18. (5.5 points)

A property insurer has an existing Quota Share reinsurance treaty in place. The insurer would like to further reduce its net loss exposure by exploring a proposed Property Per Risk Excess reinsurance treaty. Given the following:

Existing Quota Share Reinsurance Treaty

- 25% Quota Share
- 15% Ceding Commission

Proposed Property Per Risk Excess Reinsurance Treaty

- Subject premium of $100 million net of the Quota Share reinsurance treaty
- Covers net losses in excess of $500,000, up to a limit of $500,000
- The Quota Share reinsurance treaty will inure to the benefit of this treaty
- Ceded Loss Ratio for this Excess layer is estimated to be 90%

The table below illustrates the insurer's historical experience data net of the Quota Share that is subject to the proposed Property Per Risk Excess layer:

Historical Accident Year	On Level Subject Earned Premium ($ millions)	On Level Trended Ultimate Subject Loss Ratio	On Level Trended Ultimate Layer Loss Cost
2014	100	75%	25%
2015	120	75%	30%
2016	150	90%	45%
2017	80	75%	24%
2018	100	80%	36%

a. (0.5 point)

Calculate the loss cost of the Property Per Risk Excess layer using all 5 years of historical experience data provided.

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b. (1 point)

Assume that the following exposure curve definition applies to the Property Per Risk Excess layer:

$$G(x) = \frac{1 - 0.32428^x}{1 - 0.32428}$$

where $G(x)$ represents the ratio of pure risk premiums retained by the insurer, and x represents the ground up loss normalized to the maximum possible loss of $1 million.

Calculate the loss cost of the Property Per Risk Excess layer retained by the reinsurer based on the exposure curve.

c. (0.5 point)

Calculate the loss cost of the Property Per Risk Excess layer using a blend of the experience loss cost and the exposure loss cost based on a credibility weight of 80%.

d. (2 points)

The insurer's historical gross expenses are estimated to be 15% of historical gross premiums.

Calculate the insurer's expected net underwriting profit after application of both the existing Quota Share reinsurance treaty and the proposed Property Per Risk Excess reinsurance treaty.

The insurer is also exploring the following proposed modifications to the Quota Share reinsurance treaty:

- Option 1: Profit Commission equal to 100% of reinsurer profit above a 5% reinsurer margin
- Option 2: 20% Ceding Commission

e. (1 point)

Calculate the 5 year weighted average ratio of profit commission to ceded premium for the Quota Share reinsurance treaty using the historical experience data provided.

f. (0.5 point)

Briefly describe one advantage and one disadvantage of implementing the proposed profit commission versus the higher ceding commission from the insurer's perspective.

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SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 18	
TOTAL POINT VALUE: 5.5	**LEARNING OBJECTIVE(S): C**
SAMPLE ANSWERS	
Part a: 0.5 point	
Sample 1 (100 x 0.25 + 120 x 0.3 + 150 x 0.45 + 80 x 0.24 + 100 x 0.36) / 550 = .334 *Sample 2* Use a simple average of 5 year data Loss Cost = (0.25 + 0.3 + 0.45 + 0.24 + 0.36) / 5 = 0.32	
Part b: 1 point	
Sample 1 G(1m / 1m) – G(500k / 1m) = 1 – 0.6372 = 0.3628 Pure Risk Prem =(75 + 90 + 135 + 60 + 80) / 550 = 0.8 Loss Cost = 0.3628 x 0.8 = 29.024% *Sample 2* Since max possible loss is 1M, I assume X represents ground up loss net of the quota share. Otherwise, X > 1 at limit of excess treaty, which violates the condition that 0 <= X <= 1 when using max possible loss G(500K / 1M) = G(0.5) = (1 – 0.32428^0.5) / (1 – 0.32428) = 0.6372 G(1) = 1 Avg Loss Ratio Net of QS = (3 x 0.75 + 0.8 + 0.9) / 5 = 0.79 Loss Cost = 0.79 (1 – 0.6372) = 0.287	
Part c: 0.5 point	
Sample 1 0.8 x 33.4m + 0.2 x 29.024m = 32.5248m *Sample 2* Loss Cost = 0.8 x 0.32 + 0.2 x 0.287 = 0.313	
Part d: 2 points	
Sample 1 E[Loss Ratio] = 80% Ceded using cred wt = 32.52% Retained = 80 – 32.52 = 47.48% Ceded Prem = 32.5248m / 0.9 = 36,138,667 Profit = 100m – (80m – 32.5248m) – 36.138667m – 15m = 1,386,133 *Sample 2* Use loss cost from part c to estimate ceded losses. Expected Ceded Loss to XS = 100M x 0.313 = 31.3M 0.9 = 31.3M / XS Premium	

XS Premium = 34.78M
Ceding Commission = (100 / 0.75 – 100) x 0.15 = 5M
Profit = 100M + 5M – 34.78M – 100M (0.79 – 0.313) – 0.15 (10M / 0.75) = 2,522,222

Part e: 1 point

Sample 1

Reinsurer's Profit = Max[(1 – Ceded LR – Ceding Commission – Margin), 0]
= Max[(1 – Ceded LR – 15% - 5%), 0]
Profit Commission = 100% * Reinsurer's Profit

AY	Reinsurer's Profit %	Profit Commission
2014	Max(1-75%-15%-5%, 0) = 5%	5% = 100% * 5%
2015	Max(1-75%-15%-5%, 0)= 5%	5%
2016	Max(1-90%-15%-5%, 0) = 0	0
2017	Max(1-75%-15%-5%, 0)= 5%	5%
2018	Max(1-80%-15%-5%, 0) = 0	0

