ACSC/STAT 4703, Actuarial Models II

FALL 2021

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Homework Sheet 6

Due: Thursday 25th November: 11:30 AM

Basic Questions

1. An insurer collects $4,450,000 in earned premiums for accident year 2020. The total loss payments are $3,831,000. Payments are subject to inflation of 7%, and policies are sold uniformly throughout the year. If the insurer's permissible loss ratio is 85%, by how much should the premium be changed for policy year 2022?

2. For a certain line of insurance, an insurance company collects a total of $6,204,000 in premiums in 2020. The company ran advertisements from May to December, and estimates that the rate of sales of new policies during that period was double the rate from the start of 2019 to the end of April 2020. Estimated incurred losses for accident year 2020 are $3,612,000. An actuary is using this data to estimate rates for premium year 2024. Claims are subject to 4% inflation per year. By what percentage should premiums increase from 2020 in order to achieve a loss ratio of 0.8? [Assume that policies will be sold uniformly during the 2024 year.]

3. A health insurance company classifies customers as "Young", "Middle aged" and "Old". The experience from policy year 2020 is:

Policyholder	Current differential	Earned premiums (000s)	Loss payments (000s)
Young	0.53	3,700	3,420
Middle-aged	1	7,000	6,740
Old	2.64	6,500	5,590

The base premium was $660. Claim amounts are subject to 3% annual inflation. If the expense ratio is 25%, calculate the new premiums for each type of policyholder for policy year 2022.

Standard Questions

4. A workers' compensation insurer has different premiums for manufacturing and services. Its experience for accident year 2020 is given below. There was a rate change on 18th October 2020 [292nd day of the year — note that 2020 was a leap year], which affects some of the policies.

Policy Type	Differential before rate change	Current differential	Earned premiums	Loss payments
Manufacture	4.31	4.08	3,206,190	2,938,110
Services	1	1	829,240	720,400

Before the rate change, the base premium was \$423. The current base premium is \$440. Assuming that policies are sold uniformly over the year, calculate the new premimums for policy year 2023 assuming 5% annual inflation and a permissible loss ratio of 0.7.

5. An insurer classifies product liability insurance policyholders into food and other, and into low-risk or high-risk. It has the following data from policy year 2020:

Number of policies

	low-risk	high-risk
Food	2,734	1,921
Other	6,046	1,822

loss payments

	low-risk	high-risk
Food	\$4,480,200	\$4,343,500
Other	\$3,055,300	\$2,270,600

The base classes are Other and low-risk, the base rate is \$506.

(a) If the differentials are 3.5 for Food and 2.4 for high-risk, calculate the new premiums which give an expense ratio of 0.25 using the loss-ratio method.

(b) Repeat part (a) if the differentials are 0.6 for Food and 1.1 for high-risk.