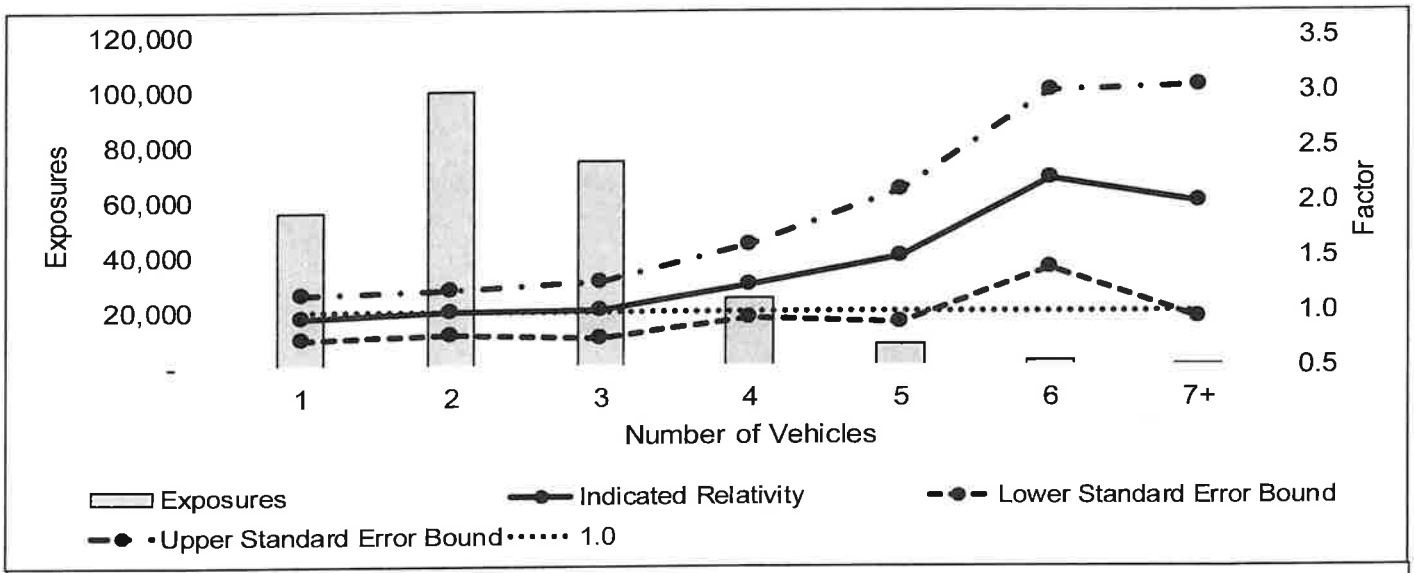
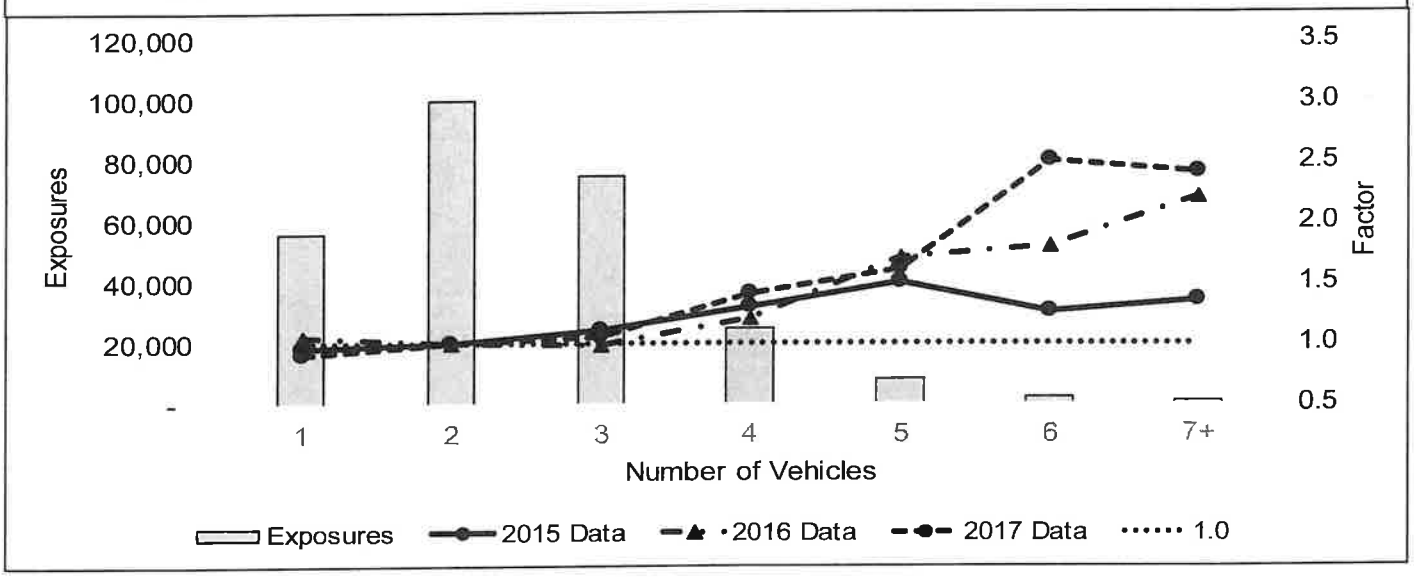
9. (2 points)

