ACSC/STAT 4703, Actuarial Models II
Fall 2020
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Homework Sheet 3
Due: Friday 14th February: 13:30 PM

Basic Questions

1. A homeowner's house is valued at $430,000, but is insured at $220,000. The insurer requires 70% coverage for full insurance. The home sustains $9,300 from fire. The policy has a deductible of $5,000, which decreases linearly to zero when the total cost of the loss is $15,000. How much does the insurance company reimburse?

2. An insurance company has three types of coverages for businesses with different expected loss ratios, and has the following data on recent claims:

Policy Type	Policy Year	Earned Premiums	Expected Loss Ratio	Losses paid to date
Workers' compensation insurance	2017	$3,000,000	0.74	$2,300,000
	2018	$3,600,000	0.75	$1,100,000
	2019	$4,100,000	0.73	$200,000
Fire insurance	2017	$1,100,000	0.75	$680,000
	2018	$920,000	0.74	$645,000
	2019	$1,080,000	0.77	$680,000
Liability insurance	2017	$2,400,000	0.72	$480,000
	2018	$2,700,000	0.73	$740,000
	2019	$2,900,000	0.71	$190,000

Calculate the loss reserves at the end of 2019.

3. The following table shows the paid losses on claims from one line of business of an insurance company over the past 6 years.

Accident year	Earned premiums	Development year					
		0	1	2	3	4	5
2014	4979	549	1182	730	508	312	339
2015	5333	605	1210	737	693	176	
2016	5431	731	1027	778	551		
2017	5555	579	1314	681			
2018	5461	807	1060				
2019	5719	727					

Assume that all payments on claims arising from accidents in 2014 have now been settled. Estimate the future payments arising each year from open claims arising from accidents in each calendar year using

(a) The loss development triangle method

(b) The Bornhuetter-Ferguson method with expected loss ratio 0.73.

4. An actuary is reviewing the following claims data:

No. of closed claims

Acc.	Development Year					Ult.
Year	0	1	2	3	4	
2015	662	1,150	1,435	1,544	1,697	2035
2016	691	1,207	1,444	1,736		2070
2017	819	1,314	1,455			2105
2018	777	1,263				2140
2019	761					2175

Total paid losses on closed claims (000's)

Acc.	Development Year				
Year	0	1	2	3	4
2015	1,446	2,950	5,287	6,530	7,241
2016	1,536	3,616	5,361	6,902	
2017	2,075	3,833	5,328		
2018	1,636	4,067			
2019	2,069				

(a) Calculate tables of percentage of claims closed and cumulative average losses.

(b) Adjust the total loss table to use the current disposal rate.

(c) Use the chain ladder method to estimate claim development based on the adjusted numbers. Compare this to the chain ladder method on aggregate payments on closed claims.

Standard Questions

5. The number of claims on an insurance policy follows a Poisson distribution with mean 0.04. For each claim, there is the following distribution of years to settlement and final claim amount:

Years to settlement	Probability	Final Claim amount	
		Mean	Standard Deviation
0	0.15	700	300
1	0.25	800	350
2	0.35	1,200	600
3	0.1	1,700	1,200
4	0.1	2,600	4,200
5	0.05	3,400	6,500

(a) Calculate the expected loss development ratio.

(b) The number of policies sold in the past 5 years is given by

Year	Policies Sold
2015	3,531
2016	4,055
2017	4,621
2018	4,802
2019	5,110

Using a normal approximation for aggregate losses, estimate the 95th percentile of the total payments made in 2020 for these policies.