

**UNIVERSITÄT KONSTANZ****Insurance Management**

Juli 2010

Professor Schlesinger

KLAUSUR

Answer **any 5** of the following 6 questions. Answers may be written in German or in English. Each question answered is worth 20 points (100 points in total). To get full credit you must show how you derive your answers. You need to earn at least 50 points to pass the course. Note that I will not grade all 6 questions, so only answer 5. **Please write neatly.** **IMPORTANT: No Handys allowed under penalty of failure of this exam!**

YOU MUST TURN IN THIS QUESTION SHEET WITH YOUR EXAM!

Use the following abbreviated mortality table to answer question 1.

Age	Probability of Dying	Number of People	Number of Deaths
70	0.03951	627,416	24,789
71	0.04330	602,627	26,094
72	0.04765	576,533	27,472
73	0.05264	549,061	28,903
74	0.05819	520,159	30,268

1. Frank Guenters just turned 71 years old and wishes to purchase a three-year term life insurance policy. This policy pays €100,000 if death occurs during the three year term of the policy. Any premium is paid at the beginning of the year and death benefits are paid out at the end of the year of death. Assume that the interest rate for borrowing and lending is 5%. Further assume that there is a premium loading of 10% (i.e., $\lambda = 0.1$).

- Determine the single premium that he would be charged for such a policy.
- Determine the level premium that he would be charged for such a policy.

2. An individual owns assets of initial value $W = 10$, which may suffer a random loss \tilde{x} described by the discrete random variable:

x	$p(x)$
0	0.7
4	0.1
8	0.1
10	0.1

- Compute the premium for full insurance (assume that the premium loading is zero everywhere in this exercise).
- What is the actuarially fair premium when a deductible $D = 3$ is selected? What happens to the premium when $D = 6$? Why doesn't the premium fall by 50 %?
- For each deductible ($D = 3$ and $D = 6$) compute the coinsurance rate α that yields the same premium.
- Draw the cumulative distribution of final wealth for two cases: first if $D = 6$ and then if the policy is characterized by the coinsurance rate α that yields the same premium as $D = 6$. Show that the policy with coinsurance induces a riskier distribution of final wealth in the sense of Rothschild & Stiglitz (1970).

3. Consider a consumer whose preferences exhibit constant absolute risk aversion (CARA). Suppose that there is a positive premium loading $\lambda > 0$ and let α^* denote the consumer's optimal level of coinsurance with no background risk.

- Show that $\alpha^* < 1$.
- Let $\tilde{\varepsilon}$ be an independent background risk, with $E\tilde{\varepsilon} = 0$. Show whether the optimal level of coinsurance with the background risk $\tilde{\varepsilon}$ is higher or lower than α^* from part (a).

4. Consider a deductible insurance policy and suppose that the premium loading factor is positive, $\lambda > 0$.
- Write out the first-order condition for choosing the optimal level of deductibility for an insurance policy.
 - Show that the optimal level of deductibility is positive, $D^* > 0$.
 - Suppose that this consumer's preferences exhibit constant absolute risk aversion (CARA). Show whether an increase in the initial wealth of this consumer will increase or decrease the optimal level of the deductible.
5. Bodensee Insurance, AG, has a surplus-share reinsurance treaty with Kreuzlingen Reinsurance. Bodensee Insurance has a retention limit of €500,000 per policy. Kreuzlingen Reinsurance has agreed to take up to 2 lines of Reinsurance. Each Bodensee policy pays for full coverage, up to the policy limit.
- How much would Bodensee Insurance pay and how much would Kreuzlingen Reinsurance pay for a loss of €300,000 on a policy with a €750,000 policy limit (i.e. with a €750,000 face value)?
 - Suppose that instead of a surplus-share treaty, Kreuzlingen Reinsurance had an excess-loss reinsurance treaty, with a stop-loss limit of €200,000 for each insurance policy written by Bodensee Insurance. How would your answer to part (a) change?
 - Suppose that the premium for the reinsurance in parts (i) and (ii) above is the same, and that the expected indemnity for each of these two reinsurance policies is equal. Can we say ex ante whether the reinsurance in part (a) or in part (b) would be preferred by Bodensee Insurance? Explain carefully. You can assume that Bodensee Insurance behaves in a risk-averse manner.
[Note: the answer is based on some unspecified distribution function for losses. It is not based only on the fact that this time the loss turned out to be €300,000.]
6. Consider the adverse-selection model of Rothschild & Stiglitz (1976), where there are two types of individuals who differ only in their probabilities of incurring a loss. Insurers cannot tell an individual's type, but they know the proportion of good risks and bad risks in the population. Rothschild & Stiglitz show how there cannot exist any pooling equilibrium, but there might exist a separating equilibrium.
- Explain the circumstances under which a separating equilibrium will not exist in their model.
 - In a situation such as you described in part (a), suppose that the government provides a pooling contract in which everyone receives full insurance at a fair pooling price. No private insurance is allowed, but individuals are free to decline the purchase of the government insurance. Explain whether such a pooling contract might succeed.
 - How would your answer to part (b) change if private insurers were allowed to enter the market?

Checklist before turning in your exam:

- PLEASE PUT YOUR MATRIKEL-NUMBER ON THE FIRST PAGE
- CHECK TO BE SURE THAT YOU ANSWERED 5 (AND ONLY 5) QUESTIONS
- DO NOT FORGET TO INCLUDE ALL OF THE PAGES WITH YOUR ANSWERS
- REMEMBER TO TURN IN THIS QUESTION SHEET WITH YOUR EXAM