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 an influence diagram for your decision to undertake an MBA. Make sure any uncertainties pass the *clairvoyant clarity test* esee Readings Package pp. 116 and 154), 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 any probabilities. Now draw a second, much simpler, I.D.: eliminate non-critical uncertainties and influences.

   b. Draw an influence diagram for the probability of a major pandemic 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? Now draw a second, much simpler, I.D.: eliminate non-critical uncertainties and influences.

   c. Draw an influence diagram for the AGSM's (hypothetical) decision to enter into a joint venture with the National University of Singapore by offering a common MBA. Again, make sure any uncertainties pass the "clairvoyant clarity test". Are there any difficulties in completing this problem (calculating a probability distribution), and, if so, what are they? Now draw a second, much simpler, I.D.: eliminate non-critical uncertainties and influences.

2. A sports figure tests positive for a banned substance. Suppose that the test is wrong 10% of the time and that you believe that 40% of athletes in this sport use the substance. Consider the following table of payoffs:

	Banned	Not banned
Drug User	10	−10
Non-User	−50	0

   a. Should the sports figure be banned? What is the expected payoff? (Hint: see pp. 7−37 to 7−42 of the Lecture Notes to calculate the probabilities.)

   b. What if the payoff from banning a non-user is −150?

   c. Answer part a. using: (i) the extreme-pessimist criterion (which maximises the minimum payoff), (ii) the extreme-optimist criterion (which maximises the maximum payoff), and (iii) the minimum-regret (or minimax regret) criterion. (See Reading Package p. 57.)

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. Remember to subtract the capital costs ($10m or $6m) from the Net Cash Flows.) Explain.

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