



Twelfth Actuarial Case Competition

— Fall 2019 —

Intro

Greetings! This year, the California Actuarial League is hosting its Twelfth Actuarial Case Competition to provide participants the opportunity to work with realistic data and present business solutions to professional actuaries. This case study is ideal for students who are interested in developing their understanding of the insurance industry, polishing their data exploration and manipulation skills, and practicing their communication and presentation skills. The tracks included this year are:

- **Property & Casualty**
- **General Analytics**

Up to four to six teams will be selected to participate in the final presentation round. Finalists will present in front of a panel of actuaries from renowned consulting and insurance companies. Students will have the opportunity to win prizes up to \$400.

Timeline



Instructions | Details

All teams must consist of three to four students. Students from all years and majors are welcomed. The guideline for team formations is a maximum of two upperclassmen in each team. For any questions regarding team registration, please contact the following email:

calactuarialcasecomp@gmail.com

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Excel files associated with each question can be found in a zip file under the corresponding file names and on the Piazza forum. (piazza.com/university_of_berkeley/fall2019/calfall2019/home).

The link above leads to a Piazza forum where participants can discuss any questions or concerns they have about the case. We will periodically release more information on Piazza to all contestants.

Here are some Piazza guidelines:

- Before posting a question, please check if someone has already asked on Piazza.
- We encourage public posts and participants from different teams to discuss and answer each other's questions.
- If you have a technical issue, please make a private post.

For any clarifications regarding the case competition, please consult Piazza before contacting us through email.

The Case Competition team will host a Case Competition Workshop on Thursday, October 31st, 7:00 PM to address common concerns and pitfalls that the team has observed.

Submission Guidelines

The Property & Casualty Case must be solved using Excel, while you are free to use either Python or R, along with Excel, to solve the General Analytics Case. It is important to note that tasks are provided as a guide, but reports should **not** take a question-answer approach and should instead consult the case holistically.

Each team is required to submit a **zip file** including the following:

1. Written Report (5-page total)
 - Include a professional cover page with a title and the team's number.
 - Include team members' names on the last page of the report.
 - The 5-page limit **does not** include the cover page and citations.
2. Excel Solution Workbook
 - Reasonable assumptions and additional data from outside sources may be required to solve certain parts of this case study. Therefore, please explain your work, such as variables, formulas, assumptions, and steps you took to solve the case, in your report **and** in the first sheet of your workbook.
3. The HTML file of your GA solution in Python and the Notebook, or the HTML file of your solution in R and the R markdown file.
 - Be sure to include proper documentation explaining each step
4. The CSV submission file for the GA solutions.

Submit via e-mail with all team members carbon-copied with the subject title "[CAL] Team #" to calactuarialcasecomp@gmail.com by Friday, November 8th, 5:00 PM

Instructions | Details

A team must submit complete solutions to both tracks to qualify for the final presentation round. Additionally, the team must be ranked among the top two or three teams for the said track and meet a specific point-threshold in the remaining track to qualify. Four to six teams - two to three per track - will be selected to participate in the final presentation round. Finalists will present in front of a panel of actuaries from renowned consulting and insurance companies. Additionally, students will have the opportunity to win prizes up to **\$400**.

All teams will be notified of their status in the competition by **Tuesday, November 12th, 9:00 PM**.

Finalists' teams will do the following:

- 1) Finalist teams will prepare a 15-minute presentation about their solutions for their track. All team members are required to speak.
- 2) Finalists will record a rehearsals video and submit the first draft of their presentations on November 18th, 5:00 PM, the Monday before the final presentation.
- 3) **Final deliverables will be due on Friday, November 22nd, 3:00 PM**. More details will be released privately to finalists.
- 4) **Finalists are required to participate in the final presentation.**

The final presentation will be held on **Sunday, November 24th, 2:00 PM in 20 Barrows Hall**.

During the final presentation, each finalist team has 30 minutes of floor time, in which the team will present for a maximum of 15 minutes, while the remaining time will be a Q&A session with the judges. After the presentations, judges will provide feedback to the finalists and announce the winners. In addition to the judges, professional actuaries and CAL's alumni will be present. All interested students are welcome to attend the final round. A networking session with recruiters and alumni will be held after the event.

Judging | Prizes

All submissions should be the **original work** of the team members. We look for a clear understanding of the business problems described, evidence of strong analytical skills, and effective communication of results through the written reports and oral presentations. Since the case questions do not have a single correct solution, **original ideas and creative thinking** are especially valued.

Participants should also pay special attention to the style and visual content of all submissions. In this case competition, as in real life, **style counts**: the more professional your presentation is, the higher your chances of winning are.

This year, we are proud to offer two awards for our finalists:

- Best **Property & Casualty** Solution & Presentation: **\$200** cash prize
- Best **General Analytics** Solution & Presentation: **\$200** cash prize

Acknowledgements

We would like to thank our case question sponsors

Property & Casualty

CSAA

Eric Truelsen, Actuarial Analyst

General Analytics

Capital Insurance Group (CIG)

Charles Zhu, Actuarial Analyst

Arceo.ai

James Han, Data Scientist

Roy Kim, Cyber Actuarial Analyst

We would also like to thank our corporate partners

Aon, Beam Dental, Milliman, Marsh, Mercer, Blue Shield of California, and Fidelity Investments



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Beam Dental is a late-stage IOT insurtech startup and the fastest growing dental benefits company in the world. Having raised \$90 million in venture funding to date, Beam is quickly expanding to other ancillary lines of insurance such as vision, life & disability as well as other markets in dental. Beam's actuarial department focuses most of its efforts in research & development which includes (but not limited to) automation of underwriting processes as well as merging modern machine learning techniques towards traditional actuarial approaches. (<https://beam.dental/>)



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Acknowledgements



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We also gratefully acknowledge the support of the Associated Students of the University of California.

