Lecture 1.1 : Introduction

Game theory : "study" of "games".

<u>Game</u> : any "system" involving multiple "self-interested/selfish", "intelligent" players/agents.

<u>Ex</u>: (Grading game)

players : students of algorithmic game theory course

Action set of each player : $\{0, 1, \ldots, 100\}$

Outcome : grade of each students. grades will be ralative

Ex: (Prisoner's dilemma)

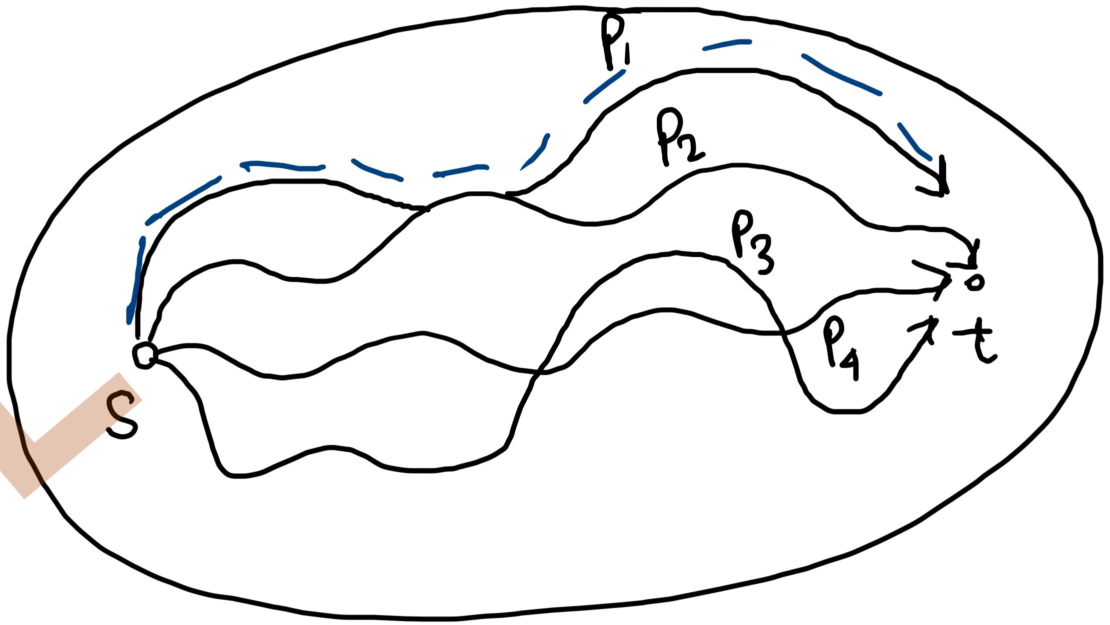
players: 2 people

Action/strategy set : {confess(c), not confess(nc)}

player1 / player2	c	nc
c	-5, -5	-10, -1
nc	-1, -10	-2, -2

Ex: (Congestion game)

players: n commuters wanting to go from s to t.



Strategy set: set of all s-t paths.

Outcome: time required to traverse an edge. This is proportional to the number of players using that edge.

Strategic form game / Normal form game.

Defn. A normal form game Γ is defined as a tuple

$$\langle N, (S_i)_{i \in N}, (u_i)_{i \in N} \rangle$$

- N is the set of players
- S_i is the strategy set of player $i \in N$
- $u_i : \underset{i \in N}{\times} S_i \longrightarrow \mathbb{R}$

For prisoner's dilemma:

u_1, u_2:

2 \ 1	c	nc
c	$-5, -5$	$-10, -1$
nc	$-1, -10$	$-2, -2$

Two important questions

(1) as a player, how should one play?

(2) can we predict the outcome of the game?

Equivalently, can we predict the $\underbrace{\text{strategy profile}}_{(s_i)_{i \in N} \in \times_{i \in N} S_i}$ played by the players?