2024 New Item Type Sample Solutions

1 – Multiple Selection
Answer: A, B, C

2 – Fill in the Blank
Answer: 28

3 – Multiple Choice - 0.5 point
Answer: A

4 - Multiple Choice – 0.5 point
Answer: B

5 – Spreadsheet – 2.25 points
Solution: 2.48%

Sample 1

Trend period is from 1/1/2017 to 1/1/2019 – 2 years

Complement = (loss trend/premium trend)^2 x (indicated rate change/implemented rate change)

= (1-1%)/(1+1.5%)^2 x (1+8%)/(1+3.5%)

=0.9927

Expected claim counts = # of exposures x projected frequency

=20,000 x 3% = 600

Full Credibility = (1.645/2.5%)^2 = 4330 claims

Z = SQRT(600/4330) = 37.2%

Credibility-weighted indicated rate change = 37.2% x 1.079 + (1-37.2%) x 0.9927

=1.0248 >>> +2.48%

Sample 2

(1.645/0.025)^2 = 4329.64 >>> Number of claims needed for full credibility

4329.64/0.03 = 144321.3 >>> Number of exposure needed

Z = SQRT(20000/144321) = 0.372

1.079(0.372) + (1-0.372)(1.08/1.035)(0.99^2/1.015^2) = 1.0248

2.48% indicated rate change

6 – Matching
Answer:

C1 – Interval 2
P1 – Interval 1

7 – Spreadsheet – 1.25 points
Solution:

Prob Under 50% = (60+132+209)/1000= .401
Prob 50% to 70% = (192+144)/1000 =.336
Prob over 70% = (96+62+105)/1000 = .263

LR range	prob	cond avg lr	Commision	Technical Ratio
<50	0.401	39%	35%	74%
50-70	0.336	60%	25%	85%
>70	0.263	91%	15%	106%
expected		60%		86.1%

Technical ratio = Avg LR + Commission

8 – Multiple Choice – 0.25 point
Answer: Defective.

This question is defective as currently phrased. None of the answers listed are correct. It is balanced because the expected combined ratio is the combined ratio using the ceding commission at the expected loss ratio. The use of the phrase ‘target' would be appropriate if we did not already use that phrase in a different context.

If this question had been included on the official exam, candidates would have had the opportunity to provide feedback on this question and other potentially defective questions during the examination itself as well as immediately after submitting their exam.

To the extent candidates suspect any items to be defective (such as items testing material not on the exam’s Syllabus/Content Outline or items that cannot be answered with the information provided), such feedback may be provided through any of the options listed in the Candidate Feedback and Candidate Grievances Policy, and we encourage using the Post-Exam Questionnaire.

CAS Staff and Admissions Leadership review all feedback and grievances. Through statistical analysis and candidate feedback, any potentially defective questions identified are reviewed by exam chairs and graders and a determination on how the question will be graded is made. The course of action depends on the exam, and options could include not using the question in the pass mark determination or to grade the question with additional solutions considered.

If this question had been on Exam 9, the question would not have negatively impacted any candidate’s score.

Please note: the same level of rigor that goes into reviewing and testing actual exam questions was not applied to this sample exam. The demonstration exam is a resource developed by taking questions from previous exams and transforming them into the new item formats. The

purpose is for the candidates to prepare for the exam environment by reviewing previous exam material with the features and functions of the Pearson VUE CBT environment.

9 – Multiple Selection – 0.5 point
Answer: B, C, E

10* – Spreadsheet – 1.5 points
Solution: 1,074,999 or 1,109,218

Note: The information on the left-hand side for question 10 and 11 should say "The link ratio ultimate losses for accident year **2021 are: 1,091,454".*

This solution requires recognizing that the 24 to ultimate has a negative intercept. Candidates who recognize the negative intercept might choose to use the LDF method instead as Brosius suggests.

Sample Using LDF Approach

1) Use the provided 36 to ultimate tail factor to develop 2018 and 2019 ultimate losses:

   2018 Ultimate Losses: $987{,}500 * 1.1 = 1{,}086{,}250$

   2019 Ultimate Losses: $789{,}750 * 1.1 = 868{,}725$

2) Calculate the AY 2020 ultimate losses. Two methods are shown below. The first uses the triangle and provided tail factor to calculate a link ratio ultimate. The second uses 24 month and ultimate values for 2018 and 2019 to calculate a 24 to Ult least squares ultimate.

   Least Squares Ultimate for 2020

   $\bar{X} = \frac{790{,}000+675{,}000}{2} = 732{,}500$ $\bar{Y} = \frac{1{,}086{,}250+868{,}725}{2} = 977{,}488$

   $\overline{XY} = \frac{790{,}000 * 1{,}086{,}250 + 675{,}000 * 868{,}725}{2} = 722{,}263{,}438$

   $\overline{X^2} = \frac{790{,}000^2 + 675{,}000^2}{2} = 539{,}862{,}500$

   $b = \frac{\overline{XY}-\bar{X}\bar{Y}}{\overline{X^2}-\bar{X}^2} = 1.892$ $a = \bar{Y} - \bar{X} * b = -408{,}052$

   2020 Ultimate Losses: $840{,}000 * 1.892 - 408{,}052 = 1{,}180{,}826$

   Recognize a negative slope is not ideal, so use link ratio instead.

