



# actuarialREVIEW

VOL 47 / NO 6 / NOVEMBER-DECEMBER 2020

PUBLISHED BY THE CASUALTY ACTUARIAL SOCIETY 

## Volunteers Make Things Happen:

*Galvanizing Efforts  
to Advance Inclusion,  
Equity and Diversity*

**A Volunteer-Staff Collaboration  
Advances the CAS's Mission and  
Programs Through the COVID Chaos**



# 2020

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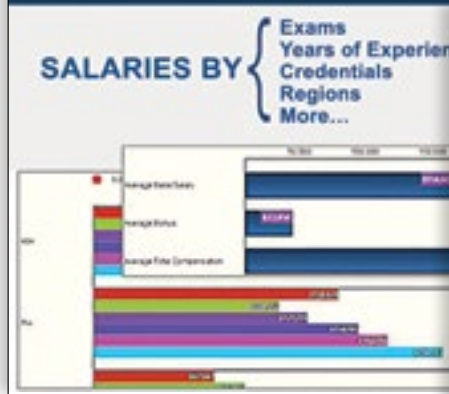
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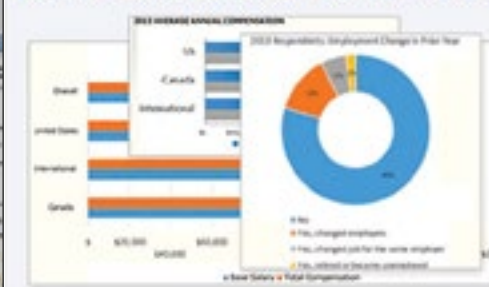


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# actuarialREVIEW

November-December 2020



## departments

4

### EDITOR'S NOTE

- In Praise of the Volunteer-Staff Partnership

6

### PRESIDENT'S MESSAGE

- 2020 — The Year of Collaboration

8

### READER RESPONSE

9

### MEMBER NEWS

- Comings and Goings
- Calendar of Events
- Certify Compliance with the CAS Continuing Education Policy
- In Memoriam
- CAS Staff Spotlight
- Meet the Winners of the 2020 CAS University Award
- The CAS Institute Establishes New Exam Waiver
- CAS 2020 Employer Honor Roll

30

### PROFESSIONAL INSIGHT

- Ethical Issues

34

### ACTUARIAL EXPERTISE

- GitHub and Continuous Integration
- Fresh Look

42

### VIEWPOINT

- In My Opinion

44

### SOLVE THIS

- It's a Puzzlement



FSC  
LOGO

on the cover

## Volunteers Make Things Happen: Galvanizing Efforts to Advance Inclusion, Equity and Diversity

By MICHELE LIFSHEIN

In celebrating all CAS volunteers, this year-end *AR* spotlights the Joint CAS/SOA Committee for Inclusion, Equity and Diversity, a group that well represents the volunteer spirit of all those dedicated to the CAS.



## A Volunteer-Staff Collaboration Advances the CAS's Mission and Programs Through the COVID Chaos

18

By ANNMARIE GEDDES BARIBEAU

When the United States entered a sudden lockdown last March to prevent the spread of novel coronavirus COVID-19, volunteers and staff at the Casualty Actuarial Society sprung into high-energy, collaborative action.

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## editor'sNOTE By ELIZABETH A. SMITH, AR MANAGING EDITOR

### In Praise of the Volunteer-Staff Partnership

It's long been a tradition for the last *AR* of the year to include a Volunteer Honor Roll listing all the CAS member volunteers — from authors to committee members to graders. The Honor Roll is a testament to the many dedicated CAS members offering their time and talents, but each year the roll took up more and more magazine real estate, making it impractical to continue.

In lieu of the list, however, our plan for this and upcoming issues is to feature more in-depth stories on a single committee or activity that has made the CAS a success. For our cover story, new *AR* contributor Michele Lifshen profiles the JCIED, a joint committee of the CAS and the Society of Actuaries devoted to issues of inclusion, equity and diversity in the workplace and hiring practices. Awareness and understanding of these matters have taken root in organizations around the world. Companies and individuals are learning what can be done to combat bias in the workplace — and they are taking action.