An auto insurer is evaluating the variable "number of vehicles" for inclusion in a rating plan. Given the following Generalized Linear Model (GLM) output:





- Number of vehicles chi-square percentage: 10%

a. (1 point)

Fully justify whether number of vehicles should be included in the rating plan.

b. (0.75 point)

Briefly discuss three challenges associated with performing GLM analysis on loss ratio data.

c. (0.25 point)

GLM analysis is widely accepted in classification ratemaking. Briefly discuss one reason that univariate analysis may be more appropriate than GLM analysis.

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QUESTION 9	
TOTAL POINT VALUE: 2	**LEARNING OBJECTIVE: A8**

SAMPLE ANSWERS

Part a: 1 point

Based on GLM output would NOT implement because:

- Chi-square > 0.05
- Nearly all of the levels are not statistically significant from 1.00, as 1.00 is contained in the error range
- Consistency over time is poor outside of the first few buckets

Part b: 0.75 point

- Premiums need to be on-leveled for the model
- No default distribution to model loss ratios
- Actuaries don't have a priori expectation for loss ratio
- Loss ratio model will become obsolete when rate changes
- Loss ratios do not present clear trend factors like frequency and severity trends

Part c: 0.25 point

- Univariate analysis is easier to compute than GLM
- Univariate analysis can be quickly understood and accepted by people, but GLM can't
- If there is not enough data for a GLM to be run on, then a univariate analysis may be more appropriate
- The law/regulator in some states may require univariate analysis
- Univariate analysis may be more appropriate if a company does not have the computing power to perform and set up a GLM
- Univariate is more transparent
- Simple rating algorithm, does not require higher complexity/cost GLM analysis

EXAMINER'S REPORT

Candidates were expected to understand how to analyze GLM output, recognize challenges of loss ratio data within a GLM, and specify when univariate methods are more appropriate than multivariate methods.

Part a

Candidates were expected to demonstrate knowledge and proper application of tests used to analyze the predictive quality of a variable based on GLM output: Main Effect Test, Consistency Test, Statistical Test, and Judgment. Candidates were also expected to demonstrate a clear decision on whether the variable should or should not be included based on the test results.

Candidates did not receive credit if they incorrectly stated/implied the variable passed the main effect test or the consistency test. Further, candidates did not receive credit for simply stating a recommendation on exclusion/inclusion of variable with no justification.

Common mistakes include:

- Did not clearly indicate whether the variable passed or failed each test
- Did not clearly state whether variable should or should not be used

Part b
Candidates were expected to list three challenges of using GLM on loss ratio data. A common mistake was to list general challenges of GLM without any reference to the specific issues of using loss ratio data.
Part c
Candidates were expected to discuss one reason why univariate analysis could be more appropriate than multivariate analysis. A common mistake was to describe a difficulty but not specify whether that was a difficulty for multivariate or an univariate approach so credit could not be awarded.