

ACSC/STAT 4703, Actuarial Models II

FALL 2023

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Homework Sheet 1

Due: Thursday 21st September: 14:30

Basic Questions

1. An insurance company models losses as following a Pareto distribution with $\alpha = 3.5$ and $\theta = 2000$. The fixed expenses are \$200 per claim, and variable expenses are 14% of loss amount. What is the density function of the distribution of the total cost to the insurance company for a random loss?
2. An insurer is modelling losses using a generalised regression model. Under their model, the losses X_i for a given policyholder should follow an inverse gamma distribution with shape $\alpha = 3$ and scale θ_i estimated by the regression model. To assess the model, they record the square $(X_i - \frac{\theta_i}{2})^2$. What is the density function for the distribution of this statistic.
3. An insurance company has the following data on its policies:

Policy limit	Losses Limited to				
	50,000	100,000	200,000	500,000	1,000,000
50,000	8,131,429				
100,000	10,833,728	15,096,434			
200,000	15,763,797	22,145,370	25440902		
500,000	30,126,054	46,654,553	58336196	72339459	
1,000,000	20,899,468	29,641,835	41482022	44513950	42764662

Use this data to calculate the ILF from \$50,000 to \$1,000,000 using

- (a) The direct ILF estimate.
 - (b) The incremental method.
4. An insurance company charges a risk charge equal to the square of the average loss amount, divided by 100,000. It has the following data on a set of 4,407 claims from policies with limit \$1,000,000.

Losses Limited to	100,000	500,000	1,000,000
Total claimed	\$950,249	\$1,318,024	\$1,451,334

Calculate the ILF from \$100,000 to \$1,000,000.

Standard Questions

5. An insurer divides losses into two parts: property and medical. It models the property losses as following an exponential distribution with mean Θ , and the medical losses as following an exponential distribution with mean 2Θ , where Θ varies between individuals, following an inverse exponential distribution with $\theta = 500$ and $\alpha = 3$. What is the probability that a random claim exceeds \$50,000?
6. An insurance company's premiums include a risk charge proportional to the square of the expected claim. This results in a 20% loading for its policies with limit \$500,000. A reinsurer offers reinsurance of \$500,000 over \$500,000 for a loading of 45%. The insurer calculates that this buying this reinsurance would not affect its premium (i.e. the premium with limit \$500,000 plus the reinsurance premium is equal to the premium with limit \$1,000,000). What is the ILF from \$500,000 to \$1,000,000? (It is not 1.)