

Question 5

Sample Solution 1 of 2

a.

Class	Exposures	Inc Loss (K)	Pure Premium	PP Rel	Credibility
2+	2500	1000	400	0.4	= 1 - .4 = 0.6
1	500	500	1000	1.0	
0	1000	2500	2500	2.5	
Total	4000	4000	1000	1.0	
1+	3000	15000	500	0.5	= 1 - .5 = 0.5

b. $Mod = Z \times R + (1-Z) = .6(.4) + (1-.6) = .64$

$R = (Actual / Expected) = .4$

Premium for exposure accident free 2+ years =

Base Rate x Mod = 1250(.64) = \$800

Partial Credit

- a. 0.50 point for setting up the table correctly to calculate the PP relativities
0.25 point for the 1+ line in the table
0.25 point for the credibility

- b. 0.25 point for each part (Z, R, Mod and Premium)

Sample Solution 2 of 2

a.

Yrs Acc Free	Exp	Losses	Premium	LR	Rel LR	Credibility
2+	2,500	1,000,000	3,125,000	0.32	= .32/.80 = .40	= 1 - .4 = 0.6
1	500	500,000	625,000	0.80		
0	1,000	2,500,000	1,250,000	2.00		
Total	4,000	4,000,000	5,000,000	0.80		
1+	3,000	1,500,000	3,750,000	0.40	= .40/.80 = .50	= 1 - .5 = 0.5

b. Relative LR for 2+ yr acc free: $.32/.80 = .40$

$z = 1 - .40 = .60$

Premium = $.6 * .4 * 1250 + (1 - .6) * 1250 = 800$

Partial Credit

- a. 0.50 point for setting up the table correctly to calculate the LR relativities
0.25 point for the 1+ line in the table
0.25 point for the credibility

- b. 0.25 point for each part (Z, R, Mod and Premium)

Question 6

Sample solution 1 of 3

Use LR method because uneven distribution of other factors

$$\text{LR's} = \frac{\text{Loss cost} \times \text{exposure}}{EP}$$

	t_1	t_2
Old (a_1)	$\frac{1k \times 90}{200k} = 45\%$	$\frac{3k \times 120}{500k} = 72\%$
New (a_2)	$\frac{800 \times 110}{220k} = 40\%$	$\frac{2k \times 100}{250k} = 80\%$

LR relativities = LR x Current relativities

	t_1	t_2
a_1	.5625	1.08 = .72 x 1.25 x 1.2
a_2	.4	.96

$$\text{relativities} = \frac{\sum n \cdot a \cdot t}{\sum n \cdot t^2}$$

$$a_1 = \frac{.5625 \times 90 \times .5 + 1.08 \times 120 \times 1.5}{90 \times .5^2 + 120 \times 1.5^2} = 0.75$$

$$a_2 = \frac{.4 \times 110 \times .5 + .96 \times 100 \times 1.5}{110 \times .5^2 + 100 \times 1.5^2} = 0.657$$

$$t_1 = \frac{.5625 \times .75 \times 90 + .4 \times .110 \times .657}{90 \times .75^2 + 110 \times .657^2} = 0.682$$

$$t_2 = \frac{1.08 \times 120 \times .75 + .96 \times .100 \times .657}{120 \times .75^2 + 100 \times .657^2} = 1.448$$

Partial credit: 0.25 points for each loss ratio component.
 0.25 points for each loss ratio relativity piece.
 0.25 points for setting up each "equation" correctly.
 0.25 points for solving each "equation" correctly.

**2008 CAS Exam 9
Selected Grading Rubrics**

Question 24

Policy#	PP_EFF	PP_EXP	Age (m)	Claim#	Claim Incurred (\$)			Only Premise/Ops Only occurrence Policies
					BI	PD	ALAE	
1	01/01/2006	12/31/2006	18	1	30,000	10,000	20,000	BL Premium 250,000
				2	25,000	0	275,000	ELR 70%
				3	5,000	15,000	20,000	BL (BI+PD) 100,000
2	01/01/2005	12/31/2005	30	#N/A	0	0	0	Consistent Use rule 5B
3	01/01/2004	12/31/2004	42	1	750,000	10,000	35,000	
				2	0	25,000	2,500	Calc Emod. (4.5 pts)

Step 1: apply Rule 5B from ISO GL ERM and calc Total Company Subject Loss Cost

Policy#	Basic Lim LC	PAF13b_occ	PAF13c_occ	PAF14_5b	PAF14_5c	Subject LC	PTS>			
1	175,000	1.000	1.000	0.907	0.928	158,725				
2	175,000	1.000	1.000	0.864	0.893	151,200				
3	175,000	1.000	1.000	0.823	0.858	144,025	453,950			
PTS>							0.25	0.50	0.25	1.00

