

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* (see Readings Package pp. 144 and 182), 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. Imagine your friend is being tested for HIV. You have read and believe that this test is 97.5% 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 97.5% 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 friend has tested positive. What is the probability that your friend is HIV-positive, given the positive test result?

3. Your company has recently developed Florix, a new sugar-free chewing gum that contains fluoride. Not only does it taste good, but it's also good for your teeth. You're faced with the decision of whether or not to put Florix on the market, (i.e. whether to launch it).

Total sales of all brands of chewing gum are expected to be about \$20 million over the next ten years (in present-value terms).

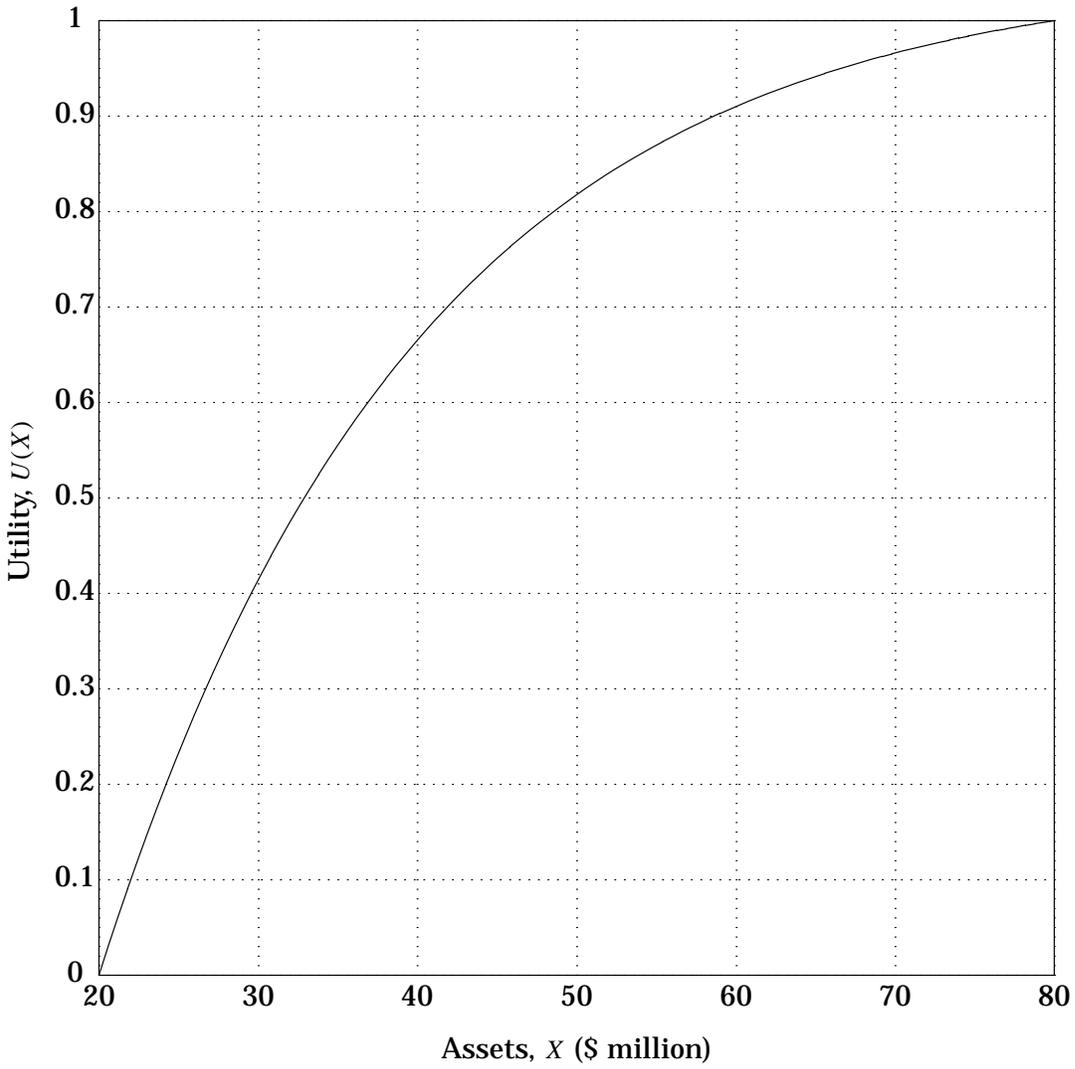
Your marketing people believe that with their best efforts and with a front-end marketing expenditure of \$400,000, your company could capture from 2% to 10% of the chewing gum market with Florix. They have given you the following probabilities:

<i>Market share</i>	<i>Probability</i>
High (10%)	0.30
Medium (6%)	0.50
Low (2%)	0.20

Your financial advisors point out that the profit margin on Florix is quite uncertain because of unusual manufacturing requirements: they say that there is a 40% chance that the profit margin will be only 25% of sales revenue, and a 60% chance that it will be 50% of sales revenue.

- a. Structure an influence diagram for the Florix decision. (Take care to consider the “clairvoyance clarity test” — see Package pp. 144, 182).
- b. Then structure a decision tree for Florix. (Chance nodes, decision nodes, payoffs, and probabilities.)
- c. What is the preferred decision and the expected value?
- d. The engineers say that if you postpone the launch decision for six months, they will be able to tell you the manufacturing requirements (and hence the profit margin), but there will be extra costs to be borne for

- waiting. You decide to wait. What does the influence diagram look like now, before you learn the profit margin?
- e. How high would these extra costs have to be to eliminate any advantage from waiting to find out? (Ignore any time-value-of-money effects.)
 - f. What if there were no information before the launch decision? What then would be the value of perfect information on market share? On profit margin (as in part e). On both?
4. The Arrow Insurance Company has been approached to insure a building against destruction by fire. The building is valued at \$20,000,000, and Arrow estimates that there is a chance of approximately one in twenty-five that such a fire will take place in any calendar year. Arrow's current assets amount to \$40,000,000. You may ignore any administrative charges.
- a. Assume that Arrow is a risk-neutral decision maker. What is the minimum annual premium that Arrow will require to take on the fire policy? (Hint: What is the lottery faced by Arrow? What is its certain equivalent?)
 - b. Assume now that Arrow is an enlightened organisation which has been persuaded to base the premiums it charges on values from a utility curve. The relationship between its money assets and its utility is represented in the attached curve. What now is the minimum premium that Arrow will require to take on the fire policy? (Hint: if the utility of a lottery is its expected utility, what is the certain equivalent of the lottery facing Arrow?)
 - c. With items which could involve payments greater than 25% of current assets, Arrow usually has an understanding with the Comstock Insurance Company to share the risk on a 50–50 basis. If Comstock happens to work from the same utility curve and currently also has assets of \$40,000,000, what now would the combined premium be? Comment: why are the answers to b. and c. different?
 - d. What would the effect in the answer in part c. be if Comstock's assets were \$80,000,000? Is this what you'd have expected? Explain.



Arrow's Utility Curve, $U(X) = \frac{1 - e^{-\gamma Y}}{1 - e^{-\gamma}}$, $\gamma = 3$, $Y = \frac{X - 20}{60}$

X	$U(X)$
20	0.0
30	0.4141
38.670	0.6386
39.200	0.6494
39.324	0.6519
39.488	0.6552
39.600	0.6574
40	0.6652
70	0.9660
79.488	0.9986
79.600	0.9989
80	1.0

