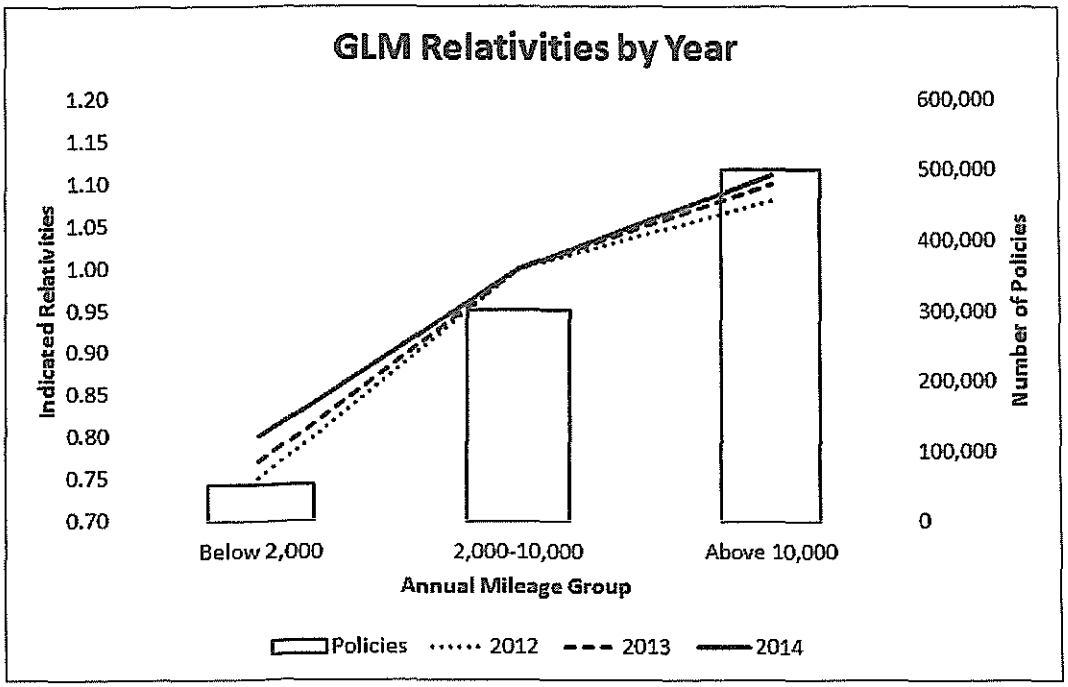
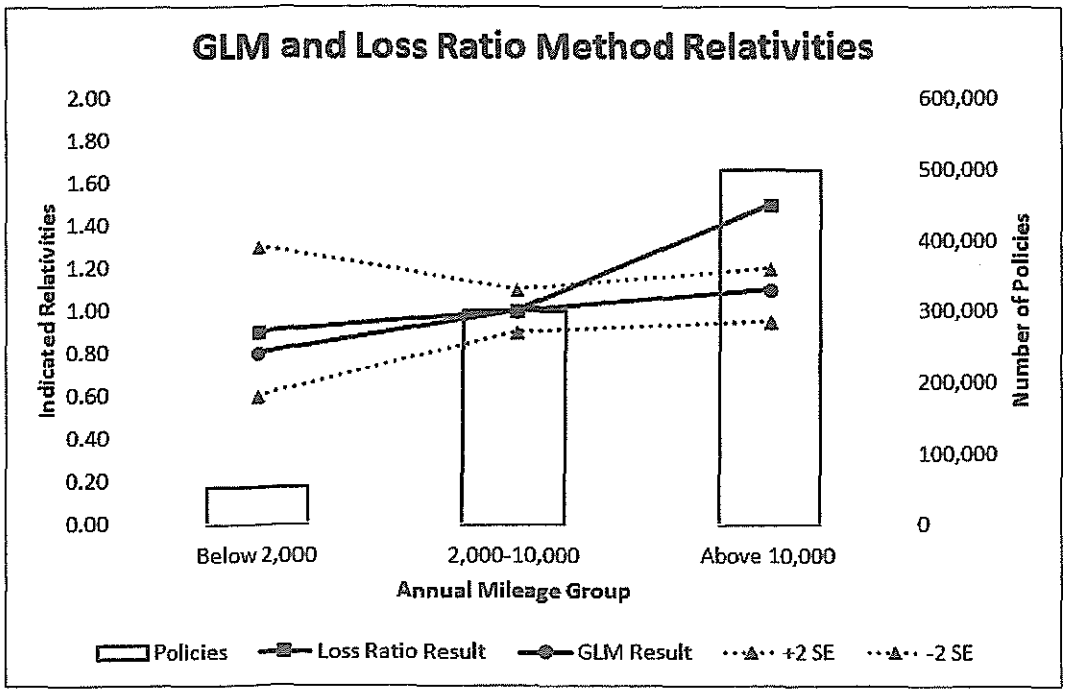
10. (2 points)