Weighted Average = $\frac{5\%*100 + 5\%*120 + 0 + 5\%*80 + 0}{100 + 120 + 150 + 80 + 100}$ = 5% * 300/550 = 2.73%

Sample 2

Ceded Premium = $\frac{\text{On Level Subject EP (net of QS)}}{(1 – 25\%)}$ * 25%
Ceded Loss = Ceded Premium * ULR
Ceding Commission = 15% * Ceded Premium
Profit Margin = 5% * Ceded Premium
Profit Commission = Max(0, Ceded Premium – Ceded Loss – Ceding Commission – Profit Margin)

AY	On Level Subject EP	Ceded Premium	Ceded Loss	Ceding Commission	Profit Margin	Profit Commission
2014	100	33.33	25	5	1.67	1.67
2015	120	40	30	6	2	2
2016	150	50	45	7.5	2.5	0
2017	80	26.67	20	4	1.33	1.33
2018	100	33.33	26.67	5	1.67	0
Total		183.33				5

Weighted Average = 5 / 183.33 = 2.73%

Part f: 0.5 point

Sample Responses for Advantage of Proposed Option 1 (Profit Commission) vs. Option 2

- Proposed profit commission allows the insurer to benefit from favorable results with good underwriting performance

- The insurer can retain a significant amount of profit if the ceded business performs well
- Profit commission can provide incentive for risk control and get money back if that risk control is successful

Sample Responses for Disadvantage of Proposed Option 1 (Profit Commission) vs. Option 2

- Higher ceding commission is paid upfront so there is cash flow benefit for the insurer
- Expected commission under option 1 based on part e is 2.73% + 15% = 17.73%, which is lower than the 20% guaranteed commission under option 2
- As shown in part e, the expected profit commission is 2.7%, which is lower than the added 5% ceding commission under option 2, therefore on average option 2 is better
- Profit commission is not as stable as higher ceding commission which is guaranteed.

EXAMINER'S REPORT

Part a

Candidates were expected to take the historical layer loss ratios with corresponding premiums to derive the weighted average expected loss cost. Full credit was given to both weighted and straight averages.

Common mistakes included:

- Failing to recognize the given table is net of Quota Share
- Applying ultimate loss ratio on top of layer loss ratio
- Not taking the average for expected figures

Part b

Candidates were expected to apply the given exposure curve to derive the expected loss percentage in the layer and then apply it to the subject loss ratio to determine the exposure loss cost.

Common mistakes included:

- Applying Excess Layer Ceded Loss Ratio as Subject Loss Ratio
- Forgetting to apply Subject Loss Ratio on loss in layer
- Applying ceding ratio on maximum possible loss.

Part c

Candidates were expected to apply the correct credibility weights to the experience loss cost from part a and the exposure loss cost from part b.

A common mistake included:

- Applying the wrong credibility.

Part d

Candidates were expected to calculate premium, losses and expenses after applying the terms of two treaties and then combine them in the expected underwriting profit provision. Candidates received full credit for deriving gross and ceded components and then combining them into net

figures. Candidates could also attempt to calculate the u/w provision in a percentage form as long as all components were converted to a consistent base.

Common mistakes included:

- Missing components of premiums, losses or expenses (e.g. including the benefit of quota share but not excess of loss treaty)
- Mixing up gross and net figures or applying factors to incorrect base (e.g. given subject premium net of quota share as gross premium or applying PPR loss cost to subject losses instead of subject premiums)
- Using inconsistent calculations for different components of the same treaty (e.g. calculating ceded PPR losses based upon historical loss cost from part a while applying loss cost from part b or c to calculate premium ceded to the same treaty)

Part e

Candidates were expected to calculate the 5 year weighted average profit commission as a ratio to ceded premium with the proposed structure from Option 1 using the historical experience data provided.

There were two ways to calculate the weighted average profit commission ratio that received full credits. Candidates could:

- Calculate the profit commission percentages for each accident year and get weighted average ratio using either gross premiums or ceded premiums as weights since both provide the same weights under a QS treaty
- Calculate the profit commission dollars for each accident year based on ceded premiums, sum them up across all five years and divide the total profit commissions by the total ceded premium. Candidates who consistently used gross premiums instead of ceded premiums also received full credit as it made no difference to the final ratio under a QS treaty.

Common mistakes included:

- Forgetting to include the 15% ceding commission when calculating profit commission
- When calculating the profit margin, incorrectly multiplying the 5% margin with either the reinsurer's profit or ceded premium net of ceding commissions, instead of multiplying it with the ceded premium
- Calculating profit commission using 5-year total ceded premium, losses, and commissions, instead of calculating it for each AY individually which would have captured any negative profit commissions and applied a floor of zero to them
- Calculating a simple 5-year average of the profit commission instead of a weighted average.

Part f

Candidates were expected to understand different commission structures between the primary insurer and reinsurer as well as the purpose and mechanics of the profit commission structure as described in Clark.

Candidates could talk from either Option 1 or Option 2's standpoint and received full credits as long as both one advantage (over the other option) and one disadvantage (over the other option) were correctly provided.

Common mistakes included:

- Simply stating that the insurer has potential to receive higher commission under Option 1 without explanation
- Stating that the insurer is giving up 20% guaranteed ceding commission for the profit commission, not recognizing the insurer is only giving up 5% additional ceding commission over the existing 15% ceding commission
- Stating that insurer might get no commission under option 1, without considering the fixed 15% ceding commission
- Assuming that profit commissions are paid by the insurer to the reinsurer
- Stating something too vague or generic that isn't necessarily an advantage/disadvantage over the other option
- Talking from the reinsurer's perspective with something that cannot be translated into a proper advantage/disadvantage from the insurer's perspective