Economic Foundations and Applications of Risk (2022)

Exam

October 21st, 2022

Instructions

- You are supposed to **answer all questions**.
- You have **60 minutes for a total of 60 points.**
- **Show how you derived your answers** (either by calculation or by verbal reasoning).
- Your answers can be in **German or English** (or any combination that I am able to understand).
- **You may use** a (non-programmable) **calculator**.
- Questions marked with an **asterisk** (*) are **meant to be a bit trickier** then the rest, so don't despair if you find them hard to crack.
- **Good luck!!!**

1. **Preferences over lotteries [20 points]**

   An individual must choose between P, a sure payment of 200, and Q, a gamble with $Q = (0.5, 0.3, 0.1, 0.1; 0, 200, 400, 1000)$. All you know is that

   - the individual's preferences satisfy the vNM axioms for this kind of lottery,
   - she is risk-averse, and
   - she prefers more money over less.

   (a) Explain (either graphically or formally) which of the two lotteries (P versus Q) this individual prefers. [8 points]

   Now assume that the same individual is facing the choice between P, a sure payment of 200, and a different gamble $Q' = (0.5, 0.3, 0.1, 0.1; 0, 200, \mathbf{450}, 1000)$.

   (b) Explain (either graphically or formally) why it is not possible to generally determine which of the two lotteries (P versus Q') the risk-averse individual will prefer. [4 points]

   *(c) How does your answer to (b) change if you also know that the individual's certainty equivalent for a gamble $G = (0.5, 0.5; 450, 1000)$ is 650. *(Hint: Use the idea of compound lotteries, i.e. that the gambles Q' and Q'' are equivalent, where $Q'' = (0.5, 0.3, 0.2; 0, 200, G)$.)* [8 points]

2. **The value of information [40 points]**

During the Tour de France, the champion racer of one of the teams, racer A, shows a drop in performance and is ranked only tenth in the overall classification. The team still has another racer, B, who, although young and inexperienced, ranks second in the overall classification. The risk-neutral team management must decide between one of the following two actions:

- a_1: Let racer A ride as a favorite. (This means that all the other racers in the team have to support him and are not allowed to win themselves.)
- a_2: Let racer B ride as a favorite. (Dito.)

Suppose that there are two states of the world: Racer A has either a severe flu (z_1) or just a mild cold (z_2). If the team still waits for another day, it will receive one of two possible signals, namely that racer A rode a bad race (s_1) or that racer A rode a good race (s_2) on that next day. Let the **common** probabilities ($Pr[s_i \cap z_j]$) be:

	s_1	s_2
z_1	0.2	0.1
z_2	0.2	0.5

Depending on the true medical condition of racer A, and the action taken by the management, the team can expect the following payouts (in EUR):

	z_1	z_2
a_1	1000	10000
a_2	7000	7000

(a) Calculate all four ex-post probabilities ($Pr[z_j|s_i]$). [8 points]

(b) Which racer will be nominated as the favorite if the team manager does **not** want to wait for another day? *(Hint: Recall that you can calculate the ex-ante probabilities of the states of the world by using the common probabilities given above.)* [8 points]

(c) If the team waits for another day, they will lose 500 EUR of advertising revenue. Will they wait for another day? Which is the maximum loss in advertising revenue that they would accept and still delay their decision? [10 points]

*(d) The main sponsor of racer B offers the team manager 450 EUR if she already nominates racer B as the favorite today. How will the team manager proceed now? [8 points]

(e) Could your answer to (d) change if the team management was risk-averse instead? *(Hint: Argue verbally. No calculations necessary.)* [6 points]