The Expected Utility Theory

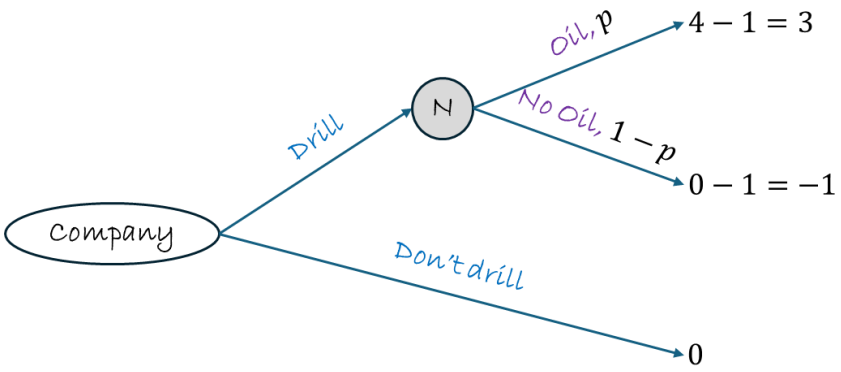
Problem 4

Drilling for Oil

An oil drilling company must decide whether or not to engage in a new drilling venture before regulators pass a law that bans drilling on that side. The cost of drilling is Rs. 1 Crore. The company will learn whether or not there is oil on the site only after drilling has been completed and all drilling costs have been incurred. If there is oil, operating profits are estimated at Rs. 4 Crore. If there is no oil, there will be no future profits.

(a) Using p to denote the likelihood that drilling results in oil, draw the decision tree for this problem.
(b) The company estimates that $p = 0.6$. What is the expected value of drilling? Should the company go ahead and drill?
(c) To be on the safe side, the company hires a specialist to come up with a more accurate estimate of p. What is the minimum value of p for which it would be the company's best response to go ahead and drill?

Answer (a). Decision Tree



Answer (b). Best Response & Expected Value

$$v(Drilling) = p \times 3 + (1 - p) \times (-1)$$

$$\therefore v(Drilling) = 3p - 1 + p$$

$$\therefore v(Drilling) = 4p - 1$$

For $p = 0.6$, we get

$$v(Drilling) = (4 \times 0.6) - 1 = 1.4 > 0$$

Since the payoff from drilling is greater than that for not drilling ($v(Not\ Drilling) = 0$), the company should go ahead and drill.

ANSWER (C). THRESHOLD VALUE OF p

For drilling to be worthwhile, the expected payoff of drilling should be greater than that of not drilling. That is—

$$4p - 1 > 0$$

$$\therefore 4p > 1$$

$$\therefore p > \frac{1}{4}$$

The company can proceed with drilling is the probability of finding oil is greater than $\frac{1}{4}$.

KEY TAKEAWAYS

- Drawing the decision tree.
- Calculating expected payoffs for uncertain outcomes.
- Calculating threshold probabilities of outcomes to 'enforce' a certain action.