

AGSM 306  
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## ***STRATEGIC GAME THEORY FOR MANAGERS***

### *Problem Set 1*

*Note: Make any economic assumptions you think necessary, but make them explicitly. You may talk to fellow students about this, but **do not copy** others' work.*

1. Imagine that there are three major television stations in a large city: RBC, CBC, and MBC. All three stations have the option of airing the evening news program live at 6:00 pm, or in a delayed broadcast at 7:00 pm. Each station's objective is to maximize its viewing audience in order to maximize its advertising revenue. The following normal-form representation describes the share of the population that is "captured" by each station as a function of the times at which the news programs are aired.

- a. The stations make their choices simultaneously. The payoffs are list in the order RBC, CBC, MBC. Find the set of Nash equilibria. Explain.

**MBC News @ 6:00 pm —**

		C B C N e w s	
		6:00 pm	7:00 pm
RBC News	6:00 pm	(14%, 24%, 32%)	(8%, 30%, 27%)
	7:00 pm	(30%, 16%, 24%)	(13%, 12%, 50%)

**MBC News @ 7:00 pm —**

		C B C N e w s	
		6:00 pm	7:00 pm
RBC News	6:00 pm	(16%, 24%, 30%)	(30%, 16%, 24%)
	7:00 pm	(30%, 23%, 14%)	(14%, 24%, 32%)

Payoffs: (RBC, CBC, MBC)

- b. What is the definition of a dominated strategy?
- c. Suppose now that the stations interact sequentially. First, MBC chooses between 6:00 and 7:00. Then, after observing MBC's choice, RBC decides between 6:00 and 7:00. Finally, after observing the behaviour of both MBC

and RBC, CBC chooses either 6:00 or 7:00. Payoffs are unchanged. Draw a game tree of this sequential interaction and identify the subgame perfect equilibrium. Is the outcome different from part a.? Explain.

2. Bob and Mike both sell DVD playback machines, and both have per-unit costs of \$250. They compete on price: the low-price seller gets all the market, and they split the market if they have equal prices. Each prices without knowing the other's price.
  - a. Using the tools of game theory, explain why the only Nash equilibrium has both firms charging \$250, splitting the market, and making zero profit.

Suppose the monopoly price for DVD players (the price that maximises the sum of the profits of both firms) is \$300. Now suppose Bob advertises that if a customer buys a DVD player from him for \$300 and discovers he or she can buy it more cheaply at Mike's, then Bob will sell the customer the DVD player with a rebate equal to twice the price difference between the two stores (e.g., if Mike charges \$275, then Bob will give the customer a rebate of  $(\$300 - \$275) \times 2 = \$50$ ). Suppose Mike does the same thing.

- b. Using the tools of game theory, show that it is now Nash for both stores to charge \$300. (Conclusion: pricing strategies that seem to be super competitive can in fact be anticompetitive!)
3. A debtor owes \$15,000 to each of two creditors, but he only has \$25,000. If he defaults on the debt, he will lose the whole amount, and the legal costs of filing for bankruptcy and litigating the liquidation of his assets will be \$15,000, so each of the debtors will collect \$5,000. The debtor has his solicitor draw up the following letter, which he sends to each of the creditors: "I hereby offer you \$5,001 if both you and my other creditor agree to cancel my debt. If either or both of you decline this offer, I will be legally in default."

Write a game tree for this situation. and show that it is a dominant strategy for each creditor to accept the offer, allowing the debtor to eradicate his debt and retain the amount \$14,998 for himself. (What does this tell you about bankruptcy law?)

4. Suppose the Intel Corporation and the Microsoft Corporation are considered engaging in a joint venture. Each will have to invest \$10 million in assets that will then be of no use or value outside this project. If both firms act in accord with their promises, the annual economic profit to each firm is \$2.5 million. If one or both do not act in this way, the annual economic profit to each is as shown below (Intel, Microsoft, in millions):

Possible strategies for Intel	Possible strategies for Microsoft	
	Act in accord with promises	Don't act in accord with promises
Act in accord with promises	\$2.5, \$2.5	-\$1, \$5
Don't act in accord with promises	\$5, -\$1	\$0, \$0

- In the absence of a contract, would the joint venture generally be a good idea? Explain.
  - Suppose a contract can be formulated that will ensure that both firms will act in accord with their promises. Will either firm enter into the joint venture (assuming their lawyers' fees are nominal)? Why or why not?
  - Explain why might it be very difficult to formulate an effective contract of this sort.
  - Is this an ordinary Prisoner's Dilemma game? If not, why not?
5. What is the definition of a strategic interaction? Consider a strategic situation that you are personally familiar with from work, uni, or through social contacts.
- Describe it, briefly. Who are the players?
  - What are the possible actions of each of them? Does one (or more) move first (and be seen to move first)? Who?
  - Plot an outcomes matrix (if the number of players is not too many, and the number of possible actions is not too many) with the outcomes for each. If the matrix is a cube or worse, discuss a few of the possible combinations of actions and the payoffs for each player.

- d. Can you reduce the numbers of possible actions? If so, do so.
- e. Are there one or more players who are peripheral (whose actions have only a marginal impact on the other players)? If so, remove them.
- f. Can the outcomes be easily ranked for each remaining player? If so, do so.
- g. Can you solve for the equilibrium of the interaction (perhaps using a game tree, if appropriate)? Do so. If not, why not? (What additional information would allow solution?)