Notes:

- 0.25 for calc of BI Loss Cost (175) for PY
- 0.25 for use of 5B detrend factors (PAF14)
- 0.25 for use of premise/ops detrend factors (PAF14)
- 0.25 for correct calc of Company Subj LossCost

Step 2: Lookup from Rule 16 table using result of Step 1

Credibility	EER	MSL	PTS>
0.610	0.958	208,050	
PTS>			0.00

No points here as points given if used correctly below

Step3: Calculate incurred loss limited to BL and MLS by PY

Policy#	Claim#	100% Loss	BL Loss	ALAE	Total	Total MSL	PTS>				
1	1	40,000	40,000	20,000	60,000	60,000					
1	2	25,000	25,000	275,000	300,000	208,050					
1	3	20,000	20,000	20,000	40,000	40,000	308,050				
2		0	0	0	0	0	0				
3	1	760,000	100,000	35,000	135,000	135,000					
3	2	25,000	25,000	2,500	27,500	27,500	162,500				
PTS>							0.25	0.25	0.25	0.25	1.00

- 0.25 for correctly use of basic limits for policy3, claim1
- 0.25 for correctly use of MSL for policy1, claim2
- 0.25 for correctly excl ALAE from BL and incl inMSL
- 0.25 for correct calc of includable incurred loss

Step4: Calculate ARULL by PY and in total

Policy#	Subject LC	EER	LDF_15	ARULL	PTS>			
1	158,725	0.958	0.519	78,918				
2	151,200	0.958	0.338	48,959				
3	144,025	0.958	0.198	27,319	155,196			
PTS>					0.25	0.75	0.25	1.25

- 0.25 for correct use of EER
- 0.25 for correct use of LDF at 18m
- 0.25 for correct use of LDF at 30m
- 0.25 for correct use of LDF at 42m
- 0.25 for correct calc of ARULL

Step5: Calculate AER

	470,550	155,196	453,950	1.378				
PTS>					0.25	0.25	0.25	0.75

- 0.25 for using result of Step3
- 0.25 for using result of Step4
- 0.25 for correct calc of AER

Step5: Calculate Emod

	0.610	1.378	0.958	0.27 DEBIT			
PTS>					0.25	0.25	0.50

- 0.25 for correct use of Credibility
- 0.25 for correct calc of Emod

4.50

Sample solution 2 of 3:

Assume other class relativities accurate

Loss ratios:

	t_1	t_2
a_1	$\frac{1,000 \times 90}{200,000} = .45$	$\frac{3,000 \times 120}{500,000} = .72$
a_2	$\frac{800 \times 110}{220,000} = .40$	$\frac{2,000 \times 100}{250,000} = .8$

→ Multiply by current relativities:

$$R = \begin{bmatrix} .45 \times 1.25 = .5625 & .72 \times 1.2 \times 1.25 = 1.08 \\ .4 \times 1 = .4 & .8 \times 1.2 = .96 \end{bmatrix}$$

Minimize:

$$\rightarrow 90(0.5a_1 - 0.5625)^2 + 110(0.5a_2 - 0.4)^2 + 120(1.5a_1 - 1.08)^2 + 100(1.5a_2 - .96)^2$$

$$\text{Partial derivative w.r.t. } a_1 = 2(90)(.5)(0.5a_1 - 0.5625) + 2(120)(1.5)(1.5a_1 - 1.08) = 0$$

$$\rightarrow a_1 = 439.425/585 = 0.75$$

$$\text{Partial derivative w.r.t. } a_2 = 2(110)(.5)(0.5a_2 - 0.4) + 2(100)(1.5)(1.5a_2 - .96) = 0$$

$$\rightarrow a_2 = 332/505 = 0.66$$

Minimize:

$$\rightarrow 90(.75t_1 - 0.5625)^2 + 110(.66t_1 - 0.4)^2 + 120(.75t_2 - 1.08)^2 + 100(.66t_2 - .96)^2$$

$$\text{Partial derivative w.r.t. } t_1 = 2(90)(.75)(0.75t_1 - 0.5625) + 2(110)(.66)(.66t_1 - .4) = 0$$

$$\rightarrow t_1 = 134/197 = 0.68$$

$$\text{Partial derivative w.r.t. } t_2 = 2(120)(.75)(0.75t_2 - 1.08) + 2(100)(.66)(.66t_2 - .96) = 0$$

$$\rightarrow t_2 = 321/222 = 1.45$$

Partial credit: 0.25 points for each loss ratio component.
 0.25 points for each loss ratio relativity piece.
 0.25 points for setting up each partial derivative correctly.
 0.25 points for solving each partial derivative correctly.