#### In other news ...

Our feature story by *AR* contributor Annmarie Geddes Baribeau chronicles the measures that the CAS leadership

and staff took to carry on in the wake of the pandemic. This story speaks to the power of teamwork between the two groups. It includes a timeline of events and interviews with many of my coworkers. I think that they were surprised to be the subjects of an *AR* article. It's good to see them in print, and I appreciate the time they took to help with this story.

*AR* is also premiering a new column, Fresh Look, that aims to revisit established actuarial concepts and their places in the modern era. Stephen Mildenhall's piece on the work of Robert Bailey and LeRoy Simon concerning minimum bias insurance rates is especially poignant in light of the passing of Bailey this past September. Bailey lived to be 90 and definitively left his mark on the actuarial profession.

Also in this issue, CAS Research Actuary Brian Fannin advocates for the power of Github (If you don't know it, you should; look it up!), Ethical Issues considers both sides of the story behind some transactions, Grover Edie tries to make sense of the everyday world using Actuarial Standards of Practice and Jon Evans presents another perplexing puzzle.

Please enjoy this issue and stay safe and healthy! ●

*Actuarial Review* welcomes story ideas from our readers. Please specify which department you intend for your item: Member News, Solve This, Professional Insight, Actuarial Expertise, etc.

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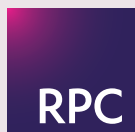
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## 2020 — The Year of Collaboration

One of the greatest silver linings for the CAS in 2020 was proving that a new collaborative operating model between CAS staff and volunteers was not only necessary, but actually works and works really well!

With significant change foisted upon us by the environmental changes from COVID-19 and under the leadership of Victor Carter-Bey and the CAS Board, we made tremendous strides toward a new way of working between volunteers and staff. Recognizing the need for change in how we work to best serve the current and future needs of our candidates and members, the evolving staff-volunteer model makes the best use out of the talents of staff and volunteers.

Three examples help illustrate the success of the new collaborative model.

### 1. CAS Examinations

Given the fact that we could not offer the spring examinations for sundry reasons, we had to prepare for ensuring that we could administer the Fall Exams. Under our existing model, our plans were to transition exams to computer-based testing (CBT) in stages over 18 to 24 months. But to pull off a successful fall sitting for *all* CAS exams, we needed to speed up that timeframe by six months. This was a Herculean effort and required an all-hands-on-deck mentality to bring the project to fruition. Through the leadership of CAS Chief Learning Officer Jennifer Naughton, her CAS Admissions staff, a few CAS staff actuaries, and a host of Admissions volunteers, the CAS was able to move this effort forward effectively. The full-time staff at the CAS

expanded their operational scope of responsibility and decision-making to keep the initiative moving forward while CAS volunteers lent their actuarial subject matter expertise to question-writing and grading. For CAS Admissions, as-

that dreams are made of. Galvanizing staff and volunteers to develop the eight-week program (with case studies!) and soliciting volunteers to mentor, present and judge — all while staff ironed out the details of how all this would operate

**The collaborative effort between the CAS volunteers and staff on the University Engagement Committee is the stuff that dreams are made of.**

signing staff the day-to-day operational work and relying on the volunteers for actuarial knowledge and thought leadership were profound changes — changes that worked brilliantly.

### 2. CAS Student Central Summer Program

This second example is an initiative that we never even had on the radar screen for 2020. The thought that came to be known as the CAS Student Central Summer Program started when we began to hear news that some students' summer internships were being cancelled due to the pandemic. We nurtured the idea of offering students something from the CAS that could give them solid property-casualty actuarial skills, general business skills, group projects and mentoring. In a matter of weeks, we went from thought to execution to over 600 program applications, the latter of which compelled us to create two slightly different programs to accommodate the overwhelming demand — a mentor-guided program and an independent study program.

The collaborative effort between the CAS volunteers and staff on the University Engagement Committee is the stuff

virtually — are dreams come true. I especially appreciate the work of CAS Director of Engagement Tamar Gertner, who was instrumental in making the Summer Program succeed. The common mission of offering this unique educational experience to these students was really the beating heart that made this come alive so successfully.

### 3. A New CAS Strategic Plan

This example highlights the collaboration among the CAS Board, Executive Council and staff. Historically, updates and refreshes to strategic plans were conducted primarily by the board in consultation with the executive council and, ultimately, some input from the CAS staff (mostly on the back end of the process). Recognizing inclusion as a core value and that the CAS staff would be taking on more authority and accountability to bring the new Strategic Plan to life, we determined that it only made sense to work throughout 2020 as one collaborative unit.

