16. (1.75 points)

An insurance company generally uses two different methods to price excess layer insurance contracts:

- Empirical construction of Table M; or
- Approximating the distribution of aggregate losses with a continuous approximation model.

a. (0.5 point)

Briefly describe two potential disadvantages of using a continuous approximation model.

b. (1.25 points)

Fully describe the process of constructing an empirical Table M and estimating the aggregate loss cost of an excess layer using the table.

CONTINUED ON NEXT PAGE

SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 16	
TOTAL POINT VALUE: 1.75	**LEARNING OBJECTIVE(S): B2**

SAMPLE ANSWERS

Part a: 0.5 point

Sample 1

1) Lack of data. The distribution estimated can be difficult or far away from reality due to sparse data.
2) Need more calculation. Maybe time consuming.

Sample 2

1) Computational complexity – it requires to calculate aggregate losses more than necessary as the additional informal becomes available. This computation is cumbersome and burdensome for the portfolio with a large number of claims coming in.
2) Sensitive to input parameters – the distribution can be changed significantly due to the initial set of parameters and it can be significantly different than the initial expectation.

Sample 3

1) Data is thin especially for the highest claim amounts, the charge for highest entry ratio will have high standard errors.
2) The fitted curve will depend a lot on highest few points, which are the most volatile so shape of curve may have significant bias.

Sample 4

1) Parameter risk – need to estimate parameters.
2) Computational intensive. Need a computer to calculate

Part b: 1.25 points

Sample 1

1) For all n risks (assume similar sizes), calculate the average aggregate loss amount. 2) Order the risk in order of their entry ratio actual/expected. 3) For each desired entry ratio (r_i), determine the % of risks whose entry ratio is above that r_i. 4) Starting from the highest ratio, assume its charge is 0. The charge for r_{n-1} can be determined using the layer method referred in the formula: charge (r_n)=charge (r_{n+1}) + (r_{n+1} -r_n)(% of risks above r_n). Repeat until all charges are complete. If desired, the table M savings can be included by computing saving (r_n) = charge (r_n)+ r_n -1. The aggregate excess loss cost of an layer at G can be determined by finding the entry ratio r_G and multiplying the charge (r_G)* E(A)

Sample 2

Get average expected aggregate loss at all policies in that size of risk group selected. For each policy, divide agg loss by avg agg loss, this is r entry ratio. Sort entry ratio in increasing order. Determine what % of risks are above at each r. Charge at bottom r is 0, one above is (% of risk above at that r)*(that r – r – r one below) + plus charge at r below. Continue working up to fill out charges. Estimating loss above certain limit can be estimated by r=excess limit / expected loss. Expected loss * (charge that corresponds to r) = Agg loss cost of excess layer. For layer with

bottom and top, do above for both limit and agg loss cost at lower limit- agg loss cost at high limit.

Sample 3

You need to get an expected aggregate loss from empirical data. Then compute entry ratios, actual/ expected losses. Then put entry ratio in order smallest to largest. For each entry ratio, calculate the % of claims bigger and the difference between the subsequent entry ratio. Now start at the highest entry ratio, multiply % bigger by size and (difference in entry ratio) and sum with the value from the subsequent row. This is the charge. To estimate agg loss cost, take aggregate/expected loss to get entry ratio. Then look up table to get the charge. Now multiply expected loss by charge to get loss cost for that agg.

Sample 4

1) From a sample of aggregate losses, calculate the average loss and use this to calculate the entry ratio for each loss, actual/expected.
2) Order the entry ratios from lowest to highest starting at 0 and going up to the max entry ratio.
3) Create columns for the # of risks at each r, # of risks above r, and the % of risks above r and calculate these values for each r.
4) starting at the bottom with the max entry ratio, set charge=0. Then working up the column use charge (r_i)=charge (r_{i+1}) + (r_{i+1} –r_i)(% of risks above r_i) to calculate the charge at each entry ratio.
5) Then the aggregate loss cost of an excess layer is given by k*E(A)+E(A)*(1-k)*charge(r_{agg}) where k=excess loss ratio and r_{agg} =Agg limit/E(A)

EXAMINER'S REPORT

Candidates were expected to know disadvantages of using a continuous approximation model and techniques to estimate aggregate loss distributions directly from aggregate data (e.g., Table M, Table L).

Part a

Candidates were expected to briefly describe the disadvantages of using a continuous approximation model versus Table M.

Some candidates responded with disadvantages in both models. Some candidates gave disadvantages for GLM but the question doesn't mention that the continuous model is fitted using a GLM.

Common mistakes included:

- Stating that the model is not easy to communicate and understand (black box) or the need to select a distribution to use, but the question states that the company is already using the continuous approximation model
- Stating that the model doesn't allow for loss-free scenarios (but this is excess layer insurance, so loss-free scenarios are not appropriate) or does not split the impacts of frequency and severity (those individual distributions may not be known, so this is actually an advantage of the model)
- Stating that it would be difficult for the model to reflect changing or varying per-occurrence limits, or cannot be easily adjusted for changes to expected loss due to

inflation - but this is a problem for both Table M and the continuous approximation model
- Mentioning that the distribution may not fit the empirical data well or may be hard to fit, but not explaining why

Part b

Candidates were expected to describe the process of constructing an empirical Table M and estimating the aggregate loss cost.

Many candidates gave the formula for savings as well, but this was not needed for full credit.

Since the meaning of "excess layer" is not clear in the question, different formulas were accepted for calculating the loss cost; (1- charge + saving)*expected loss was also accepted.

Common mistakes included:
- Forgetting to calculate aggregate loss cost
- Misstating that the charge is the entire loss cost
- Calculating layer loss cost using the charge at the top of the layer minus the charge (instead of the savings) at bottom
- No mention of the data needing to be split into groups of insureds with similar loss potential, or any data requirement