3. (2 points)

The random component of a generalized linear model must come from the exponential family of distributions.

The variance of a distribution from the exponential family can be expressed using the following formula:

$$Var(Y_i) = \frac{\phi V(\mu_i)}{\omega_i}$$

a. (0.5 point)

Define the parameters ϕ and ω_i in the formula above.

b. (1 point)

For each of the data sets below, identify the error distribution that should be used to model the data. Briefly explain why that error distribution is appropriate.

i. Severity

ii. Policy Renewal Retention

c. (0.5 point)

For each of the error distributions in part b. above, provide an example of how ω_i should be assigned for the type of data being modeled.

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EXAM 8 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 3

TOTAL POINT VALUE: 2 **LEARNING OBJECTIVE: A3**

SAMPLE ANSWERS

Part a: 0.5 point

Sample responses for defining φ

- Scale
- Shape
- Dispersion

Sample responses for defining ω_i

- Prior weights
- Credibility

Part b: 1 point

Sample responses for Severity

- Gamma error distribution as it has a longer tail and produces only positive outcomes. Good fit for severity modeling.
- Gamma error distribution because it is invariant to measures of currency.
- Gamma error distribution because variance proportional to x^2. This will naturally assign higher variance to higher expected values which is appropriate for severity.

Sample responses for Renewal Retention

- Binomial error distribution as the retention is either a yes/no outcome and the binomial is a good fit when modeling a 0 vs. 1 outcome.
- Binomial error distribution because it is invariant to probabilities of success or failure.

Part c: 0.5 point

Sample responses for Severity: ω_i =

- claim count
- 1 for each claim

EXAM 8 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

Sample responses for Retention: $\omega_i =$

- 1
- # policies available for renewal
- # years with company

EXAMINER'S REPORT

General Commentary

Candidates were expected to know the components of a GLM formula for typical model forms. Candidates overall scored very well on this question.

Part a

- Candidates were expected to identify the scale and prior weights parameters of the GLM variance formula.
- Candidates overall scored very well on this part. The majority of candidates earned full credit.
- There were no common errors on this part.

Part b

- Candidates were expected to know the appropriate error distribution for common model forms and be able to list a reason supporting the selected distribution.
- Candidates scored well on this part. The majority of candidates earned full credit.
- Common errors were listing a link function instead of the error distribution or listing the error distribution without a supporting reason.

Part c

- Candidates were expected to know the appropriate prior weights for common model forms.
- This was the most difficult part of the problem for candidates. The majority of candidates earned half credit or more.
- Common errors were listing prior weights for a different model form.