We quickly learned that removing any sense of hierarchy from our ap-

*President's Message, page 8*

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## President's Message

from page 6



proach was the most proper way to move forward. We also recognized that jointly developing the new CAS Envisioned Future — “CAS members are sought after globally for their insights and ability to apply analytics to solve insurance and risk management problems” — gave us that common goal that unified this collaborative work. The result is a Strategic Plan like no other the CAS has created. The plan is both unified and comprehensive, shows where clear ownership of the operational aspects of the plan are divided between staff and volunteers, and acknowledges that volunteers are primarily relied upon for their actuarial knowledge and insights.

## Going Forward

As we move into 2021, I am excited to move the Strategic Plan forward and tackle new issues that come to the CAS Board. I am so proud of what the CAS accomplished in 2020 and that I could be a part of it as president. ●

## Encouraged by Growing Diversity Efforts

### Dear Editor:

I read Steven Armstrong’s “President’s Message” in the September-October issue of *AR* with great interest. For a handful of years, I led the P&C actuarial recruiting, hiring and training efforts at Mr. Armstrong’s current employer. In that role, I pursued diversifying company recruiting efforts to incorporate schools with no actuarial science program, but strong math programs. The lack of competition from other actuarial employers for the best candidates at these schools proved beneficial, although it did require rethinking many traditional recruiting “givens.”

The lack of racial diversity within the profession in North America had always been a concern of mine. Mr. Armstrong rightly identifies this unintended consequence of the growing pipeline to the profession from schools offering actuarial science majors. I have nothing against these fine schools, but if we are to change the racial diversity of the profession, company recruiting efforts and university recruiting strategies must diversify as well.

I was pleased to see the CAS join the International Association of Black Actuaries Corporate Advisory Council, on which I represented my former employer. I’m heartened to see a greater collective focus being put on increasing diversity within our profession ... a very steep hill (mountain?) to climb.

—Jim Rowland, FCAS (Retired)

### Dear Editor:

In the September-October 2020 *Actuarial Review*, CAS President Steven

Armstrong writes about the pros and cons of having a majority of actuarial science majors among CAS members. Considering my unique and untraditional education, background and experiences, I would like to share some insight. With respect to an actuarial science degree, it is positive to see universities increase their interest in the actuarial profession. However, according to the Society of Actuaries listing “Universities and Colleges with Actuarial Programs” (UCAP), there are only 208 American schools with properly accredited actuarial programs. This is only 4.77% of the 4,360 degree-granting institutions that are recognized by the U.S. Department of Education’s National Center for Education Statistics (*Digest of Education Statistics*, 2018 (NCES 2020-009), Chapter 2). The probability of a student being granted the opportunity to attend one of these prestigious institutions is small. I agree that the CAS should expand their efforts to include nontraditional majors because actuarial candidates come from a variety of backgrounds and their capacity to attain a superior education should not diminish their talent and skills. This brings me to career changers. Seemingly unlikely candidates can excel in their soft and technical skills because they’ve had to pursue this career in less than favorable circumstances. Not only can the CAS increase their member population in the areas of diversity and inclusion on many levels, they can also continue to market themselves as a progressive, innovative and ethical organization during a time when equity and equality are paramount to all.

—Muriel Alejandra Holmquist



## COMINGS AND GOINGS

**Erick Mortenson, ACAS**, has joined Pinnacle Actuarial Resources as a consulting actuary. Mortenson comes to Pinnacle from Willis Towers Watson, where he was a senior vice president focused on providing analytics solutions in areas including reinsurance and medical professional liability.

