17

Solving a game by using "Nash Equilibrium Concept"

John F. Nash → Mathematician
→ Ph.D (Princeton)
→ Nobel Prize Winner 1994 w/ Selten and Harsanyi

A Beautiful Mind in Netfix

		Firm B: adv	Firm B: do not adv
Firm A	adv	10*, 5*	15*, 0
	do not adv	6, 8*	10, 2

Consider Firm A :

If B chooses "ADV" A's Best Response is "ADV."
since $\pi^A(ADV, ADV) > \pi^A(DO\ NOT\ ADV, ADV)$.
$= 10$ $= 6$

If B choose "DO NOT ADV", A's Best Response is "ADV"
since $\pi^A(ADV, DO\ NOT\ ADV) > \pi^A(DO\ NOT\ ADV, DO\ NOT\ ADV)$
$= 15$ $= 10$

Consider Firm B

If A choses "ADV", B's Best Response is "ADV"
since $\pi^B(ADV, ADV) > \pi^B(DO\ NOT\ ADV, ADV)$
(5) (0)

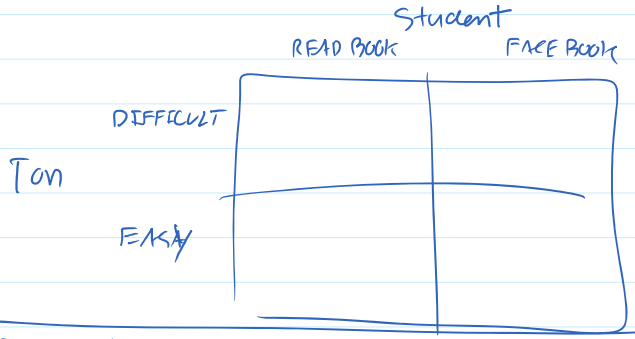
If A chooses "DO NOT ADV", B's Best Response is "ADV"
since $\pi^B(ADV, DO\ NOT\ ADV) > \pi^B(DO\ NOT\ ADV, DO\ NOT\ ADV)$
(8) (2)

Nash Equilibrium : $(s_A^*, s_B^*) = (ADV, ADV)$

$(\pi^A(s_A^*, s_B^*), \pi^B(s_A^*, s_B^*)) = (10, 5)$

In Equilibrium, both players choose "ADV".

Nash Equilibrium = Set of Actions/strategies in which each firm does its best given its rival's actions/strategies.

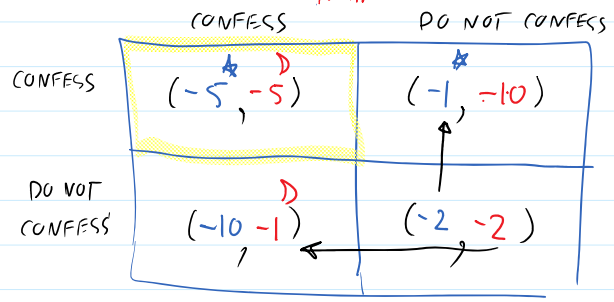


Nash Equilibrium : I'm doing the best I could given what you're doing & You are doing the best you could given what I'm doing

means that, once both are in an equilibrium, each has No incentive to alter/change/modify the action that he/she is currently using.

Prisoner's Dilemma

Two prisoners : Franc Nam Nhan



(1) Nash equilibrium : (CONFESS, CONFESS)

(2) (DO NOT CONFESS, DO NOT CONFESS) is "Pareto-Superior outcome but it will not be played in equilibrium as both will have incentive to deviate.

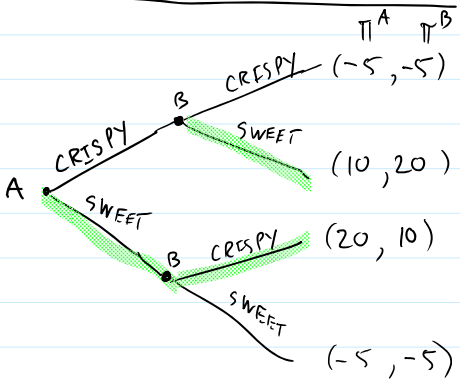
(3) Notice that "Confess" is the dominant strategy of both players.

When a dominant strategy is available, any player will play it.

Sequential Move Game

π^A π^B

Sequential Move Game

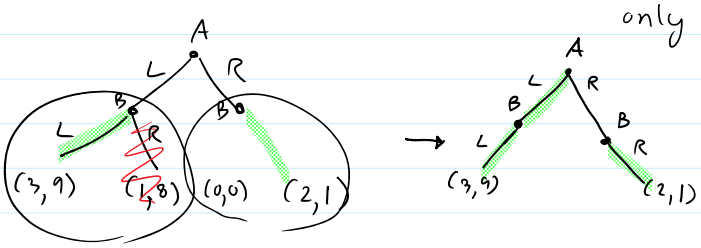


Consider A Product Choice Game

Firm A moves first and B moves second.

(1) By using backward induction:
looking ahead and reasoning backward, (SWEET, CRISPY) is a Nash equilibrium.

(2) First Mover Advantage OR Advantage of Moving First:
When A chooses "SWEET", it leaves Firm B little choice but to choose only CRSIPY. (TO AVOID A CRASH IN THE SAME MARKET)



Nash equilibrium: (L, L)

Battle of Sexes

HUSBAND \ WIFE	BULL FIGHT	BALLET
BULL FIGHT	(10, 5)	(0, 0)
BALLET	(0, 0)	(5, 10)

- TWO NASH EQUILIBRIA
- Which one will be played depends players' bargaining power.

Matching pennies

(1)

	H	T
H	(1, -1)	(-1, 1)
T	(-1, 1)	(1, -1)

(2) Unit: Million baht

- No Nash Equilibrium
- Zero Sum Game