
Directions: Each problem from the Module Problem Set will be worked out in its entirety. Your solution method may vary and will not be used against you if you get the right answer.

1. (Optimal Decisions) An agent has three alternatives, a_1 (go to the mall), a_2 (go to the theater) and a_3 (stay at his apartment). There are two states of nature, θ_1 (sunny outside) and θ_2 (cloudy outside). The agent has a convex set of probability distributions:

$$p(\theta_1) = 0.3\alpha + 0.7(1 - \alpha)$$

with $\alpha \in [0, 1]$. Notice that $p(\theta_2) = 1 - p(\theta_1)$. The utilities are defined in the following table.

	Sunny	Cloudy
a_1 (park)	10	10
a_2 (mall)	-5	4
a_3 (stay in)	0	0

Figure 1: Table of utility values for our agent.

- For a fixed value of α , solve for the expected utility $E(a_1)$ given the utility values.
- Plot the expected gain curves for each of a_1, a_2, a_3 .
- What are the admissible decisions according to Γ -maximin?
- What are the admissible decisions according to E-admissibility?
- What are the admissible decisions according to maximality?

2. (Influence Diagram) A real estate mogul is faced with a choice of:

- A large-scale investment (R) to renovate their apartment towers. This could produce a substantial pay-off in terms of increased revenue net of costs but will require an investment of \$1,400,000. After extensive market research it is considered that there is a 40% chance that a pay-off of \$2,500,000 will be obtained, but there is a 60% chance that it will be only \$800,000.
- A smaller scale project (D) to re-decorate her premises. At \$500,000 this is less costly but will produce a lower pay-off. Research data suggests a 30% chance of a gain of \$1,000,000 but a 70% chance of it being only £500,000.
- Continuing the present operation without change (N). It will cost nothing, but neither will it produce any pay-off. Clients will be unhappy and it will become harder and harder to rent the flats out when they become free.

- Draw the decision tree of the problem.
- Solve the decision tree and state the optimal decision given MEU.