**Sean Kevelighan, Jodie Slaughter** and **Talithia Williams** have been elected CAS Appointed Directors. Appointed directors are elected by the CAS Board of Directors and serve one-year terms that are renewable for up to three years. Kevelighan is the CEO of the Insurance Information Institute. Slaughter is the retired president and founding partner at McKinley Advisors, a Washington D.C. strategy and research firm serving associations. Williams is the associate dean and associate mathematics professor at Harvey Mudd College in Pomona, California. ●

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## CALENDAR OF EVENTS

**March 15-17, 2021**

Rate-making, Product, and  
Modeling Virtual Seminar

**May 23-26, 2021**

Spring Meeting  
Disney's Coronado Springs Resort  
Orlando, FL

**June 8-9, 2021**

Virtual Seminar on Reinsurance

**September 13-15, 2021**

Casualty Loss Reserve Seminar

**Spring 2022**

Actuarial Colloquia  
(hosted by the CAS)

## Certify Compliance with the CAS Continuing Education Policy

**A**ll Fellows and Associates need to certify their compliance with the **CAS CE Policy's requirements as of December 31, 2020**. Compliance with the CAS CE Policy allows the member to provide actuarial services in the year immediately following certification of compliance. Note that even members who are not in actuarial roles should review the requirements as CE compliance may still be required. If members are not providing actuarial services, they must still attest this **in their CAS member account**.

For more information on certification, visit the Continuing Education webpage at <http://www.casact.org/education/index.cfm?fa=ceinfo>. ●

## IN MEMORIAM

James E. "Jim" Scheid (FCAS 1969)  
1934-2020

Robert Arthur Bailey (FCAS 1955)  
1930-2020

## CAS STAFF SPOTLIGHT

## Meet Jennifer Naughton, CAS Chief Learning Officer

**W**elcome to the CAS Staff Spotlight, a column featuring members of the CAS staff. For this spotlight, we are proud to introduce you to Jennifer Naughton, MA Ed, CAE, SPHR.

- **What do you do at the CAS?**

I am the new chief learning officer for the CAS. I oversee the CAS Admissions, Professional Education and Research departments.

- **What do you enjoy most about your job?**

I enjoy the opportunity to transform an entire profession, especially when it is at an inflection point. I like identifying and closing skills gaps due to the massive impact they have on people's careers, and in turn, on their contributions to society.

- **Where is your hometown?**

McLean, Virginia, just across the Potomac River from D.C. My father moved to D.C. from Sioux City, Iowa, when he was in his early 20s to work on Capitol Hill. Then he stuck around after he met my mom.

- **Where did you go to college and what is your degree?**

I attended undergrad at James Madison University in Virginia (Go Dukes!) and earned a BS in psychology. I also attended the University of London as an undergrad, which was by far one of the best decisions I made at that time. It made me more

appreciative of other cultures and perspectives and the importance of applied learning. I then went on to earn my master's degree in education from the George Washington University in D.C.

- **What was your first job out of college?**

I held down two jobs right after college: a research scientist by day and billiard club DJ by night. Music is one of my many passions, so my second job was a labor of love.

- **Describe yourself in three words.**

My friends describe me as driven, strategic and a catalyst.

- **What is your favorite weekend activity?**

I enjoy traveling with friends. COVID-19 has made this difficult, but where there's a will, there's a way, thanks to rapid testing and N95 masks.

- **What is your favorite travel destination?**

I can't pick just one. Among my most memorable are Singapore (hawker centers), Thailand (beaches!), Istanbul (history museums), Barcelona (Basílica de la Sagrada Família) and San Diego (La Jolla sea lions). The list goes on.

- **Name one interesting or fun fact**



Jennifer Naughton

**about you.**

I am a genealogy nut. Apparently, I descended from someone who came over on the *Mayflower*. Legend has it that he was sent to America as punishment for stealing a pewter mug. I have no idea if this is true, but it's a good story, so I'll keep telling it. ●





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## Meet the Winners of the 2020 CAS University Award

By TAMAR GERTNER, CAS DIRECTOR OF ENGAGEMENT

**M**cMaster University, Middle Tennessee State University, Temple University and University of Illinois at Urbana-Champaign are the 2020 recipients of the CAS University Award. The program recognizes innovative and exemplary ways that universities are preparing students for careers in the property-casualty insurance industry. Each school will receive a \$5,000 award to further enhance their own programs. They were recognized during the 2020 CAS Annual Meeting that was held virtually.

The CAS University Award is an honor created to celebrate universities that share the CAS's commitment to fostering the development of the next generation of P&C actuaries. The selection process is extremely competitive, with nearly 40 schools worldwide seeking recognition. Winners of the 2020 CAS University Award Program were determined by a panel of judges from companies across the P&C insurance industry.