   Link Ratio Ultimate for 2020

   24-36 LDF: $\frac{987{,}500+789{,}750}{790{,}000+675{,}000} = 1.213$

   24-Ult LDF: $1.213 * 1.10 = 1.334$

   2020 Ultimate Losses: $840{,}000 * 1.334 = 1{,}120{,}941$

3) Using the 12 month and ultimate amounts for 2018, 2019, and 2020, calculate the 2021 least square ultimates. Note two solutions are provided, one based on each 2020 ultimate calculated above.

Using 2020 Link Ratio Ultimate:

$\bar{X} = \frac{500{,}000+450{,}000+600{,}000}{3} = 516{,}667$ $\qquad \bar{Y} = \frac{1{,}086{,}250+868{,}725+1{,}120{,}941}{3} = 1{,}025{,}305$

$$\overline{XY} = \frac{500{,}000 * 1{,}086{,}250 + 450{,}000 * 868{,}725 + 600{,}000 * 1{,}120{,}941}{3} = 1{,}606{,}615{,}850{,}000$$

$$\overline{X^2} = \frac{500{,}000^2 + 450{,}000^2 + 600{,}000^2}{3} = 812{,}500{,}000{,}000$$

$b = \frac{\overline{XY}-\bar{X}\bar{Y}}{\overline{X^2}-\bar{X}^2} = 1.491$ $\qquad a = \bar{Y} - \bar{X} * b = 255{,}061$

2021 Ultimate Losses: $\qquad 550{,}000 * 1.491 + 255{,}061 = 1{,}074{,}999$

Using 2020 Least Squares Ultimate:

$\bar{X} = \frac{500{,}000+450{,}000+600{,}000}{3} = 516{,}667$

$$\bar{Y} = \frac{1{,}086{,}250 + 868{,}725 + 1{,}120{,}941}{3} = 1{,}045{,}267$$

$$\overline{XY} = \frac{500{,}000 * 1{,}086{,}250 + 450{,}000 * 868{,}725 + 600{,}000 * 1{,}180{,}826}{3} = 547{,}515{,}617$$

$$\overline{X^2} = \frac{500{,}000^2 + 450{,}000^2 + 600{,}000^2}{3} = 270{,}833{,}333$$

$b = \frac{\overline{XY}-\bar{X}\bar{Y}}{\overline{X^2}-\bar{X}^2} = 1.919$ $\qquad a = \bar{Y} - \bar{X} * b = 54{,}020$

2021 Ultimate Losses: $\qquad 550{,}000 * 1.919 + 54{,}020 = 1{,}109{,}218$

11* – Spreadsheet 0.5 point
Solution: 0.751 or 0.97

Note: The information on the left-hand side for question 10 and 11 should say "The link ratio ultimate losses for accident year **2021 are: 1,091,454".*

Since the solution to part b) uses the slope from part a), two solutions are provided. The first uses the 12 to ultimate slope based on a link ratio ultimate for 2020. The second uses the 12 to ultimate slope based on a least squares ultimate for 2020.

Formula: $Z_{implied} * \frac{X}{d} = b * X$

Given: $\frac{X}{d} = 1{,}091{,}454$

Slope based on 2020 Link Ratio Ultimate

$$Z_{implied} * 1{,}091{,}454 = 1.491 * 550{,}000$$

$$Z_{implied} = 0.751$$

Slope based on 2020 Least Squares Ultimate

$$Z_{implied} * 1{,}091{,}454 = 1.919 * 550{,}000$$

$$Z_{implied} = 0.967$$

12 – Blank Spreadsheet
Solution: N/A

Example of a point and click question:

