Course #8

March 19th 2026

CHAPTER 5: Extensive games with perfect information

Player 1 \ Player 2	L	R
U	7, 3	7, 4
D	2, 4	10, 5

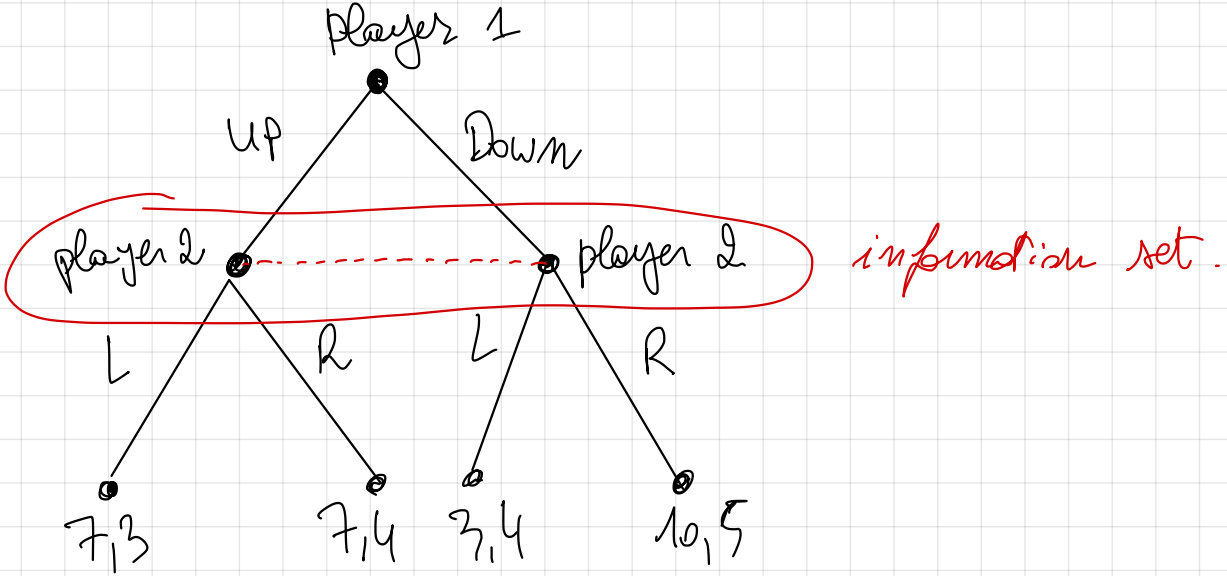
Simultaneous games

=

Normal form games

Kuhn (1953): → extensive form games.

Decision tree.



information set.

Remark: Game theory :

- imperfect information: At least one player does not know what other players have done previously.
- incomplete information: At least one player does not know perfectly the structure of the game.

Economic motivation

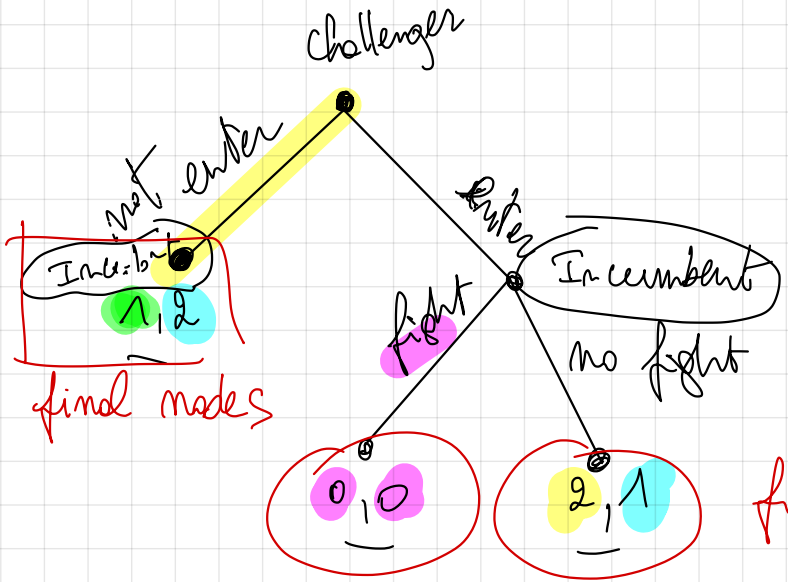
- Incumbent firm is already in business 2000's Nokia cellphones monopoly.
- challenger (Iphone 2006).

two steps: 1) decide to enter or not
2) incumbent decides to fight or not.