"Applicant schools are sharing new approaches in how they incorporate P&C concepts into their curriculum, research and industry engagement. Those innovations are at the center of our evaluation process," said Anson Lo, FCAS, chair of the CAS University Award Program. "As schools continue to adapt and enhance their programs to prepare their students for actuarial careers, the property and casualty insurance industry will likewise be better positioned to meet the challenges of the future," he said. "It was impressive to see

several diversity and inclusion initiatives that schools have developed within their actuarial programs. I applaud this year's winners, as well as the many other strong applicants, for their continued efforts to promote property and casualty education."

### Meet the University Award Program Winners



#### McMaster University

McMaster University's Actuarial & Financial Mathematics (AFM) program is led by Dr. Anas Abdallah, a 2016 recipient of the CAS Hachemeister Prize, which recognizes the impact of research on the P&C actuarial industry in North America. Made up of five faculty members and 165 students, the AFM im-

pressed the judges with its focus on P&C insurance across curriculum, research and industry engagement.

Some of the university program's highlights include the following:

- The university has recently updated the curriculum to include two new P&C courses and a data science course. The university's formal co-op program enables students to complete three or four work terms, each lasting four months. This allows them to gain relevant professional skills and experience before graduation.
- Through its industry partnership with the Co-Operator General Insurance Company, the university has produced P&C research on topics including reserving, rate-making and flood modeling. Much of the university's research output has been published in top actuarial journals.
- The AFM program is strongly connected to the P&C industry, es-



*Students involved with Canada's McMaster University Actuarial & Financial Mathematics program in Hamilton, Ontario.*

pecially through the McMaster/Co-operators Problem-Solving Workshop. In the workshop students can develop their interpersonal and technical skills as well as participate in experiential learning using real-world P&C problems. Students can also enjoy such perks as invitations to present their results at the industrial partner's headquarters or a full-day job shadowing or both.

"We are honored and humbled," said Dr. Abdallah about receiving the award. "We have been working tirelessly lately to enhance the P&C component and build a program at McMaster University that responds to the evolving needs of the industry and facilitates the transition into the workforce. I am happy to see that these efforts have been recognized by the world's only actuarial organization focused exclusively on P&C risks," he said.

## MIDDLE TENNESSEE STATE UNIVERSITY.

### Middle Tennessee State University

Middle Tennessee State University's actuarial science program has five full-time actuarial faculty members, five full-time statistics faculty members and about 120 actuarial students housed in the department of mathematical sciences. The university impressed the judges with its focus on P&C topics, as shown in the following examples:

- The undergraduate and graduate curriculum exposes a wide variety of P&C topics covered for VEEs and CAS-specific exams including MAS-I, MAS-II and Exam-5. In addition,



*Jubilant actuarial science program students celebrate graduation from Middle Tennessee State University in Nashville.*

it incorporates modern data science techniques that can support broader applications in P&C insurance. Highlights include a P&C ratemaking and loss reserving course, a data project-focused predictive analytics course, and a course on computational statistics.

- The program has close connections to the P&C industry and active engagements with the CAS through multiple channels including participating in the University Liaison, Academic Central and Student Central programs and CAS committee services, and hosting the Casualty Actuaries of Southeast (CASE) regional conference. In addition, the program has a highly influential advisory board in the P&C field that supports and provides students with internships, entry-level positions and project resources for research topics and student theses that contribute to

actuarial conference presentations and publications.

- The program provides students with broad training opportunities in communications, business and data skills with possible minors or certificates in data science, and minors in risk management & insurance. In addition, all actuarial faculty members are active in research and heavily involved in the Computational Science Ph.D. Program.

"We are thrilled to receive such wonderful news, especially during this special and challenging time," said Professor Don Hong, director of the actuarial science program. "We are honored to receive such a prestigious award and would like to thank the CAS for recognizing the dedication and accomplishments of our faculty, students, distinguished alumni, the university liaisons and industrial partners of our program. Middle Tennessee State University has been fortunate to partner with the CAS

and Casualty Actuaries of the Southeast (CASE) to educate and train students on property and casualty actuarial topics and skills. The award will inspire us to keep improving our program to fulfill our mission of providing a world-class actuarial education to our students.”



