3. (1.75 points)

An insurance company has a private passenger auto book of business with an experience modification factor in its rating plan.

Given the following:

- Annual claims for an individual driver follow a negative binomial distribution with $r = 10$.
- The expected claim frequency for the entire book of business is 0.101.
- The credibility for the group of risks that have had at least one accident in the last year is 0.02.

a. (1.25 points)

Calculate the experience modification factor for a policy that has had at least one accident in the last year.

b. (0.5 point)

Describe why a class with a higher volume of claims and more exposures may have less credibility than a class with fewer claims and exposures.

CONTINUED ON NEXT PAGE

- Discussing the relative performance of each model without providing a final recommendation.

QUESTION 3	
TOTAL POINT VALUE: 1.75	**LEARNING OBJECTIVE(S): A1**
SAMPLE ANSWERS	
Part a: 1.25 points	

Sample 1

z = 0.02 r = 10

$$.101 = \frac{10p}{1-p}$$
$$.101 - .101p = 10p$$
$$p = .01$$
$$\Pr(N = 0) = \binom{9}{0}(1 - .01)^{10}(.01)^{0}$$
$$\Pr(N = 0) = .9044$$
$$R = \frac{1}{1-\Pr(N=0)}$$
$$R = \frac{1}{1-.9044} = 10.458$$

$$Mod = (.02)(10.458) + (1 - .02)$$
$$Mod = 1.1892$$

Sample 2

$$E(x) = \frac{pr}{1-p}$$
$$.101 = \frac{p * 10}{1-p}$$
$$1 - p = 99p$$
$$p = .01$$
$$R = \frac{1}{1-(1-.01)^{10}}$$
$$R = 10.458$$
$$Mod = Z * R + (1 - Z)$$
$$Mod = (.02)(10.458) + (1 - .02)$$
$$Mod = 1.18916$$

Sample 3

$$\frac{pr}{1-p} = 0.101 = \frac{10p}{1-p}$$
$$0.101 - 0.101p = 10p$$
$$p = .009999$$

$$(1-p)^{10} = (1 - .009999)^{10} = 0.904391119$$

$$E(x|x \geq 1) = \frac{0.101}{1 - .90439119} = 1.056387$$

$$Mod = \frac{(.02)(1.056387)+(1-.02)(0.101)}{0.101} = 1.189$$

Part b: 0.5 point

Sample Answers:

- Experience rating credibility depends not only on volume of data but also the variance within a class. Therefore, a class may receive more credibility than a class with more volume if it has more variance within the class.
- Experience rating is meant to distinguish an individual within the class. If there is low variance within a class, then experience rating is not as useful, so credibility is lower, even if the class has high volume.
- If a class is very homogeneous already, experience will not actually be very useful and will have a low credibility.
- If a class is well-defined the experience has less credibility than if a class is less defined even if the well-defined class has more claims and exposure.
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EXAMINER'S REPORT

Candidates were expected to be able to calculate an experience mod based on a claim count distribution and to be able to describe what determines the credibility given to experience rating for a class.

Part a

Candidates were expected to calculate the negative binomial parameter p, calculate R, and then calculate the experience mod.

Common mistakes included:

- Assuming p = E(x) = .101
- Assuming claim counts followed a Poisson distribution
- Using an incorrect formula for R.

Part b

Candidates were expected to understand that credibility for experience rating depends not only on the volume of data in the experience period but also on the amount of variation of individual hazards within the class. Candidates were also expected to understand that more credibility is given to experience rating when there is more variation within the class.

Some candidates said credibility would be lower because risks may be entering or leaving the class, or risk characteristics within the class might be changing. This is a reason credibility does not increase directly with the number of years of experience as the increase in volume of data alone would suggest, but it was not accepted as a reason credibility given to experience rating would differ between two classes.

Common mistakes included:

- Stating that more variation would produce less credibility
- Discussing variation in the claim count distribution rather than variation of individual risks within the class.