9. (4.5 points)

Suppose that workers compensation risks are subject to a no-split experience rating plan under which credibility, as a function of expected loss, is calculated as follows:

$$Z = \frac{E}{E + 50{,}000}$$

During the experience rating period, a group of homogeneous risks had the following experience:

Risk	Actual Loss	Expected Loss
1	$130,000	$125,000
2	$60,000	$85,000
3	$160,000	$150,000
4	$200,000	$130,000
5	$100,000	$150,000
6	$250,000	$175,000

After the experience modifications were applied, the same group had the following experience:

Risk	Manual Premium	Actual Loss
1	$50,000	$35,000
2	$50,000	$25,000
3	$70,000	$60,000
4	$75,000	$50,000
5	$65,000	$40,000
6	$65,000	$100,000

a. (3.75 points)

Assess how effectively the experience rating plan corrected for the differences it identified for these particular workers compensation risks. Group the risks as appropriate.

b. (0.75 point)

Propose and justify a change to the plan that would improve its ability to correct the differences it identifies.

CONTINUED ON NEXT PAGE

Question 9:

Model Solution 1

a.

Calculate mod as: $\left(\frac{A-E}{E}\right)Z+1$

Act Loss = A
Expected Loss = E

Risk	Z	Mod
1	.714	1.029
2	.63	.815
3	.75	1.05
4	.722	1.389
5	.75	.75
6	.778	1.333

$$\frac{175}{175+50} = \left(\frac{250-175}{175}\right).778+1$$

$$= \frac{40+25}{48.75+40.75}$$

Rank f/ low mod to High Mod

Risk	Mod	MP	SP = Mod * MP	Loss	Stand. LR	Man LR
5	.75	65	48.75	40	.726	.565
2	.815	50	40.75	25		
1	1.029	80	51.45	35	.7603	.792
3	1.05	70	73.5	60		
6	1.333	65	86.645	100	.786	1.071
4	1.389	75	104.175	50		

Group into 3 buckets
mod < 1
Mods close to 1
Mods significantly > 1

To see how well the plan corrects risk differences, look at standard loss ratio. Expect to see little variability in standard loss ratio by bucket. We see the Std LR increase as the mod increases → The plan is giving too little credibility to actual experience and thus does a poor job of correcting for risk differences. The plan does do a good job of identifying risk differences though, as shown in the increasing manual LRs as mod increases.

b.

One change that could be made is to use a split plan, breaking losses into primary and excess components. Since WC losses are highly skewed, there is a substantial difference between the optimal estimate of credibility and the best linear estimate. This plan uses a linear estimate. By splitting losses into primary and excess, the distributions will be less skewed and predictive accuracy will be enhanced.

Model Solution 2

a.

$Z = \frac{E}{E + 50{,}000}$ K = 50,000

Risk	Actual loss (000)	Exptd (000)	M = $\frac{A+K}{E+K}$
1	130	125	1.029
2	60	85	0.815
3	160	150	1.05
4	200	130	1.389
5	100	150	0.75
6	250	175	1.333

$\rightarrow = \frac{60+50}{85+50}$

Use 3 groupings to test the plan. (by mod)

b.

Since K is constant, it implies that the variance of loss ratios will decrease as the size of risk increases. We know that is not necessarily the case, due to changing conditions and diversifying operations as risk size increases. Therefore, allowing K to increase as risk size increases would improve the predictive accuracy of the plan, since it will avoid problem of large risks essentially being self-rated and will assign credibility < 1.

Examiner's Comments:

****

Part a

Many candidates did not pay attention to the instructions that they needed to group the risks in order to appropriately assess the experience rating plan. The optimal grouping was to group the risks by mod (low, mid, high) as explained in the Venter (and Gillam) paper. Some candidates grouped credit vs. debit risks, which was

acceptable. Those who did not appropriately group the risks could only receive partial credit.

Some candidates performed a quintiles test, but given that there were 6 risks, it would not make sense to create 5 groups. Candidates needed to recognize that the mods were clearly divided into three groups of 2. Without grouping in this fashion, one could not assess the plan in a valid way due to volatility in individual risk experience over 1 year.

Many candidates who did not group the risks chose to perform the efficiency test, which is not an appropriate method to apply here because there is no other experience rating plan with which to compare those test statistics.

Two common conceptual errors were:

- Re-calculating the mod after combining risks; and
- Taking straight averages of the standard loss ratios instead of properly combining losses and standard premiums for each mod group

Candidates did not need to calculate manual loss ratios to receive full credit on this question.

Part b

This question asked candidates to identify a change to the experience rating plan itself that would improve its ability to correct for the differences it identifies. Thus, this part was not directly related to the specific numerical example given in part a.

In general, candidates did well, but overall they needed to improve their justification of the identified change. Explaining what the change is in more detail does not serve as justification for the same.

Candidates who misunderstood the question and simply said that K should be lowered (to increase credibility) received partial credit, since it is true that if K is lowered, the standard loss ratios calculated in part a. become nearly flat across mod group.
****