1. (2.5 points)

An actuary is evaluating a merit rating plan for private passenger cars. Given the following:

Number of Accident-Free Years	Earned Car Years	Number of Claims Incurred
2 or More	500,000	20,000
1	200,000	15,000
0	100,000	9,000
Total	800,000	44,000

- Frequency varies by territory.
- State law prohibits reflecting territory differences in rating.
- Annual claims for an individual driver follow a Poisson distribution.
- Claim cost distributions are similar across all drivers.

a. (0.5 point)

Identify one potential issue with the exposure base used. Briefly explain whether or not earned premium would be a better choice for the exposure base.

b. (1.0 point)

Calculate the credibility of one driver with one or more year's accident-free experience.

c. (1.0 point)

Calculate the credibility of one driver with 0 Accident-Free years.

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QUESTION 1

Total Point Value: 2.5 **Learning Objective: A2.B**

Sample Answers

Part a: 0.5 points

Using earned car years may create maldistribution because some territories (or other non-merit rating variables) may have higher frequency. But using premium assumes the high frequency is reflected in higher premium and territorial differentials are proper, however, state regulation prevents territorial rating therefore, territorial differentials are not proper and premium is not necessarily a better exposure base.

Part b: 1.0 points

Number of Accident-Free Years	Earned Car Years	Number of Claims Incurred	Frequency
1 or More	700,000	35,000	0.050
C = 0	100,000	9,000	0.090
Total	**800,000**	**44,000**	0.055

Mod = Z * R + (1 – Z)

<u>For one or more year's accident-free:</u>

Mod = 0.05 / 0.055 = 0.909; R = 0;

- ⇨ 0.909 = 1 – Z
- ⇨ Z = 0.0909;

Part c: 1.0 points

Current Average Claim Frequency = 0.055 (44,000 / 800,000)

Mod = Z * R + (1 – Z)

<u>Since prior claim experience follows Poisson distribution and average claims is non-zero:</u>

Mod = 0.09 / 0.055 = 1.636; R = $\frac{1}{(1-e^{-\lambda})}$, where λ = current average claim freq = 0.055;

- ⇨ 1.636 = 18.686*Z + (1 – Z)
- ⇨ Z = 0.036;

EXAMINER'S REPORT

Part a:

- Most candidates mentioned the maldistribution that exists using car-years as an exposure base.
- A common error among candidates was arguing that earned premium is preferred since it corrects for maldistribution that exists due to territorial differences. Candidates failed to realize this was not an advantage since territorial rating is prohibited; hence territorial differentials are not proper.
- Some candidates argued premium may still be a stronger exposure base if non-territorial factors are captured correctly therefore reducing the maldistribution that exists using car-year – this was given full marks.

Part b:

- Candidates performed very well on this subpart; The majority of the candidates received full credit.

Part c:

- Candidates performed relatively well on this subpart; many candidates got full credit.
- Some common errors are:
  - i) Incorrect formula for R = $\frac{1}{(1-e^{-\lambda})}$;
    - a. Common incorrect formulas:
      - i. $R = \frac{1}{(1+e^{-\lambda})}$
      - ii. $R = \frac{\lambda}{(1+e^{-\lambda})}$
  - ii) Incorrect calculation for λ:
    - a. Many candidates used the 0-year frequency (.09) instead of the total frequency (.055).
  - iii) Incorrect calculation of the Modification (there was no common error that was made in the calculation of the Modification)