An automobile insurer has calculated indicated rating plan factors using both a loss ratio analysis and a generalized linear model (GLM). Data from years 2012-2014 was used in both analyses. Given the following output for the proposed Annual Mileage rating variable:





<QUESTION 10 CONTINUED ON NEXT PAGE>

10. (continued)

a. (1 point)

Using the data in each graph above, discuss whether annual mileage would be a good rating variable.

b. (0.5 point)

Taking into account two other criteria of a good rating variable, discuss whether annual mileage would be a good rating variable.

c. (0.5 point)

Recommend whether the insurer should add annual mileage to their rating plan.

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EXAM 5 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 10	
TOTAL POINT VALUE: 2.0	**LEARNING OBJECTIVE: A2**
SAMPLE ANSWERS	
Part a: 1.0 point	

Sample Answers for Graph 1

- The annual mileage is a good rating variable since there is a clear difference in the indicated relativity for each level (conveys the idea of "clear differentiation") or:
- The indicated relativities are CONSISTENT across all 3 years (conveys idea of "consistency" across years); this implies the rating variable is good

Sample Answers for Graph 2

- The +/- 2 standard error bars include the base relativity of 1.0 for each level, suggesting the 'mileage' variable may not be statistically significant and, therefore, not be a good rating variable
- The LR relativity is considerably above the indicated GLM relativity for the ">10,000" level, implying that "mileage" may be correlated with other exposure variables (the candidate may then argue the merits of this observation)

Sample Answers for Graph 1 or 2

- Since the first ("<2K") level contains far fewer policies than the other two levels, the actuary should consider combining it with the "2K-10K" level – and recasting the results with only two groups.

Part b: 0.5 point

Sample Answers (needed two arguments for full credit):

- Controllable: drivers have control over the number of miles driven in a year, so the 'mileage' variable is good with respect to this consideration
- Mileage is intuitive and proportional to expected loss
- Socially acceptable: This variable would not seem to violate any privacy concerns, so would be good from a social acceptability standpoint
- Subject to Manipulation: Drivers may lie about how many miles they drive, so this variable is subject to manipulation, an undesirable quality.
- No historical precedence – switching exposure bases could result in large premium swings
- Acceptable to regulators: This variable is widely used for personal auto and is largely considered to be acceptable to regulators, a good thing.

Note that this list is not exhaustive, and other reasonable answers were accepted provided they were adequately supported.

EXAM 5 SAMPLE ANSWERS AND EXAMINER'S REPORT

Part c: 0.50 point

Sample Answer 1

I would not recommend using the rating variable, as it does not appear to have statistical significance (graph 2), is expensive to verify and is subject to manipulation.

Sample Answer 2

I would include the rating variable given that graph 1 shows the levels to be clearly differentiated, "mileage" is easy to verify and proportional to loss, and does not violate any privacy concerns.

EXAMINER'S REPORT

Part a

Candidates were expected to have knowledge of strengths/weaknesses of rating variables and how the graphs may or may not reflect such strengths/weaknesses, as well as have an understanding of GLM output, including standard error considerations and comparison of GLM results to LR results.

In general, candidates scored well on this part. Common errors included:

- Misinterpreting the lines on graph 1 as "confidence intervals", when they are actually the results by year
- Making statements about either graph which are not relevant to the determination of whether the rating variable is "good/bad"
- Making unjustified conclusions about each level's credibility based on the relative number of exposures in each level

Part b

Candidates were expected to know desirable qualities of rating variables/exposures and whether "annual mileage" reflected these qualities.

In general, candidates scored well on this part. One common mistake was providing observations already made in part a. since the question asked for "two other criteria".

Part c

Candidates were expected to know how to make a final recommendation based on pros/cons of data analysis and operational/practical considerations.

In general, candidates scored well on this part. Common mistakes include providing explanations which were unclear or untrue (based on the graphical results) or which contradicted earlier statements made in parts a. or b.