

## Bruin Actuarial Society Seventh Annual Case Competition

### Case Question

#### Background:

You are an actuarial analyst at Bruins Mutual, a mid-sized insurance company writing automobile and homeowners insurance in 20 states.

The company offers four main auto insurance coverages: Bodily Injury Liability (BI), Physical Damage Liability (PD), Comprehensive (COMP), and Collision (COLL).

#### Task 1:

Currently, all policy rating is done on the system, but the company would also like to set up an Excel rater to accommodate premium audits.

#### Part a:

Before setting up the rater, you are asked to verify the Driver Age factor from a prior model output. (See “Driver Age Factor” tab for details and instructions)

#### Part b:

Given the rating steps and factor tables (including the Driver Age factor you just calculated), create a rater in Excel that has the following functionalities:

- Display the rating factor for each rating step
- Display the total premium for each vehicle by coverage
- Display the total premium for the policy

Note the rating rules in force:

- The system is able to rate a maximum of 4 vehicles and 4 drivers per policy.
- All vehicles in the policy must select the same liability coverage limits.
- The average driver level factor of all drivers will be taken, and then applied to all vehicles.
  - Example: Suppose a policy has 2 vehicles and 2 drivers - driver level factor for Driver 1 is 1.082, and driver level factor for Driver 2 is 0.968. The average driver factor  $(1.082+0.968)/2=1.025$  will be applied to both vehicles.

Using the Excel rater you built, calculate the current term (effective in 2018) premium for the three sample policies provided on “Profile” tab.

#### Part c:

Besides the “Driver Averaging”, another common option used for driver level rating is called “Driver Assignment” – Each vehicle in the policy will be assigned to a primary driver, whose driver profile will be used to determine the driver level factors.

Create another version of the rater using “Driver Assignment” instead of “Driver Averaging”, and re-rate the two sample policies.

- Compare the premium discrepancies between the two methodologies.
- What are the considerations when the company chooses between “Driver Averaging” and “Driver Assignment”?

### **Task 2:**

Since the existing rating algorithm was developed few years ago and relatively simple, the company would like to re-evaluate the effectiveness of the rating structure. Your team is responsible for running a Generalized Linear Model on selected rating variables for each coverage. The experience data used to train the GLM is 80% of 5 years’ worth of data from 2014-2018 (20% of the data was held out for validation). Currently you are working on the GLM for Collision coverage.

#### Part a:

What is a GLM? What are the advantages of using GLM for insurance ratemaking?

#### Part b:

You have pulled data on current rating variables and other variables that the company collects, and ran them through a GLM. Evaluate the GLM output (on tab “Model Output”). [In general, a variable is considered significant if its standard error % (*standard error % = standard error / indicated factor*) is below 20%.]

- Is there any potential data issue?
- Explain if you would like to make any adjustment to the current rating variables (e.g. change variable groupings).
- Explain if you would like to add any new variables to the current rating algorithm based on the model output.

#### Part c:

For future model enhancement, your manager suggested some alternatives to the methodologies you used this time.

- What are the considerations when selecting time period of the data?
- What are some pros and cons of using one countrywide model comparing to using different models for each state?

#### Part d:

Executives at the company are facing business challenges in some states

- After taking consecutive rate increases due to high loss ratios in the past few years, retention has been dropping.
  - The company is trying to expand the market to younger drivers, but close ratio has been constantly low for that segment
- Based on these conditions, how would you adjust your variable selection in part b)?
  - What other non-rating suggestions do you have to address the issues?