Normal form (simultaneous game)

Challenger \ Incumbent	Fight	Not fight
Enter	0, 0	2, 1
Don't enter	1, 2	1, 2

extensive form



Strategy = complete plan of actions.

For the incumbent : 2 nodes

DEFINITION : Game in extensive form

- set of players { challenger, incumbent }
- set of terminal histories : { (not enter) ; (enter ; fight) ; (enter ; no fight) }.
- other histories : subhistories of terminal histories :

  { ϕ , (enter) }

- Player function : $P(\phi)$ = challenger

  $P(\text{enter})$ = Incumbent.

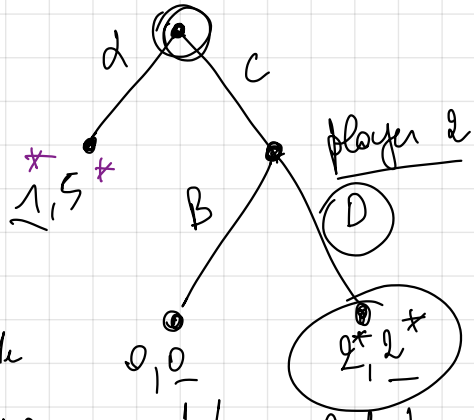
  ↳ assigns a player to each subhistory of terminal histories.

- preferences : payoffs assigned to terminal histories
- Actions $A(h) = \{ a \mid (h, a) \text{ is a history} \}$

Example :

Set of all histories h

$\{ \emptyset, \alpha, C, CB, CD \}$



P: 1, 2

Terminal histories :

$\{ \alpha, CB, CD \}$

Histories : $\{ \emptyset, C \}$

player function :

$P(\emptyset) = $ pl 1

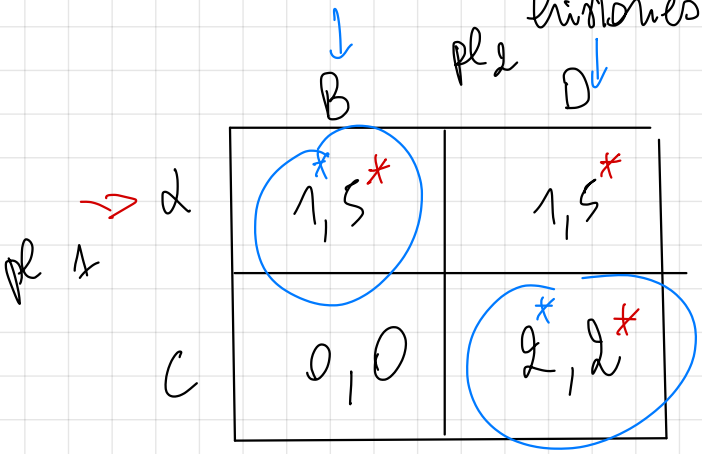
$P(C) = $ pl 2

The set $A(\cdot)$ of possible actions is defined on histories that are strict subhistories of terminal histories.

$A(h = \emptyset) = \{ \alpha, C \}$

$\emptyset, \alpha = \alpha$ $\emptyset, C = C$ is also a history.

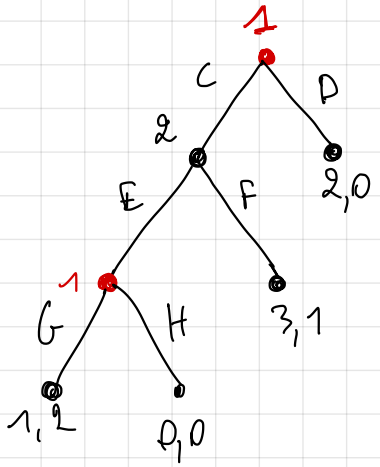
$A(C) = \{B, D\}$ since (C, B) and (C, D) are histories.



Two N.E: $(A; B)$ and $(C; D)$

But $(A; B)$ is not credible.

Example :



Set of terminal histories :

(D) ; (C, F) ; (C, E, H) ;

(C, E, G).

set of other histories :

ϕ ; (C) ; (C, E)

$A(h) = \{a \mid (h, a)$ is a history$\}$

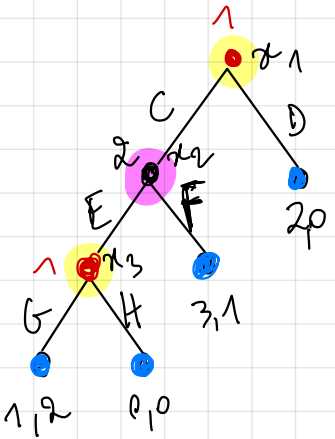
$A(\phi) = \{C, D\}$ because ϕ, C and ϕ, D are histories.