Property & Casualty

You are the actuary for a P&C company specializing in insurance for restaurants in the state of Notliable. Due to regulation in the state of Notliable, all liability losses are covered by the state. Thus, only property losses are covered by your company. You are asked to produce a rate level indication for a January 1, 2019 rate change.

You are given:

All policies are annual.

Exposures are defined as “policy years.”

Proposed effective date for the rate change is 1/1/2019.

Rates will be in effect for one year.

There was a 5% rate change effective January 1, 2015.

There was a 5% rate change effective January 1, 2016.

There was a 3% rate change effective January 1, 2017.

There was a 6% rate change effective January 1, 2018.

Commissions = 10.0%.

Taxes = 3.0%.

Variable portion of General and Other Acquisition = 4.0%.

Profit load = 2.0%.

Total fixed expense = 40 dollars per exposure.

Assume no catastrophes.

Tasks:

Task 1

What is a rate level indication? Why is it necessary?

Task 2

On-level all premium using the parallelogram method and select a premium trend using internal data. Justify your choice.

Property & Casualty

Task 3 (You can do a/b/c in whatever order you like. Just answer all parts.)

a) Determine whether you will develop losses and ALAE separately or together. Justify your choice. In general, when does combining losses and ALAE make more sense? When does it not?

b) Develop reported losses and ALAE using whatever method you like. Also, please highlight any major assumptions or alterations made to the data.

c) Explain the difference between ULAE and ALAE.

Task 4

Select a loss trend using internal data. How does this loss trend compare to those offered by ISO? What is one potential weakness of the internal data?

Task 5

Trend your developed losses using either an internal or external trend. Justify your choice. Please clearly show the dates you are using to trend.

Task 6

Produce a Variable Permissible loss and ALAE ratio from the given expenses. Show the formula used.

Task 7

Using the loss ratio method and your work from tasks 1-6, what is the indicated rate level change and what does it mean for the company? Given the current indication, do previous rate changes make sense? What is the difference between the loss ratio method and pure premium method, and when might one be better than the other?

General Analytics

You are a data analyst at Cal Insurance working closely with the actuarial department to use data-driven approaches to improve your company's underwriting guidelines and pricing models.

Cal Insurance expanded into the Personal Auto line of business in 2010, and in 2013, the firm filed a comprehensive rating plan to update the relativities. Since then, the firm has not made any updates to the rating plan. In the last six years, Cal Insurance's Personal Auto product suffered unexpectedly high losses. Due to the fact that the relativities have not been updated for more than six years, the Chief Actuary believes that inaccuracies in the pricing model are causing adverse selection for this product. Unfortunately, Cal Insurance's pricing model was already filed with the Department of Insurance and cannot be changed for another two years. You are tasked to work with the data provided to you by the actuarial department to establish a new underwriting guideline to preemptively decline applicants who are expected to incur more claims than the premiums they are charged.

Having not previously worked with the underwriting team, your manager has provided you with a quick description of underwriting's responsibilities:

Underwriters facilitate the transaction of insurance policies by reviewing insurance applications and approving or denying each application. They may choose not to underwrite some applications that have valid pricing (e.g., homes that are 80+ years old may be priced with a high premium, but an insurance company may not be interested in insuring homes that old).

Oftentimes, underwriting guidelines for an insurance company are proprietary, defining the firm's risk appetite. Underwriting the right risks can drastically impact an insurance company's finances and help it differentiate from and outperform its competitors.

You have been provided some tasks to guide your work on this project.

Tasks:

Task 1

Use the policy data and the filed relativities provided by your actuarial department to calculate the filed premiums for each policyholder in each policy year starting in 2013, when the new rating plan was put in place. Create a few exhibits to show the premium structure.

Task 2

Describe how you would construct a model trained on the policy and claims data from the last six years to help the company decide which applications to underwrite and which ones to deny coverage for.

- Identify the response variable and explain how it can be derived from the data you are given
 - Both regression and classification models can be correct if interpreted properly
- Justify your choices of model type and features
- Explain how your model predictions can be used to approve or deny coverage for applicants

General Analytics

Task 3

Construct the model you described in Task 2 and report the training accuracy and any other interesting metrics.

Task 4

The model you constructed cannot be used directly for underwriting due to regulations. Describe how you could interpret the trained model to understand how the pricing variables can be used to create an underwriting guideline so that the outcomes of underwriters using your guideline will resemble the predictions of your model as much as possible.

Task 5

Create an underwriting guideline using your model results. It is sufficient to list out conditions for accepting and declining applications. As a simple example, consider the following underwriting guideline published by your competitor:

***Decline** any drivers satisfying one or more of the following conditions:*

- 1. Over the age of 75*
- 2. Drives more than 25,000 miles a year*
- 3. Male and has at least one prior accident*
- 4. Under the age of 25 and has at least two prior accidents*
- 5. Married and has a low credit score*

Task 6

Apply your underwriting guideline to the group of new applicants and submit a prediction file in the same format as the sample provided. Make sure the predictions are made by the underwriting guideline and not the model you constructed in Task 3. Briefly comment (in two or three sentences) about your prediction results and their business implications to Cal Insurance.