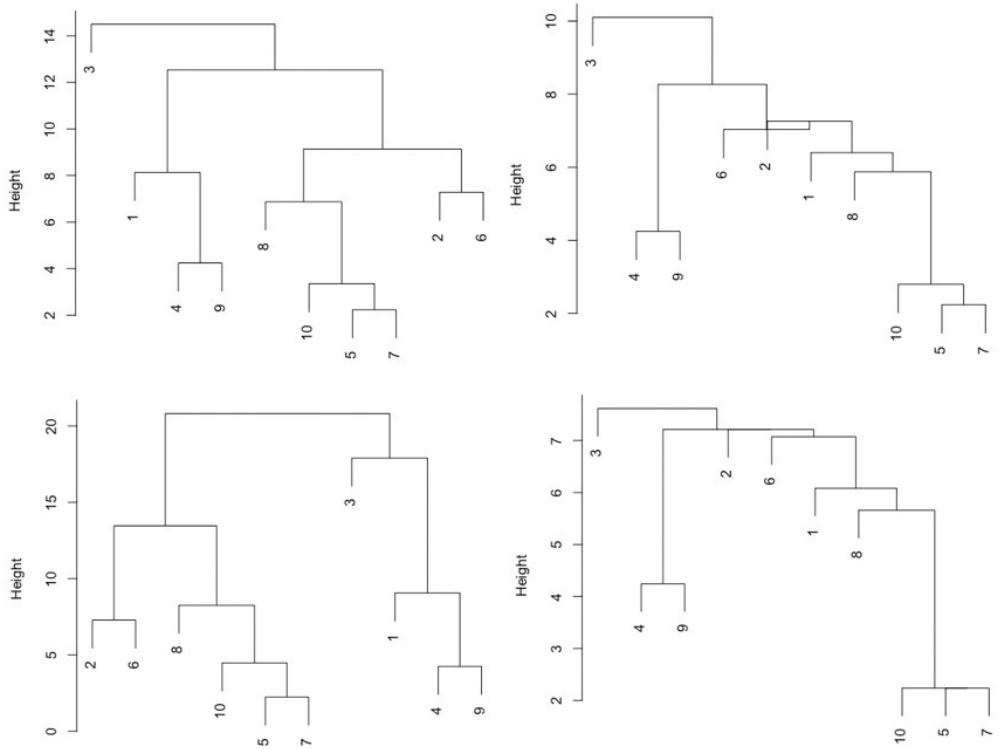
Point and Click
This item type is a sample of what you may see on Exams MAS-I and MAS-II. The content of this item is from Exam MAS-II.

This question was developed for the CAS by Coaching Actuaries and is an example of a question you can find on the MAS practice exams.

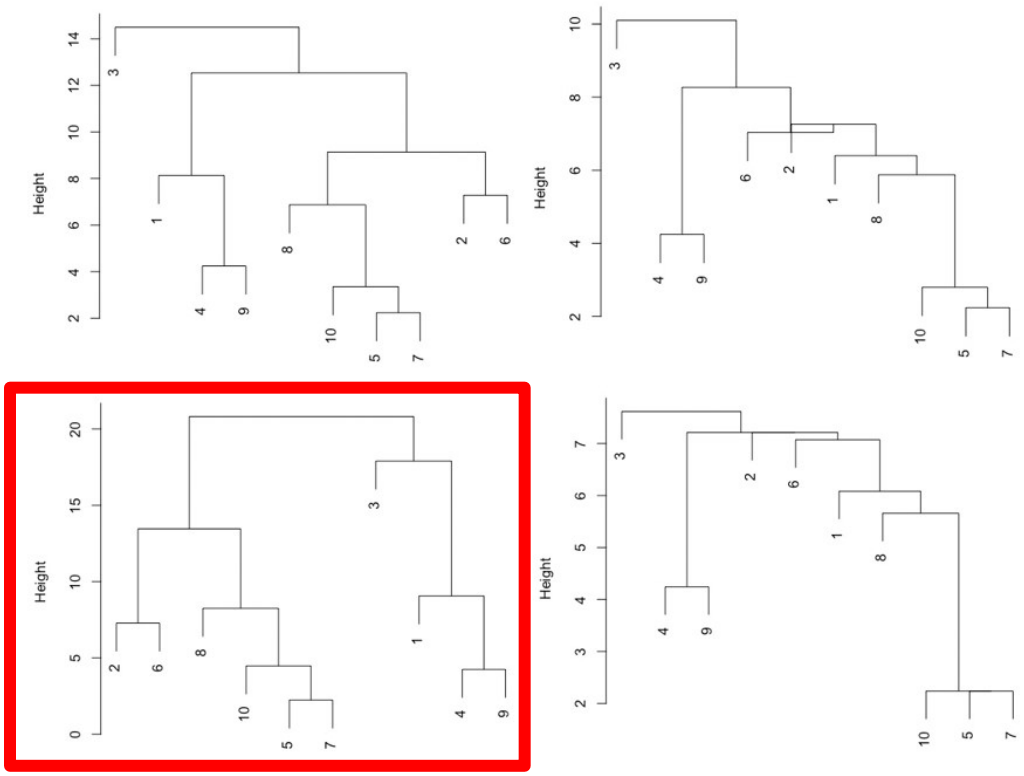
A data set with the following ten observations is hierarchically clustered using Euclidean distance and complete linkage.

i	$X_{1,i}$	$X_{2,i}$
1	1	-8
2	2	5
3	9	8
4	10	-7
5	0	-2
6	-5	7
7	-2	-1
8	-8	-4
9	7	-4
10	-4	0

Determine which of the following dendrograms accurately represents the result of this clustering. (click on the correct dendrogram)



Answer:


Height
3
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