ACSC/STAT 4703, Actuarial Models II

FALL 2022
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Homework Sheet 6

Due: Thursday 24th November: 17:30

Basic Questions

1. An insurer collects \$6,820,000 in earned premiums for accident year 2021. The total loss payments are \$5,391,000. Payments are subject to inflation of 4%, and policies are sold uniformly throughout the year. If the insurer's permissible loss ratio is 75%, by how much should the premium be changed for policy year 2023?

2. A liability insurance company classifies companies as "Technology", "Medical" and "Other". The experience from policy year 2021 is:

Policyholder	Current differential	Earned premiums (000s)	Loss payments (000s)
Technology	1	9,600	8,060
Medical	1.83	6,400	5,330
Other	0.47	7,800	6,170

The base premium was \$1,530. Claim amounts are subject to 5% annual inflation. If the expense ratio is 20%, calculate the new premiums for each type of policyholder for policy year 2023.

Standard Questions

3. An auto insurer has different premiums for male and female drivers. Its experience for accident year 2021 is given below. There was a rate change on 9th July 2021 [190th day of the year], which affects some of the policies.

Policy Type	Differential before rate change	Current differential	Earned premiums	Loss payments
Male	1.22	1	2,036,420	1,643,290
Female	1	0.81	1,951,890	1,601,320

Before the rate change, the base premium was \$629. The current base premium is \$760. [Note the change of base class.] Assuming that policies are sold uniformly over the year, calculate the new premimums for policy year 2023 assuming 6% annual inflation and a permissible loss ratio of 0.75.

4. For a certain line of insurance, an insurance company collects a total of $4,140,000 in premiums in 2021. This line of insurance was introduced at the start of October 2020, when $1,264,000 in premiums were paid. The company assumes the rate of premiums was constant from October 2020 to December 2021. Estimated incurred losses for accident year 2021 are $3,019,000. $1,206,000 of these losses were in August, and for the other months of the year, losses were distributed in proportion to the number of policies in force. An actuary is using this data to estimate rates for premium year 2024. Claims are subject to 6% inflation per year. By what percentage should premiums increase from 2021 in order to achieve a loss ratio of 0.75? [Assume that policies will be sold uniformly during the 2024 year, and that claims will be follow the same pattern.]

5. An insurer classifies home insurance policyholders into apartment and house, and into low-risk or high-risk. It has the following data from policy year 2021:

Number of policies				loss payments		
	low-risk	high-risk			low-risk	high-risk
Apartment	8,205	3,052		Apartment	$2,269,400	$1,191,000
House	4,631	11,822		House	$2,074,300	$11,460,700

The base classes are House and high-risk, the base rate is $1211.

(a) If the differentials are 0.38 for Apartment and 0.67 for low-risk, calculate the new premiums which give an expense ratio of 0.2 using the loss-ratio method.

(b) What differentials for 2021 would make the new premiums before inflation $592 for low-risk houses, and $1381 for high-risk houses?