$A(C) = \{E, F\}$ because (C, E) and (C, F) are histories

$A(C, E) = \{G, H\}$ because (C, E, G) and (C, E, H) are histories.

A Strategy is a complete contingency plan.

DEFINITION: a strategy for player i in an extensive form game with perfect information is a function that assigns to each history h s.t. $P(h) = i$ an action in $A(h)$.



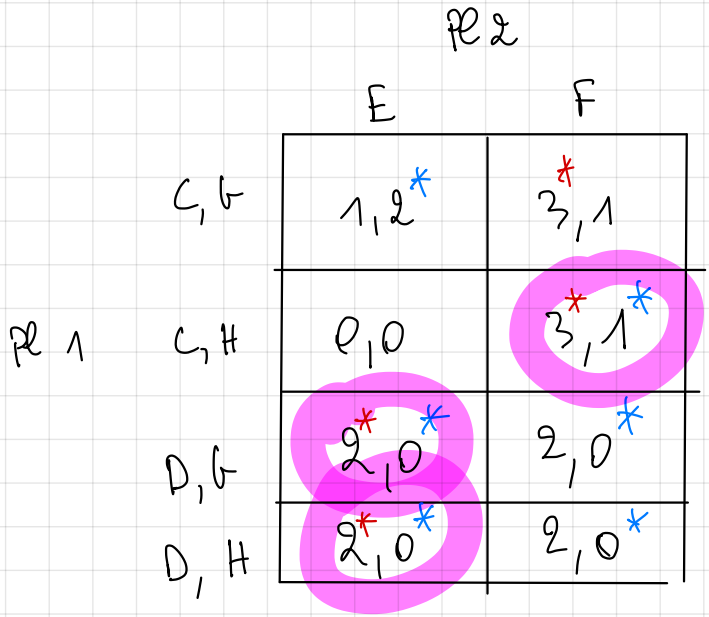
The set of possible strategies for player 1

Pl 1 plays at x_1 and x_3

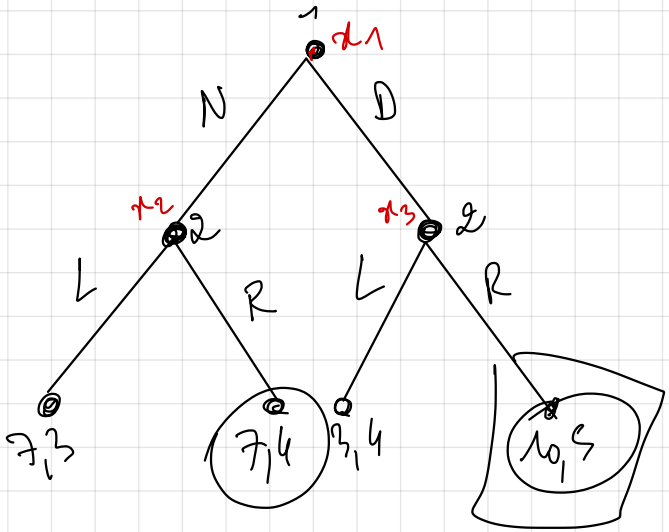
1) C G
2) C H
3) D G
4) D H.

Strategies for player 2 at x_2

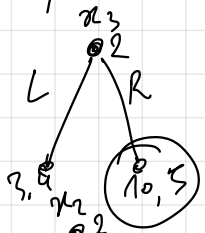
1) E
2) F.


R2
E
F
R1
C, G
C, H
D, G
D, H
1, 2
3, 1
0, 0
3, 1
2, 0
2, 0
2, 0
2, 0

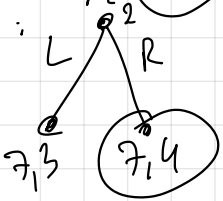
Definition: SUBGAME, start at a decision node (assigned to a player) and take all the histories starting at that node.



x_3: L, R is a subgame



x_2: L, R



x_1: whole game

Strategies for pl 1: N or D

pl 2:

x_2	x_3
L	L
L	R
R	L
R	R

		pl 1: N	pl 1: D
pl 2	LL	7,3*	3,4*
	LR	7,3*	10,5*
	RL	7,4*	3,4*
	RR	7,4*	10,5*