ACSC/STAT 4703, Actuarial Models II

FALL 2024

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Homework Sheet 1

Due: Thursday 19th September: 11:30

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

Basic Questions

1. An insurance company models losses as following a gamma distribution with $\alpha = 0.8$ and $\theta = 2000$. The fixed expenses are \$300 per claim, and variable expenses are 12% 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 models the area affected by an earthquake as a circle with radius (in km) following a Pareto distribution with $\alpha = 1.4$ and $\theta = 5$. What is the density function for the distribution of the affected area in km^2?

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	3,194,726				
100,000	5,586,215	10,503,540			
200,000	8,947,072	30,793,171	37,895,098		
500,000	5,354,052	12,769,853	16,108,054	18,450,094	
1,000,000	2,854,741	11,529,017	15,416,701	19,129,888	20,171,889

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 50,000. It has the following loss data on a set of 7,420 policies with limit \$2,000,000.

Losses Limited to	500,000	1,000,000	2,000,000
Total claimed	\$9,950,249	\$13,383,022	\$15,040,978

Calculate the ILF from \$500,000 to \$1,000,000.

Standard Questions

5. A health insurance company models claims as being either *preventative* or *curative*. 84% of claims are preventative. Costs for preventative claims are modelled as following a gamma distribution with $\alpha = 2.6$ and $\theta = 180$. Costs for curative claims are broken into *diagnostic costs* which are modelled following a Pareto distribution with $\alpha = 1$ and $\theta = 170$ and *treatment costs*, which are modelled as independent of diagnostic costs, and following a Pareto distribution with $\alpha = 1$ and $\theta = 800$. What is the density function for the total cost of a random claim?

6. The pure premium ILF from \$1,000,000 to \$2,000,000 is 1.2. A reinsurer offers excess-of-loss reinsurance of \$1,000,000 over \$1,000,000 for a loading of 25%. An insurer whose premium includes a 10% loading on expected claims and a risk charge equal to the square of the expected claims divided by \$100,000 can reduce its premium for policies with limit \$2,000,000 by 5% by buying reinsurance. What was the premium for policies with limit \$2,000,000 before buying the reinsurance? [It is not 0.]