

## Module 2: "Static games of complete information"

### Lecture 4: "EFG to NFG Transformation"

#### The Lecture Contains:

- ☰ EFG representation of Bus, metroway, taxi example
- ☰ NFG representation of Bus, metroway, taxi example
- ☰ Nim Game - EFG representation
- ☰ Nim Game – NFG representation

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**Another example of EFG  $\rightarrow$  NFG**

There are 2 players – player 1 and player 2

- Both want to see a movie and there is exactly 1 ticket left.
- Whoever out of these 2 players comes first, will get the ticket.
- Player 1 moves first and decides to take a bus(b) or a metro(c) or a taxiway(s).
- Player 2 then takes his decision as to whether to take bus or cab or metroway.

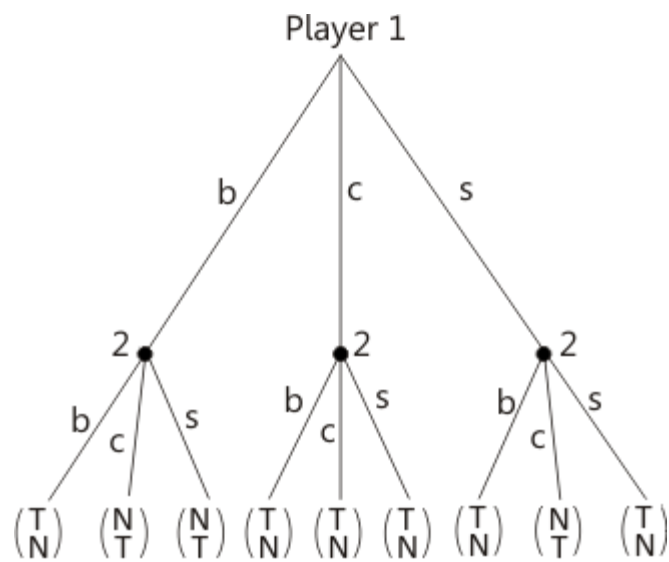
Rules for determining payoffs.

- Player 1 gets ticket regardless of player 2's transport if he chooses taxi.
- Player 1 gets the ticket if he travels by metroway provided player 2 has not taken a taxi.
- Player 1 gets the ticket if he travels by bus provided player 2 has the bus also.

Denote T for ticket, N for no ticket.

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EFG representation of Bus, metroway, taxi example



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NFG representation of Bus, metroway, taxi example

Player 2’s strategy:

XYZ

X – what will player 2 do if player 1 takes the bus

Y – what will player 2 do if player 1 takes a taxi

Z – what will player 2 do if player 1 takes a subway

Outcome of any strategy pair say (c, ssb)

- Player 1 takes a taxi
- Player 2 follows by metroway

1 gets ticket, 2 does not.

**Exercise:** You can fill in the outcomes for the rest of the cells in this NFG representation.

		Player 2								
		sss	ssb	ssc	bbs	.....	ccb	ccs	ccc	
Player 1	b	<div>N,T</div>								
	c									
	s	<div>T,N</div>								

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**Nim Game**

Start from configuration (2, 1)

- i.e. 2 matches in 1 pile and single match in other pile.

If one wins, gets payoff of 1 and if one loses, gets payoff of -1.

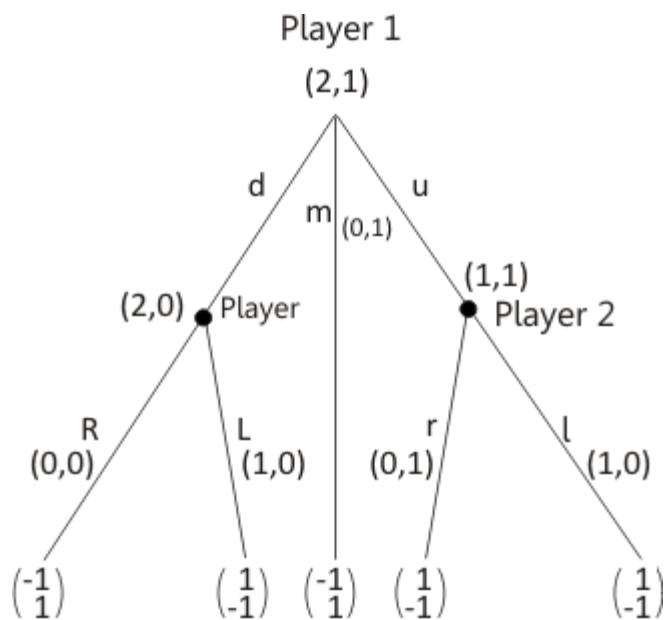
- Whichever player removes the last match wins the game.
- Represent the game in EFG as well as NFG representation.

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## Nim Game – NFG representation



$u, m, d$  : three actions of player 1 that take the game to  $(1,1)$ ,  $(0,1)$  and  $(2,0)$  respectively.

$l$  and  $r$  correspond to two actions of player 2 that take the game from  $(1,1)$  to  $(1,0)$  &  $(0,1)$  respectively.

$L$  &  $R$  take the game from  $(2,0)$  to  $(1,0)$  and  $(0,0)$  respectively.

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Nim Game – NFG representation

		Player 2			
		lL	lR	rL	rR
Player 1	u	1,-1	1,-1	1,-1	1,-1
	m	-1,1	-1,1	-1,1	-1,1
	d	1,-1	-1,1	1,-1	-1,1

Strategy of player 2 :-

XY

X – what will player 2 do if (2,0) is reached

Y – what will player 2 do if (1,1) is reached