AGSM 306   18 July, 2007
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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. (10) 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. (15) 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) × 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. (10) 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 one 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. (14) 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

a. In the absence of a contract, would the joint venture generally be a good idea? Explain.

b. 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?

c. Explain why might it be very difficult to formulate an effective contract of this sort.

d. Is this an ordinary Prisoner's Dilemma game? If not, why not?

5. (16) 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.

a. Describe it, briefly. Who are the players?

b. What are the possible actions of each of them? Does one (or more) move first (and be seen to move first)? Who?

c. Plot an outcomes matrix or game tree (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?)

(See an example on the last page.)

(Names have been changed to protect the innocent)

I have a girlfriend, Justine, who was privy to a delicate situation involving her sister, Brenda. Brenda had recently married and so it was both distressing and startling for Justine to receive a phone call from Brenda to confide that she was having a secret affair with another man. This had been going on for only a couple of weeks, and she was by all accounts "deeply in love" with this particular person. Justine on the other hand was terribly upset as she knew Brenda's husband from their long period of dating and engagement, and believed him to be a genuine, sincere, loving and trusting man. Justine felt that in no way did he deserve this treatment from her sister and told Brenda her thoughts on this in no uncertain terms. She also told Brenda that she felt she, Justine, had a moral obligation to tell Brenda's husband, since Brenda was not going to divulge her indiscretion, and that Brenda should terminate the affair immediately.

The way in which this situation progressed, the interaction of choices was essentially a simultaneous game. Both Brenda and Justine were separated geographically, with Brenda living in Adelaide and Justine in Sydney. They had ended their conversation heatedly, and both were required to decide what they would do: essentially, Justine had to decide whether or not to ring Brenda's husband and tell him his wife was having an affair, whilst Brenda had decided whether to terminate the affair or not. Given that the conversation had ended so badly, with no chance of further dialogue (at least in the short term) between them, their decisions had to be made independently and pretty much simultaneously.

The decision context for Justine and Brenda can be represented by the above payoff matrix.

If Brenda terminates the affair, the best thing that Justine can do is to maintain the secret. This is because if she told the husband and Brenda had terminated the affair, it would lead to considerable domestic strife, and Brenda probably enstrange Justine. The compensation to Justine's conscience would be the fact that Brenda had ceased the affair. If Brenda were to continue the affair, then Justine's best course of action would again be to maintain the secret. This was reasoned to me by Justine, who indicated Brenda would irrevocably estrange her, and it would probably precipitate her leaving her husband immediately, precluding any chance that Brenda would see her foolishness and terminate the affair herself.

From the point of view of Brenda, if Justine told her husband, her best course of action would be to continue the affair, since in the telling, Brenda would be forced to separate from her husband. If Justine maintained her silence, the best course of action would again be to continue the affair, since Brenda was gaining considerable satisfaction from her tryst.

The end result of this particular "game" was a Prisoner's Dilemma, as depicted in the payoff matrix. In essence, the Nash equilibrium for this situation is for Justine to maintain her silence, and for Brenda to continue the affair. But the efficient outcome is, of course, "terminate affair, tell husband" but this is not achieved because of the independent actions of the two players chosing a strategy that will maximise their payoff given the possible actions of the other player.

Comments
The matrix only represents on iteration of the situation of course. With a decision made by a participant, the opportunity to change her decision presents itself over and over as each decision is made. The situation is self-reinforcing, whereby the repercussions (payoffs) of changing that decision are associated with lower utility for the decision-maker. Indeed, the actual result was that Justine maintained the secret, and Brenda continued in the affair (they must each have studied game theory!!!)

The matrix fails to encapsulate the other participants in the situation, such as the husband, other family members, and the co-transgressor. Since these people were not instrument in the first found of the game, their exclusion was not thought to be significant.

The payoffs were constructed according to my interpretation of the facts, emotions, stated perceived outcomes of Justine, and circumstances, and ranked as such. They are therefore to an extent arbitrary.