Stat 346 Homework #9

Homework Questions

1. Policy A was written prior to 2010. Policy C was written on 01/01/2011, but individuals purchase 1 year policies at any time during the year. Find the following using the claim detail from the table below:

   - AY 2010 reported (incurred) claims @ 12/31/2010
   - AY 2010 reported (incurred) claims @ 12/31/2011
   - CY 2011 reported (incurred) claims
   - PY 2010 reported (incurred) claims @ 12/31/2011

Accident Date	Transaction Date	Claim Status	Payment	Case Reserve
Claim 1 (Policy A)				
01/01/2010	01/20/2010	Open	$500	$1000
	02/05/2010	Open	$1000	$1000
	01/10/2011	Closed	$1500	
Claim 2 (Policy A)				
01/15/2011	01/25/2011	Open	$300	$800
	02/15/2011	Open	$200	$800
	08/05/2011	Open	$400	$500
Claim 3 (Policy C)				
04/01/2011	09/15/2011	Open	$600	$1200
	10/10/2011	Open	$700	$700
	11/05/2011	Open	$800	$400
	12/10/2011	Open	$900	
	01/05/2012	Closed	$1000	

   Solution:

   - AY 2010 reported (incurred) claims @ 12/31/2010: This only includes Claim 1. By 12/31/2010 there have been 1500 in payments and there will be 1000 in case reserves. So there is $2500 incurred losses for AY 2010 at that point
   - AY 2010 reported (incurred) claims @ 12/31/2011: Still only including claim 1. Now there are no case reserves and 1500 more in payments, so total losses of $3000.
   - CY 2011 reported (incurred) claims: For claim 1, there is 1500 in payments plus -1000 in change in case reserve. For claim 2, there is 900 in payments and 500 in case reserve. For claim 3, there is 3000 in payments and 0 in case reserves. Total this is 500 + 1400 + 3000, or $4900.
   - PY 2010 reported (incurred) claims @ 12/31/2011. The answer is 0. Policy A was written prior to 2010. Policy C was written in 2011. Meaning none of these claims come from policy year 2010.

2. You know that reported claims for the last few years follow this claims triangle: You also know the following:

   - The permissible loss ratio is 80%.

Claims Triangle			
Accident Year	**DY0**	**DY1**	**DY2**
2022	120	180	240
2023	150	200	
2024	170		

- The trend factor for exponential claims growth is $\delta = 0.07$.
- The first two loss development factors for losses are estimated to be 1.35 and 1.30.
- Assume no additional losses from years prior to 2022 and no tail factor.

What should the rate be based on the loss cost method for a new one-year policy starting in 2025?

Solution: Develop the reported losses for each accident year:

- **2022**: 240
- **2023**: $200 \times 1.35 = 270$
- **2024**: $170 \times 1.30 \times 1.35 = 305.55$

Project the losses for the 2025 policy year:

- Projected losses: $305.55 \times \exp(0.07 \times 1.5) = 342.18$
- (Using parallelograms with a time period of 1.5)

Calculate the rate based on the loss cost method:

- Rate $= (342.18 + 0)/0.80 = 427.725$

Note that I do not give any fixed expenses, so that is added in as a 0.

3. The following earned premiums were calculated for the specific years given in the table:

Calendar Year	Earned Premium ($)
2017	1,800,000
2018	2,000,000
2019	2,200,000

During this time, rates were subjected to the following rate changes:

Rate Change	Effective Date	Percentage Change
1	September 1, 2017	10%
2	April 1, 2018	15%

Table 1: Rate changes during the calendar years

Assume that rate changes are applied proportionally to the remaining part of the year from the date they take effect and that all policies are 1-year policies. Other actuaries have determined that expected effective losses for 2020 are 1,600,000 and fixed expenses are 150,000. The permissible loss ratio is 80%. The current average rate per exposure unit is 1100. Based on this information, use the loss ratio method to determine rates for the 2020 year.

Solution: We will use the current rates of 2019 earned premiums. I do not give any indication that I want an average over several years, so we just assume the most recent year of premiums. If we let P be the earned premium rate for the beginning of 2019. The beginning of 2020 rate would be $1.15P$. To find the rate level for 2019, we us parallelograms. On Jan 1st, 75% will have the new rate, 25% will still have the old rate. This will last through April 1st, when everyone has the new rate. This means, $(.25)^2/2 = .03125$ of premiums were at P and $1 - .03125 = .96875$ have $1.15P$. Then the rate level is $.03125 \times P + 0.96875 \times 1.15P = 1.145$. The on-level factor is then $\frac{1.15}{1.145} = 1.004$. The earned exposures at current rates is then $1.004 \times 2200000 = 2209005$. Using this the loss ratio method says rates increase by

$$\frac{\frac{1600000}{2209005} + \frac{150000}{2209005}}{0.8} = 0.99$$

. This means the new rate should be $1100 \times 0.99 = 1089.23$.

4. You are given the following information:

Item	**Value**
Expected Effective Losses (Trended and Developed)	$500,000
Exposure Units	10,000
Earned Premium at Current Rates	$700,000
Current Average Premium	$70
Fixed Expenses	$100,000
Fixed Expenses per Exposure Unit	$10
Permissible Loss Ratio	80%

You need to find the new rate based on the loss cost method and the loss ratio method.

Loss Cost Method:

- **Expected Effective Loss Cost Calculation:**

$$\text{Expected Effective Loss Cost} = \frac{\$500,000}{10,000} = \$50$$

- **New Rate Calculation:**

$$\text{New Rate} = \frac{\$50 + \$10}{0.80} = \$75$$

Loss Ratio Method:

- **Expected Effective Loss Ratio Calculation:**

$$\text{Expected Effective Loss Ratio} = \frac{\$500,000}{\$700,000} = 0.7143$$

- **Fixed Expense Ratio Calculation:**

$$\text{Fixed Expense Ratio} = \frac{\$10}{\$70} = 0.1429$$

- **Indicated Rate Change Calculation:**

$$\text{Indicated Rate Change} = \frac{0.7143 + 0.1429}{0.80} = 1.0715$$

- **New Rate Calculation (using rate change):**

$$\text{New Rate} = \$70 \times 1.0715 = \$75$$

Conclusion:

Both methods yield the same new rate of $75.