### Temple University

With five actuarial faculty members and 250 actuarial students in its actuarial science program, Temple University impressed the judges with its focus on P&C-insurance across curriculum, research and industry engagement.

Highlights include:

- For its undergraduate and master’s actuarial science program curricula, Temple has incorporated P&C topics that cover material on MAS-I, MAS-II and CAS Exam 5. The university leverages CAS case studies and P&C datasets for its courses. Particularly innovative is the Actuarial Practice-Property Liability, a course featuring an insurance game/market simulation that helps students understand P&C insurer operations and the impact of the operational decisions.
- Temple University’s faculty is very active in research. Its professors produce relevant and impactful research in the P&C area that is often cited by well-known media outlets and published in academic journals. One recent research project led to the development of an insurance product. The university also encourages students to do



*Krupa S. Viswanathan, FSA, is an associate professor in Temple University’s Risk, Insurance, and Healthcare Management Department and is director of the university’s actuarial science program.*

research and publish articles with department faculty.

- The program connects with the P&C insurance industry through several avenues, such as offering a lecturer and workshop series, engaging with recruiting companies and participating in case competitions. The university has hosted a variety of industry speakers through its Snider Distinguished Guest Lecturer Series and the Actuarial Science Career Development Committee, which has brought in actuarial-focused speakers nearly every week.
    - Temple has a robust alumni mentorship program that pairs interested students each semester with an industry mentor, many of whom are from the P&C industry. The mentors offer a deep understanding of their industries and specific lines of work as well as invaluable advice.
    - The department has hosted an Enterprise Risk Management Conference since 2018 that is open to students. It features risk officers from various industries discussing challenges organizations face including cybersecurity, supply chain and climate change.
- “Thank you to the Casualty Actuarial Society for selecting Temple Univer-

sity as one of the recipients of the 2020 CAS University Award. We are thrilled to receive this honor! The faculty strive to create and continually refine an intellectually demanding curriculum for our students. Our student engagement in professional development opportunities further expands their knowledge. The property and casualty field encompasses both traditional and innovative insurance and risk management concepts, making for interesting discussions and thought-provoking applications in the classroom. We appreciate the CAS’s



recognition of our program.”

### University of Illinois at Urbana-Champaign

University of Illinois at Urbana-Champaign’s actuarial science program has five actuarial faculty members and 375 actuarial students. According to award rules, as a winner of the CAS University Award in 2016, the school had to wait three years before applying for the award again. During those three years, the university continued enhancing its focus on P&C across its curriculum, research and industry engagement, and reemerged in 2020 as a second-time award winner.

Program highlights include the following:

- The actuarial program substantially covers CAS Exams, supports P&C practice and incorporates innovative course content. Courses offered prepare students for attaining CAS Associateship, covering topics across Exams MAS-I, MAS-II and





*Participants in the IRisk Lab (Illinois Risk Lab) at the University of Illinois at Urbana-Champaign learn about real-world actuarial problems through workshops, projects and lectures.*

Exam 5. Prep courses for CAS Fellowship Exams are also available and cover subjects on Exams 7 and 9.

- Notable courses include Extreme Value Theory and Catastrophe Modeling, which teaches practical statistical models for rare and catastrophic events, and Property and Liability Insurance, which covers underwriting, claims, ratemaking and administration. A new course, Predictive Analytics, centers around four case-study assessments in which students solve business problems combining theory and R coding, and present their results. Topics include auto insurance pricing, IBNR claims reserving, mortality modeling and stock return predic-

tion.

- The IRisk Lab (Illinois Risk Lab), established in 2018, fosters the integration of discovery-based learning experience with state-of-the-art academic and practical research in the areas of risk analysis and advanced analytics. The lab consists of four pillars that incorporate real-world P&C content: research projects, seminars and workshops, Hack Night and the Risk Analytics Symposium.
- Faculty and students have many opportunities to work on P&C research. Recently, faculty members have focused on cyberrisk and peer-to-peer risk sharing, two cutting-edge P&C actuarial research areas expected to generate fundamental

and impactful contributions to the P&C insurance industry.

