12. (2.5 points)

An actuary is given the following sample of experience from a grouping of five similarly-sized risks:

Risk	Actual Loss	Risk	Actual Loss
1	$85,000	4	$63,750
2	$127,500	5	$106,250
3	$42,500		

a. (1.5 points)

Construct a Table M of insurance charges and savings at entry ratios of 0 to 1.50 in multiples of 0.25.

b. (0.25 points)

Briefly describe what the insurance charge at an entry ratio of 1.25 reflects.

c. (0.75 points)

Suppose the Table M constructed above is used to price a book of Worker's Compensation retrospectively rated business. The following table of actual losses reflects the experience of this book:

Risk	Actual Loss	Risk	Actual Loss
1	$12,000	4	$106,250
2	$42,500	5	$275,000
3	$63,750		

Evaluate the appropriateness of using the Table M constructed in part a. above. Provide two reasons in support of the conclusion.

CONTINUED ON NEXT PAGE

QUESTION: 12

TOTAL POINT VALUE: 2.5 | **LEARNING OBJECTIVE(S): B2,B5**

SAMPLE ANSWERS

Part a: 1.5 points

Sample

E = 85k

Risk	r = L/E
1	1
2	1.5
3	0.5
4	0.75
5	1.25

Entry Ratio	n_i	$n_i > r_i$	$\% > r_i$	ϕ	ψ
0	0	5	1	1	0
0.25	0	5	1	0.75	0
0.5	1	4	0.8	0.5	0
0.75	1	3	0.6	0.3	0.05
1	1	2	0.4	0.15	0.15
1.25	1	1	0.2	0.05	0.3
1.5	1	0	0	0	0.5

$\phi(r_{max}) = 0$

$\phi(r_i) = \phi(r_{i+1}) + (r_{i+1} - r_i)(\% > r_i)$

$\psi(r) = \phi(r) + r - 1$

Sample 2

Average loss = (85k + 127.5k + 42.5k + 63.75k + 106.25k) / 5 = 85000

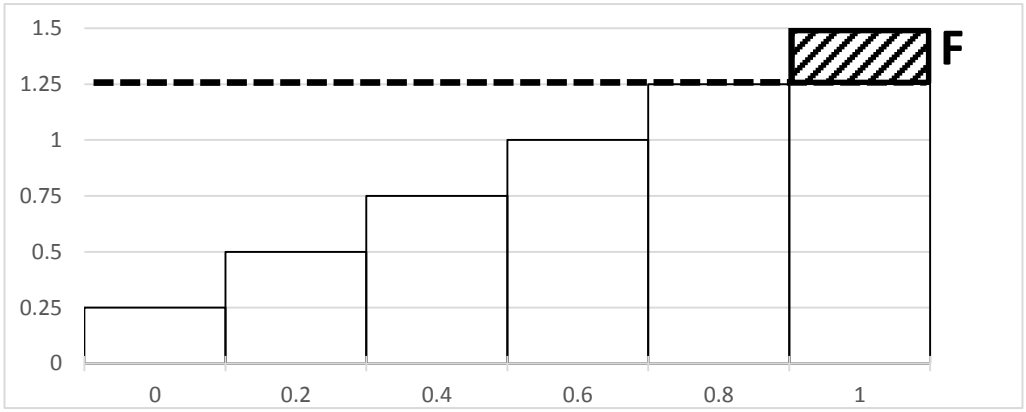
Entry ratio 1.5 is equivalent to 1.5 x 85,000 = 127,500, the highest loss

Entry Ratio	# of claims above	Incremental Charge	ϕ	ψ
0	5	5/5 x 0.25 = 0.25	1	0
0.25	5	5/5 x (0.5 – 0.25) = 0.25	0.75	0
0.5	4	4/5 x (0.75 – 0.5) = 0.2	0.5	0.5 – 1 + 0.5 = 0
0.75	3	3/5 x (1 – 0.75) = 0.15	0.3	0.3 – 1 + 0.75 = 0.05
1	2	2/5 x (1.25 – 1) = 0.1	0.15	0.15 – 1 + 1 = 0.15
1.25	1	1/5 x (1.5 – 1.25) = 0.05	0.05	0.05 – 1 + 1.25 = 0.3
1.5	0	0	0	0 – 1 + 1.5 = 0.5

Part b: 0.25 point

Sample 1

$\phi(1.25)$ = shaded area/total area under F



Sample 2

$\phi(1.25)$ reflects the excess portion of expected losses that are above 1.25 times the mean. In this example it is the portion of losses that are greater than 1.25 x 85k = 106,250. It would be the expected sum of the excess portion of losses > 106,250 divided by the total mean.

Sample3

1.25(85k) = 106,250

$\phi(1.25)$ represents the average amount by which the aggregate losses exceed 106.25k as a % of expected total losses.

Part c: 0.75 point

Sample 1

Actual Avg Loss

1/5(12k + 42.5k + 63.75k + 106.25k + 275k) = 99.9k

1. The table above is inappropriate to use. The expected losses based off the actual losses were 99,900 whereas the expected losses in the table we calculated above were 85,000. Typically larger risks have less variance in their entry ratios and therefore have flatter curves. The curve is likely inappropriate, as a flatter curve will result in smaller insurance charges. We would be overstating the charge if we were to use the table above.
2. Only one of the actual losses is above the entry ratio of 1.25 whereas before 2 were.

risk	Entry ratio
1 12k	.12
2 42.5k	.425
3 63.75k	.6376
4 106.25k	1.06
5 275k	2.75

Sample 2

The expected LR is much higher (99k vs. 85k) and there is more volatility in the losses. Using Table M above will understate the charge and understate the savings. This could lead to a net insurance charge that is higher or lower than actual.

Sample 3

E(X) = 99,900 r_1 = 12k/99.9k = .120 r_2 = .4254 r_3 = .6381 r_4 = 1.0636 r_5 = 2.7528

1. I wouldn't use the above table M because there is a wider dispersion of r in this second table compared to the first. The charge at r = 2 would be 0 for the first table and >0 in the second table if created because there was a loss greater than 2 as evidenced in r_5 = 2.7528.
2. The expected losses are different which could imply a different loss distribution so I would not use the first table. In the NCCI retro manual, you look up the expected losses to get an expected loss group because as expected losses increase, we would expect lesser variation in the losses.

EXAMINER'S REPORT

Candidates were expected to demonstrate the techniques to construct Table M, and be able to evaluate the appropriateness of using a particular Table M.

Part a

Candidates were expected to construct a Table M with insurance charges and savings using the provided loss data points.

Common mistakes include:

- Missing the insurance savings column.
- Not showing all work on how the charges/savings were being derived.

Part b

Candidates were expected to describe the definition of insurance charge.

Responses in both verbal form and drawings were accepted.

A common mistake was an insufficient explanation of the insurance charge.

Part c

Candidates were expected to demonstrate the appropriateness of using the table M, constructed in Part a, for the actual losses provided in Part c, with two supporting justifications.

Most candidates correctly stated the Table M, from Part a, was not appropriate to use in this case. To receive full credit though, candidates needed to be able to state in some way that the retro plan will be out of balance with an identical Guaranteed Cost book.

Common mistakes include:

- Not stating in some way that the retro plan would be out of balance with an identical guaranteed cost book.
- Stating that Table M, from Part a, lacked credibility because it was only based on 5 data points. This was not an accepted justification in this case.