

**Unit IV Case Study: The Oil Wildcatter**  
(Adapted from Raiffa, *Decision Analysis*.)

An oil wildcatter must decide whether or not to drill at a given site before his option expires. He is uncertain about many things: the cost of drilling, the extent of the oil or gas deposits at the site, the cost of raising the oil, and so forth. He has available the objective records of similar and not-so-similar drillings in this same basin, and he has discussed the peculiar features of this particular deal with his geologist, his geophysicist, and his land agent. He can gain further relevant information (but still not perfect information) about the underlying geophysical structure at this site by conducting seismic sounding. This information, however, is quite costly, so it may or may not benefit him to obtain it before making his final decision: to drill or not to drill.

Let us label the options and events that the wildcatter will encounter. He must decide to drill (act  $a_1$ ) or not to drill (act  $a_2$ ). He is uncertain as to whether the hole is dry (state  $S_1$ ), wet (state  $S_2$ ), or soaking (state  $S_3$ ). Drilling costs a fixed \$70,000. His payoffs are given in the table below (taking into account the drilling costs):

	$a_1$	$a_2$
$S_1$ (dry)	-\$70,000	\$0
$S_2$ (wet)	\$50,000	\$0
$S_3$ (soaking)	\$200,000	\$0

Our wildcatter can also experiment by conducting seismic soundings (@ \$10,000 a pop). This can reveal no structure (NS – this is bad!), an open structure (OS – so-so), or a closed structure (CS – oh frabjous day!) The information provided by the test changes the probability of getting different oil strikes. His probabilities, based on advice from his technical advisors, is given in the following table:

	NS	OS	CS	Marginal Prob.
$S_1$ (dry)	.300	.150	.050	.500
$S_2$ (wet)	.090	.120	.090	.300
$S_3$ (soaking)	.020	.080	.100	.200
<b>Marginal Prob.</b>	.410	.350	.240	1.000

The entries in the table are “joint probabilities”: for instance, the entry in row 1, column 1 refers to the probability of finding both (NS) *and* ( $S_1$ ). By “marginal probability” is meant the total probability of getting a particular deposit  $S_1$  or the total probability of a given structure. For instance, the marginal probability of  $S_1$  is equal to  $.300 + .150 + .050 = .500$ .

**Problem 1.** (a) Draw the decision tree diagram for this problem. Begin with the decision whether or not to experiment. Remember that the wildcatter always has the alternative of

doing nothing. Further assume that experimentation will not be done more than once. (b) Fill in as much information about probabilities as you can. Are there any probabilities that you do not yet have? (c) Fill in the consequences for each possible outcome. (d) Consider the option of experimentation. What is the absolute *most* this option could ever be worth to you? (Name a dollar amount.) (Hint: assume that it gives you perfect information.) (e) Calculate the EMV of the “drill” option. Is the experimentation option still a contender? Assume that the wildcatter is an EMV-er.

Now suppose that the wildcatter wants an analysis that takes into account his attitude toward risk. The wildcatter has \$100,000 in present assets. Keeping in mind his future opportunities, he asserts:

“At this time in my life I want to be risk-averse. I don’t want to participate in fair gambles. I would not bet a Las Vegas even if the house cut were reduced to zero.”

“On a 50-50 bet I would just be willing to risk losing my whole \$100,000 bankroll if I could possibly net \$300,000. If I were lucky, I would then have \$400,000 to play with.”

“What would I pay for a deal where there is a .5 chance at winning \$300,000 and a .5 chance of breaking even? Well, since I don’t have to worry about dipping into my own bankroll, I would exchange this for \$100,000 certain.”

“How much would I be willing to spend of my own money to insure against a .5 chance of losing my entire working capital of \$100,000? This is a tough one. It would be a catastrophe if I lost everything; but then there is also a .5 chance of losing nothing. Okay, I would give up \$60,000 of my own money. With the other \$40,000 I would have left I could get started again somehow.”

**Problem 2:** Draw the wildcatter’s utility curve for this problem, using his statements as provided above. Explain any anomalies or special features of the construction. Re-analyze problem 1 using the BRLT data summarized in the utility curve. Given the wildcatter’s responses, is it possible that it might definitely not be worthwhile to experiment? How sensitive is the analysis to arbitrary features of your curve?