AGSM 306 | 2 July, 2001
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STRATEGIC GAME THEORY FOR MANAGERS

Problem Set 2

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. Answer ONE of:

   a. Draw the influence diagram for the date and time when a specific close relative will phone you or email you. Make sure any uncertainties pass the "clairvoyant clarity test" (see Package pp, 138, 174). and try to summon all your information and experience on the factors influencing the uncertainties. Has the exercise of drawing the influence diagram changed your understanding of the uncertainties at all? Could you do a meaningful probability assessment? Explain what (if anything) would prevent you from assessing the probabilities and calculating the expected date and time that the relative phones or emails you. (Hint: consider recent occasions when you've been phoned or emailed by this relative: what influenced their decisions then? Generalise.)

   b. Draw an influence diagram for the probability of a major war within the next ten years. Make sure any uncertainties pass the "clairvoyant clarity test". How is this problem different from part (a)? What if anything is preventing you from calculating a probability distribution for this problem?

   c. Draw the influence diagram for the number of times you will eat pasta within the next four weeks. Again, make sure any uncertainties pass the "clairvoyant clarity test". Are there any difficulties in completing this problem (calculating a probability ditribution), and, if so, what are they? (Hint: consider recent occasions when you've eaten pasta: what influenced your decisions then? Generalise.)

2. Imagine your partner is being tested for HIV. You have read and believe that this test is 97.5%/98.0% accurate. If he or she has HIV, then it will show positive 97.5% of the time, and if he or she does not have HIV, then it will show negative 98.0% of the time. You have also read that 0.9%, or 9 in 1000, of the population

actually have HIV. Now your doctor tells you that your partner has tested positive. What is the probability that your partner is HIV-positive, given the positive test result?

3. A randomly chosen college student, Bill, is presented with the following three lotteries:

   A. A 50% chance of winning \$5 and a 50% chance of winning nothing.

   B. A 25% chance of winning \$10 and a 75% chance of winning nothing.

   C. A 75% chance of winning \$3.33 and a 25% chance of winning nothing.

   Bill prefers A to B and prefers B to C. Assume that Bill is an expected utility maximiser and let U be his von Neumann-Morgenstern utility function. Setting $U(\$0) = 0$ and $U(\$10) = 1$, use his reported lottery preferences to find upper and/or lower bounds for $U(\$5)$ and $U(\$3.33)$. What can you say about the risk aversion of Bill from these bounds? (Hint: Try plotting his utility function. Where is it concave? Where is it convex?)

4. The Food Products Company has decided to introduce a new brand of breakfast cereals, and is contemplating building either a \$10 million or a \$6 million plant to produce the new breakfast cereals. If FPC builds the \$10 million plant, there is a 70% chance that competitors will respond with a large increase in their advertising and a 30% probability that competitors will respond with a small increase in their advertising. On the other hand, if FPC builds the \$6 million plant, there is a 40% probability that competitors will respond with a large increase in their advertising and 60% probability that competitors will respond with a small increase in their advertising.

   Whether or not the company builds the \$10 million or the \$6 million plant and whether or not competitors respond with a large or a small increase in their advertising, FPC believes that with probability 40% general demand conditions will be high, with probability 40% general demand conditions will be normal, and with probability 20% general demand conditions will be low.

   The net cash flows that FPC faces under each plant it can build and competitors' responses are indicated in the table below, as a function of the possible conditions of demand. Since the variability of the net cash flows is higher with the \$10 million plant, FPC uses a risk-adjusted discount rate of 20% p.a. to

calculate the present value (P.V.) of the net cash flows. On the other hand, FPC uses a risk-adjusted discount rate of 14% p.a. to calculate the P.V. of the net cash flows of the $6 million plant.

Plant	Competitors' Advertising Reaction	Conditions of Demand	Net Cash Flows for Year (millions) 1	2	3
$10 million	Large	High	$6	$6	$5
		Normal	4	5	6
		Low	3	4	2
	Small	High	$7	$7	$7
		Normal	5	5	5
		Low	4	4	4
$6 million	Large	High	$3	$4	$3
		Normal	3	3	2
		Low	2	2	2
	Small	High	$5	$4	$4
		Normal	4	3	3
		Low	3	3	2

a. Construct an Influence Diagram for FPC's decision.

b. Construct a decision tree for FPC.

c. Assuming risk neutrality, determine whether FPC should build the $10 million or the $6 million plant. (Ignore cash flows beyond Year 3, for simplicity.) Explain.

d. What is the maximum that FPC should pay to reduce the uncertainty associated with the Conditions of Demand? Explain. Bonus: Plot an Influence Diagram for this investment.