

Module 2: "Static games of complete information"

Lecture 13: "Mixed strategy NE : Case Study"

The Lecture Contains:

- ☰ Mixed strategy NE: A Case Study: Random Drug Testing

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Mixed strategy NE: A Case Study**Random Drug Testing**

- Sporting organizations like US Olympic committee, International Olympic Committee (IOC) routinely test athletes
- Testing is random
 - Athletes do not know whether they will be subject to tests or not
 - Sports body uses a mixed strategy
 - not every athlete is selected
- Why a mixed strategy?

Example

- Using a simple model
- Two athletes – X and Y
- Each athlete has 2 options
- Using a steroid (S) or not using a steroid (NS)

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Mixed strategy NE: A Case Study [Contd.]

Each athlete has a 50% chance of winning $\left[\begin{array}{l} \text{Payoff to win} = 1 \\ \text{Payoff to loss} = -1 \end{array} \right]$ if both use steroids or if neither use steroids

- If only one athlete uses steroid then he wins

		Y	
		S	NS
X	S	0,0	1,-1
	NS	-1,1	0,0

- S is a dominant strategy for both
- Both athletes would use steroids [without IOC intervention]

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Mixed strategy NE: A Case Study [Contd.]

Suppose IOC can test only one swimmer

- Options
 - a. test x
 - b. test y
 - c. use a mixed strategy
 - Test X with probability $1/2$
 - Test Y with probability $1/2$

Payoffs to IOC :

- if IOC's test uncovers drug use
 - IOC looks vigilant and payoff =1
- if IOC's test turns up negative
 - IOC's reputation unchanged and payoff =0

Payoffs to Athletes

- If an athlete is tested positive she/he faces a penalty which is worse than losing
 - Payoff = $-(1+b)$
 - Other athlete wins

Mixed Strategy NE: An Application [Contd.]

		S	NS
x	S	-1-b,1,1	-1-b,1,1
	NS	-1,1,0	0,0,0

IOC tests x



NE (NS,S)

Athlete who knows he
will be tested (x)
Will not use steroid
Other (y)uses steroid

		S	Y	NS
x	S	1,-1-b,1		1,-1,0
	NS	1,-1-b,1		0,0,0

IOC tests y

NE (S,NS)

Athlete who knows
will be
tested (y)will
not use steroid
-Other (x)uses steroid

IOC's reputation does not increase [test does not uncover drug use]

Mixed strategy NE: An Application [Contd.]

IOC uses a mixed strategy $(\frac{1}{2}, \frac{1}{2})$

		y	
		S	NS
x	S	$\frac{-b}{2}, \frac{-b}{2}, 1$	$\frac{-b}{2}, 0, \frac{1}{2}$
	NS	$0, \frac{-b}{2}, \frac{1}{2}$	$0, 0, 0$

NE (NS, NS)

- random drug testing ensures that none of the athletes take steroids