

6 Decision Analysis

1. Consider the following payoff matrix:

	θ_1	θ_2	θ_3	θ_4
a_1	1	4	7	8
a_2	10	7	15	5
a_3	7	11	5	2
a_4	8	6	10	6

- Determine Laplace action and explain its meaning.
 - Determine Maximin/Minimax action and explain its meaning.
 - Determine Hurwicz action with $\alpha = 0.5$ and explain its meaning.
2. A company owns a tract of land that may contain oil. A consulting geologist has reported that she believes there is a 1 chance in 4 of oil. Because of this prospect, another oil company offered to purchase the land for \$90,000. However, the company is considering holding the land in order to drill for oil itself. The cost of drilling is \$100,000. If oil is found, the resulting expected revenue will be \$800,000, so the company's expected profit (after deducting the cost of drilling) will be \$700,000. A loss of \$100,000 (the drilling cost) will be incurred if the land is dry (no oil).
- Determine the action that should be selected using the following criterias: Minimax (Maximin); Savage Regret; Laplace; Hurwicz Index (take $\alpha = 0.5$); Maximum Likelihood; Bayes Criteria.
3. A business man wants to decide where to invest 100 000€. With that purpose he needs to choose one of three alternative projects, P1, P2 or P3. The return of the projects depends on the performance of the economy that may stagnate or improve. The following table contains the data.

	stagnates	improve
P_1	7%	5%
P_2	-10%	14%
P_3	6%	6%

- Determine the project that should be selected using the following criterias: Minimax (Maximin); Laplace; Savage Regret; Hurwicz Index (take $\alpha = 0.5$); Maximum Likelihood; Bayes Criteria.
4. A farmer must determine whether to plant corn or wheat. If he plants corn, and the weather is warm, he earns \$8 000; if he plants corn, and the weather is cold, he earns \$5 000. If he plants wheat, and the weather is warm, he earns \$7 000; if he plants wheat, and the weather is cold, he earns \$6 500. In the past 40 percent of all years have been cold and 60 percent have been warm. Before planting, the farmer can pay \$600 for an expert weather forecast. If the year is actually cold, there is a 90 percent chance that the forecaster will predict a cold year. If the year is actually warm, there is an 80 percent chance that the forecaster will predict a warm year. How can the farmer maximize his expected profits? Use a decision tree. Compute the EVPI and the EVSI.

Some solutions

6.1

	θ_1	θ_2	θ_3	θ_4	Laplace	Maxmin	Hurwicz, $\alpha = 0.5$
a_1	1	4	7	8	$\frac{1+4+7+8}{4} = 5$	1	$8\alpha + (1 - \alpha) = 7\alpha + 1 = 4.5$
a_2	10	7	15	5	$\frac{10+7+15+5}{4} = 9.25$	5	$15\alpha + 5(1 - \alpha) = 10\alpha + 5 = 10$
a_3	7	11	5	2	$\frac{7+11+5+2}{4} = 6.25$	2	$11\alpha + 2(1 - \alpha) = 9\alpha + 2 = 6.5$
a_4	8	6	10	6	$\frac{8+6+10+6}{4} = 7.5$	6	$10\alpha + 6(1 - \alpha) = 4\alpha + 6 = 8$
					9.25	6	10