- In addition to the exceptional research opportunities offered to actuarial students through the IRisk Lab, there are other exciting opportunities for students to conduct research, including research internships at State Farm and the AXIS Student Challenge. The latter offers students the chance to compete to provide the best solution to a real-world business problem that AXIS Capital proposes each year.
- The program has strong connections to the P&C industry through its Actuarial Science Advisory Board, scholarship support, actuarial science club activities, company presentations and on-site company visits. Additionally, the program maintains a close relationship with the CAS through participation in the University Liaison and CAS Student Ambassador Programs.

“To have our actuarial science program recognized for a second time by the CAS is sincerely an honor,” said Dr. Runhuan Feng, FSA, CERA, associate professor and director of actuarial science at the university. “We believe in the power of innovation to serve and impact society and change lives ... Not only do our students develop professional knowledge, they are already making an impact on the profession by providing creative solutions to lots of real business research problems brought to the IRisk Lab by our corporate partners ... We appreciate the support the CAS has given us through the years and look forward to the continued innovation and impact that will come with our ongoing partnership.” ●

## The CAS Institute Establishes New Exam Waiver

By AMY BRENER, DIRECTOR OF THE CAS INSTITUTE

The CAS Institute (iCAS) is changing its requirements for the Certified Specialist in Predictive Analytics (CSPA) credential and is now offering a waiver for CSPA Exam 3 to candidates who have passed CAS Modern Actuarial Statistics (MAS) Exams I and II. This newest waiver was made possible by moving some material from CSPA Exam 3 to CSPA Exam 2, aligning it more closely to MAS I and MAS II. Since the Exam 3 material on causal inference is not covered in the MAS Exams, candidates who apply for the waiver will be required to take a short virtual course to learn the missing material.

This change is one of several waivers already available for CAS members and candidates. Currently, candidates who have passed CAS Online Courses 1 and 2 and CAS Exam 5 are eligible for

the CSPA Exam 1 waiver. Furthermore, CAS candidates who have completed the CAS Course on Professionalism are exempt from the iCAS ethics course requirement. With the assistance of the above waivers, candidates meeting all the necessary requirements may only need to pass CSPA Exam 2 and the CSPA Case Study Project to earn the CSPA credential (see table below).

CSPA Exam 2 is offered through The Institutes during its four exam windows throughout the year. The twice-yearly CSPA Case Study Project, in which candidates can apply knowledge on the exams to solving a real-life business problem, typically begins two to three months after each offering of CSPA Exam 3. In 2021 the Project's first sitting begins on January 15. CSPA Exam 3 will be offered in May (exact date to be determined after finalization of the



CAS Spring Exam schedule). Start dates for the Fall 2021 CSPA Exam 3 and Case Study Project have not yet been determined.

Complete information on all the waivers and the appropriate waiver request forms can be found on the [iCAS website](#). Once a waiver is approved, candidates must join The CAS Institute before the waiver is officially issued. ●

### Summary of CSPA Waivers Fulfilled by CAS Exams

		You will receive credit for the following CSPA requirements				
		Exam 1: Property-Casualty Insurance Fundamentals	Exam 2: Data Concepts and Visualization	Exam 3: Predictive Modeling — Methods and Techniques	Case Study Project	Ethics Course
If you have:	CAS Online Course 1 and 2 and Exam 5	✓				
	CAS MAS I + MAS II			✓		
	CAS Course on Professionalism					✓

# CAS 2020 Employer Honor Roll

The CAS is grateful for the support of employers that encourage their actuaries to volunteer their time and effort to the CAS.

## Top Ten Employers and Organizations with the Largest Number of Members Volunteering

Liberty Mutual Insurance  
Travelers  
Allstate Insurance Company  
The Hartford  
Willis Towers Watson  
Milliman, Inc.  
Zurich North America  
USAA  
CNA Insurance Companies  
ISO/Verisk

## Large Employers with at Least 40 Percent of Members Volunteering

Liberty Mutual Insurance  
Travelers  
Allstate Insurance Company  
The Hartford  
Milliman, Inc.  
Zurich North America  
ISO/Verisk  
Munich Re America Services, Inc.  
EY  
Deloitte Consulting, LLP  
Pinnacle Actuarial Resources, Inc.  
TransRe



# **A Volunteer-Staff Collaboration Advances the CAS's Mission and Programs Through the COVID Chaos**

By ANNMARIE GEDDES BARIBEAU





**W**hen the United States entered a sudden lockdown last March to prevent the spread of novel coronavirus COVID-19, volunteers and staff at the Casualty Actuarial Society (CAS) sprung into high-energy, collaborative action.

