5. (3 points)

The following data is used to price an excess of loss workers compensation policy:

- Data is available for the following injury types: fatal, permanent total injury (PT), major permanent partial (Major), minor permanent partial (Minor), temporary total (TT), and medical-only (Med).
- A multi-dimensional credibility technique (predicted) was used to estimate the frequency for class 5160.
- Class 5160 is in hazard group F.

Hazard Group F						
	Fatal	PT	Major	Minor	TT	Med
Frequency Relativity to TT	0.006	0.006	0.085	0.37	1.00	3.6
Severity Relativity to TT	80	100	30	4	1.00	0.3
Loss Elimination Ratio at $250,000	27%	22%	57%	100%	100%	100%

TT Frequency per $100 payroll	0.0002
TT Severity for Hazard Group F	$10,000

Hazard Group F for Fatal Claims			
	Predicted	Raw Data	Holdout Sample
Quintile 1	0.75	0.70	0.90
Quintile 2	0.90	0.90	0.95
Quintile 3	1.00	1.00	1.00
Quintile 4	1.10	1.10	1.05
Quintile 5	1.25	1.30	1.10
Mean	1.00	1.00	1.00

Hazard Group F for PT Claims			
	Predicted	Raw Data	Holdout Sample
Quintile 1	0.70	0.75	0.80
Quintile 2	0.90	0.90	0.90
Quintile 3	1.00	1.00	1.00
Quintile 4	1.15	1.20	1.10
Quintile 5	1.20	1.25	1.20
Mean	1.00	1.00	1.00

- The hazard group relativities for Major, Minor, TT, and Med will be used.
- The multi-dimensional credibility relativities for PT claims will be used.
- Class 5160 is in Quintile 4 for both Fatal and PT claims.

a. (1.25 points)

Determine whether multi-dimensional credibility relativities should be used to estimate the expected loss for fatal claims.

b. (1.75 points)

Based on part a. above, calculate the expected loss for an excess of $250,000 workers compensation policy with $10 million in payroll.

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Question 5:

Part a
Model Solution 1

Calculate MSE on Predicted to Holdout for Fatal
.2 * ((.75-.9)^2+(.9-.95)^2+(1-1)^2+(1.1-1.05)^2+(1.25-1.1)^2) = .01

Calculate MSE on Hazard to Holdout for Fatal
.2 * ((1-.9)^2+(1-.95)^2+(1-1)^2+(1-1.05)^2+(1-1.1)^2) = .005

No reduction in MSE from multi-dimension credibility use Hazard Group

Model Solution 2

Calculate SSE on Predicted to Holdout for Fatal
((.75-.9)^2+(.9-.95)^2+(1-1)^2+(1.1-1.05)^2+(1.25-1.1)^2) = .05
Calculate SSE on Hazard to Holdout for Fatal
((1-.9)^2+(1-.95)^2+(1-1)^2+(1-1.05)^2+(1-1.1)^2) = .025

No reduction in SSE from multi-dimension credibility use Hazard Group

Examiner's Comments:
****
Full credit was given to a candidate that also calculated MSE/SSE for Raw to Holdout if the two required calculations (Hazard to Holdout, Predicted to Holdout) were done.

Many candidates only did the Predicted to Holdout and Raw to Holdout calculation.

Some candidates used the PT data instead of Fatal.

A number of candidates identified the holdout group as the correct use but did not mention hazard grade, average, or 1.
****

Part b
Model Solution 1

(Frequency TT) * (Severity TT) * Payroll * * ((Predicted Rel HG) *(Frequency Rel to TT) * (1-LER) * (Severity Rel to TT))

Fatal : 1* .006 * 80 * (1-.27) = .3504
PT: 1.15 * .006 * 100 * (1-.22) = .5382
Major: 1 * .085 * 30 * (1-.57) = 1.0965
Total: 1.9851

.0002 * 10,000 * (10,000,000/100) * 1.9851 = 397,020

Model Solution 2

(Expected Pure Premium) * Payroll * (XS Ratio)
XS Ratio = SUM ((Freq Rel) * (Sev Rel) * (Predicted Rel) * (1-LER))/
SUM((Freq Rel) * (Sev Rel) * (Predicted Rel))

Type	Freq Rel	Sev Rel	Predicted	(1 – LER)	Numerator	Denominator
Fatal	.006	80	1	.73	.3504	.48
PT	.006	100	1.15	.78	.5382	.69
Major	.085	30	1	.43	1.0965	2.55
Minor	.37	4	1	0	0	1.48
TT	1	1	1	0	0	1
Med	3.6	.3	1	0	0	1.08

= 1.9851 / 7.28 = 27.27%
Expected Pure Premium = 7.28 * (.0002)(10,000) = 14.56

14.56 * 10,000,000/100 * .2727 = 397,051

Model Solution 3

(ELR) * Payroll * (XS Ratio)
XS Ratio = SUM ((Freq Rel) * (Sev Rel) * (Predicted Rel) * (1-LER))/
SUM((Freq Rel) * (Sev Rel) * (Predicted Rel))

Type	Freq Rel	Sev Rel	Predicted	(1 – LER)	Numerator	Denominator
Fatal	.006	80	1	.73	.3504	.48
PT	.006	100	1.15	.78	.5382	.69
Major	.085	30	1	.43	1.0965	2.55
Minor	.37	4	1	0	0	1.48
TT	1	1	1	0	0	1
Med	3.6	.3	1	0	0	1.08

= 1.9851 / 7.28 = 27.27%
ELR = 1.43

1.43 * 10,000,000/100 * .2727 = 38,996

Examiner's Comments:
****
Full credit was given for the three solutions noted above where the excess loss amount was calculated differently. Full credit was also given for an ELR of 1.53.

In model solution 3, a candidate could use the NCCI manual to come up with the expected loss per 1,000 for the class code even though that was not the intention of the problem. A candidate who used the given info to calculate an excess ratio and then used the NCCI ELR (instead of the given frequencies and severities) for the total loss received full credit. Only a handful of candidates successfully did this.

A fair amount of candidates came to the conclusion in Part A that the multi-dimension credibility should be used, but then did not include the Fatal Predicted relativity of 1.1 in their calculation.

Quite a few candidates did not include the PT Predicted adjustment of 1.15

A handful of candidates only completed the Fatal component of the answer above.

A fair amount of candidates did not properly calculate the XS ratio.
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