

ACSC/STAT 3703, Actuarial Models I

WINTER 2024

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Homework Sheet 1

Due: Wednesday 24th January: 13:00

Note: This homework assignment is only valid for WINTER 2024. If you find this homework in a different term, please contact me to find the correct homework sheet.

Basic Questions

1. A customer has utility function $u(x) = \log(x + 1000)$. The customer's current wealth is \$28,000. The customer's car has a value of \$14,700. The probability of the car being stolen is 0.016. How much would the customer be willing to pay for insurance against the car being stolen?
2. Which of the following risks are insurable? For risks which are not insurable, explain why they are not insurable.
 - (i) The risk that a \$10 Christmas decoration will be broken.
 - (ii) The risk that a borrower will need to pay interest on a debt.
 - (iii) The risk that the interest rate on a debt will increase.
 - (iv) The risk that an insurance company will have to pay too many losses.
 - (v) The risk that an individual is late for an important meeting.
 - (vi) The risk that a pregnancy will result in multiple births (twins, triplets, etc.) incurring unplanned expenses.
 - (vii) The risk of an individual being killed by a malfunctioning self-flying aeroplane within the next 30 years.
 - (viii) The risk that a dress will not be fashionable in two month's time.
3. A homeowner's house is insured at \$950,000. The insurer requires 75% coverage for full insurance. The home sustains \$25,300 damage from fire. The policy has a deductible of \$10,000, which decreases linearly to zero when the total cost of the loss is \$20,000. The house is valued at \$1,360,000. How much does the insurer reimburse?
4. A liability insurance policy has a deductible of \$100,000, a policy limit of \$20,000,000 and co-insurance such that the policyholder pays 20% of the remaining claim. How much does the insurer pay if the loss is:

- (i) \$50,000
- (ii) \$362,000
- (iii) \$20,065,000
- (iv) \$31,400,000

Standard Questions

5. An insurer charges a loading of 30% on its policies with limit \$500,000, and a loading of 33% on its policies with limit \$1,000,000. It purchases stop-loss reinsurance of \$500,000 over \$500,000. The cost of this reinsurance is 22% of total premiums. What is the reinsurer's loading on the reinsurance policy?
6. Policyholders are assumed to have a utility function $u(x) = -e^{-\frac{x}{\Theta}}$ where $\Theta > 0$ varies between policyholders following an exponential distribution with unknown mean. An insurance company sells an insurance policy which covers a risk which causes a loss of \$6,000 with probability 0.4. There are 3,000,000 potential customers for this policy. The insurer finds that when the premium for the policy is set to \$3000, they are able to sell 952,000 policies. How many policies would they sell if they increased the premium to \$4,000?