

ECN 275/375: Natural resource and environmental economics

Exercise set 10

Exercise 10.1. Non-cooperative games and cooperative outcomes

Consider a game that is repeated with random stop time with five players. Their payoffs from various strategies are displayed in the table below. All payoffs are common information (= all players know the payoffs of all players). The common discount rate is 5%.

Strategy for player i strategy at least one other player	Player				
	A	B	C	D	E
do not cooperate cooperate	135	140	145	150	155
cooperate cooperate	125	125	125	125	125
do not cooperate do not cooperate	100	100	100	100	100
cooperate not cooperate	50	60	70	80	90

- Show that this game does not have a cooperative solution given these payoffs.
- Show that this game can be transformed to yield a cooperative solution.
- Suppose that each player only knows his/her own payoffs (private information). Does this change the result in (b), and in case why?

Exercise 10.2. International treaties

Suppose there are 5 possible signatories to an international treaty. The treaty contains sanctions, but payoffs depend on the number of signatories. When three or more countries have signed the treaty it comes into effect.

Strategy - sign # other signatories	Country				
	A	B	C	D	E
0	90	95	100	55	80
1	90	95	100	60	80
2	90	85	100	70	80
3	105	102	100	105	101
4	110	112	105	110	100
- do not sign # other signatories	A	B	C	D	E
0	100	100	100	100	100
1	110	106	100	150	140
2	105	101	100	130	115
3	98	95	95	105	98
4	92	85	85	80	85

- Show that the treaty will be signed by at least three countries, and hence ratified.
(Hint: try to work out the order in which countries will sign, and recall that once a country has signed, that is a given for the others)
- Show that once the treaty has been ratified, the remaining four countries will also sign the treaty.