ACSC/STAT 4703, Actuarial Models II
Fall 2020
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Homework Sheet 6
Due: Friday 3rd April: 11:59 PM

Basic Questions

1. An insurance company starts a new line of insurance in 2019, and collects a total of $2,600,000 in premiums that year, and the estimated incurred losses for accident year 2019 are $982,000. The premium payments are uniformly distributed over the year. An actuary is using this data to estimate rates for premium year 2022. Claims are subject to 5% inflation per year. By what percentage should premiums increase from 2019 in order to achieve a loss ratio of 0.75.

2. An insurer collects $900,000 in earned premiums for accident year 2019. The total loss payments are $552,000. Payments are subject to inflation of 6%, 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 2021?

3. An auto insurer has three lines of insurance — motorcycle, car and truck. The experience from policy year 2019 is:

Sector	Current differential	Earned premiums	Loss payments
Motocycle	1.2	2,100	1,500
Car	1	8,230	6,400
Truck	2.3	4,050	3,400

The base premium was $840. Claim amounts are subject to 4% annual inflation. If the expense ratio is 30%, calculate the new premiums for each sector for policy year 2021.

Standard Questions

4. An insurer has different premiums for residential and commercial properties. Its experience for accident year 2019 is given below. There was a rate change on 6th June 2019 [157th day of the year], which affects some of the policies.

Policy Type	Differential before rate change	Current differential	Earned premiums	Loss payments
Residential	1	1	15,400	12,200
Commercial	1.31	1.22	12,700	8,400

Before the rate change, the base premium was $1140. The current base premium is $1310. Assuming that policies are sold uniformly over the year, calculate the new premimums for policy year 2021 assuming 4% annual inflation and a permissible loss ratio of 0.8.

5. An insurer classifies inland marine insurance policyholders into truck or train, and into low-risk or high-risk. It has the following data from policy year 2019:

	Number of policies			loss payments	
	low-risk	high-risk		low-risk	high-risk
Train	230	32	Train	$150,400	$44,200
Truck	252	844	Truck	$311,300	$2,042,000

(a) If the base classes are Truck and high-risk, the base rate is $3,240, and the differentials are 0.5 for Train and 0.4 for low-risk, calculate the new premiums which give an expense ratio of 0.3 using the loss-ratio method.

(b) Repeat part (a) based on differentials of 1.6 for Train and 0.8 for low-risk.