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Sample solution 3 of 3:

Loss ratio

	t_1	t_2
a_1	$(1000 \times 90)/200,000 = 0.45$	$(3000 \times 120)/500,000 = 0.72$
a_2	$(800 \times 110)/220,000 = 0.4$	$(2000 \times 100)/250,000 = 0.8$

	t_1	t_2
a_1	$0.45 \times 1.25 \times 1 = 0.5625$	$0.72 \times 1.25 \times 1.2 = 1.08$
a_2	$0.4 \times 1 \times 1 = 0.4$	$0.8 \times 1 \times 1.2 = 0.96$

$$a_i = \sum n_{ij} r_{ij} / \sum n_{ij} t_j$$

a_1	$= (90 \times 0.5625 + 120 \times 1.08) / (90 \times 0.5 + 120 \times 1.5)$	$= 0.801$
a_2	$= (110 \times 0.4 + 100 \times 0.96) / (110 \times 0.5 + 100 \times 1.5)$	$= 0.683$
t_1	$= (90 \times 0.5625 + 110 \times 0.4) / (90 \times 0.801 + 110 \times 0.683)$	$= 0.643$
t_2	$= (120 \times 1.08 + 100 \times 0.96) / (120 \times 0.801 + 100 \times 0.683)$	$= 1.372$

Partial credit: 0.25 points for each loss ratio component.
 0.25 points for each loss ratio relativity piece.
 0.25 points for setting up each "equation" correctly.
 0.25 points for solving each "equation" correctly.

Question No.: 30

Point Value: 3

$$\text{Entry ratio} = \text{agg limit} / L = 1M / (1M * (.70 - .14)) = 1.786$$

$$\text{Loss group adjustment factor: } F = (1 + (0.8 * \text{ELF}/E(L))) / (1 - (\text{ELF}/E(L))) = (1 + (0.8 * 0.14/0.7)) / (1 - 0.14/0.7) = 1.45$$

$$\text{Adj } E(L) = E(L) * F * \text{shgr} = 0.7 * 1M * 1.45 * 0.85 = 862,750$$

ELG 29

$$\text{Table M charge} = 0.2996$$

$$\text{Dollar charge} = IC * L = 0.2996 * (0.7 - 0.14) * 1M = 167,776$$

$$\text{Total expected loss cost} = \text{dollar charge} + XL = 167,776 + 0.14 * 1M = 307,776$$

Scoring:

Entry ratio: ¼ pt for formula + ¼ pt for calculation

Loss group adjustment factor: ¼ pt for formula + ¼ pt for calculation

Adjusted expected loss: ¼ pt for formula + ¼ pt for calculation

ELG: ¼ pt for correct lookup

Table M charge: ¼ pt for correct lookup

Dollar Charge: ¼ pt for formula + ¼ pt for calculation

Total expected loss cost: ¼ pt for formula + ¼ pt for calculation

Question 30

Sample Solution 1 of 2:

$$\text{Adj Exp Loss} = 1M (0.7)[(1+0.8 (0.2))/(1-0.2)](0.85) = 862,750 \text{ ELG} = 29$$

0.5 points for correct formula and calculation of loss group adjustment factor
0.5 points for correct formula and calculation of adjusted expected loss
0.25 points for correct expected loss group

$$\text{LER} = 0.14/0.7 = 0.2$$

$$\text{Entry ratio} = 1M/(1M(0.7-0.14)) = 1.7875 \approx 1.79$$

0.5 points for correct formula and calculation of entry ratio

$$\text{Charge} = 0.2996$$

0.25 points for correct charge

$$\text{Unlimited Loss} = 700,000$$

$$\text{Limited Loss} = 560,000$$

$$(700,000-560,000) + 0.2996 (560,000) = 307,776$$

0.5 points for correct formula and calculation of dollar charge
0.5 points for correct formula and calculation of total expected loss

Sample Solution 2 of 2:

$$\text{Entry ratio} = \text{agg ded/primary loss} = 1,000,000/(1,000,000 \times (0.7-0.14)) = 1.79$$

0.5 points for correct formula and calculation of entry ratio

$$\text{LUGS} = 1,000,000 \times 0.7 \times 0.85[(1+0.8 (0.14/0.7))/(1-0.14/0.7)] = 862,750 \text{ ELG} = 29$$

0.5 points for correct formula and calculation of loss group adjustment factor
0.5 points for correct formula and calculation of adjusted expected loss
0.25 points for correct expected loss group

$$\text{Charge} = 0.2996$$

0.25 points for correct charge

$$\text{Loss} = \text{primary} \times \text{ins charge} + \text{excess}$$
$$= 1,000,000 \times 0.2996 (0.7 - 0.14) + 1,000,000 \times 0.14 = 307,776$$

0.5 points for correct formula and calculation of dollar charge
0.5 points for correct formula and calculation of total expected loss