Besides immediately switching from in-person meetings and exams to virtual ones, the CAS also introduced a new and successful summer program for college students, made possible through volunteer-staff collaboration. “We have been able to operationally stick with our game plan ... Nothing fell off the plate,” says Dr. Victor R. Carter-Bey, the CAS’s CEO.

All of the achievements were made possible by “a lot of great compromise and collaboration” between staff and volunteers, says CAS President Steve Armstrong. It also meant investing considerable time on short deadlines. Virtual events, Carter-Bey says, take three times more effort to carry out compared to in-person ones.

For CAS staff and volunteers, responding to COVID-19 at first meant making difficult decisions in a condensed amount of time. CAS volunteers amassed more than 1,000 hours planning and organizing virtual professional education events, from the start of COVID-19 lockdowns in March through October, says Dave Core, CAS director of professional education and research.

### **2020 decisions and events spurred by COVID-19**

From April through September 2020, the CAS offered 23 webinars and four virtual workshops/boot camps. Following is a timeline of the events that took place along the way to where the CAS is now.

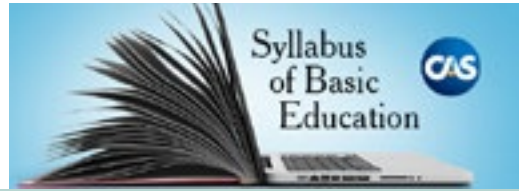
**January 30.** The World Health Organization (WHO) designates SARS-CoV-2, later termed COVID-19, a “public health emergency of international concern.” Originating in Wuhan, China, the highly contagious pathogen spread exponentially around the world, killing thousands in its wake. Within a month, leaders from nations across the globe restricted travel to quell the spread.

**February 28.** The number of people contracting the coronavirus well surpassed the SARS pandemic in 2002, which infected about 8,000 people worldwide. Although only 61 cases of COVID-19 were reported in the United States, as of this date, there were 84,544 cases worldwide, according to Metabiota, a firm that tracks pathogens.

“Tons” of speakers and attendees begin canceling attendance to the **Enterprise Risk Management Symposium (ERM)** in March due to COVID-19 concerns, recalls Kathleen Dean, CAS director of meeting services.

**March 8-10.** Speakers begin canceling on the first presentation day of the **ERM Symposium**. Anticipating similar circumstances, CAS staff and volunteers began contacting speakers to learn about their intentions for the **Ratemaking, Product and Modeling (RPM) Seminar and Workshops**, slated for March 23-25.

**March 11.** The WHO declares COVID-19 a pandemic. The governor of Louisiana puts his state in lockdown. The **RPM Seminar** is canceled and later moved to a virtual event scheduled July 28-29.



## Exams Anew

It was perhaps the hardest decision to make. Somehow, there had to be a way to rescue the in-person Spring 2020 actuarial exams despite lockdowns and cancellations.

Doors were shutting everywhere. CAS President Steve Armstrong recalls that employers, who usually provide testing space and proctors, had to back out. “These are high-stakes exams,” says Ashley Zamperini, CAS director of admissions. “People spend 400 hours per exam to study, and we did not want to add more stress to the candidate by giving a bad testing experience.”

After trying everything possible to save the Spring Exams, the hard decision to cancel exams was announced on April 7, 2020. “For the level of change and pivoting and tweaking and adjustment needed, we looked at it from a risk-reward perspective,” explains CAS CEO Victor R. Carter-Bey. “It was a matter of what was in the best interest of the candidate.”

Thanks to staff and volunteers’ dedicated effort, the CAS is expecting exam-takers in record numbers. At press time, as many as 5,871 candidates are registered for a single sitting, surpassing the averages of 4,200 and 3,800 for spring and fall exams, respectively. A record number — 1,181 candidates — registered for more than one exam.

The exam sitting in November will include the Spring Exams that were canceled and Fall Exams that were already scheduled. These computer-based exams will use a new spreadsheet format, but the MAS-I and MAS-II test sittings, also in November, will use a new exam format slated to be implemented for other CAS exams beginning in 2021.

The new exam format offers several advantages. The computer-based testing provides real-life simulations of problems that candidates might experience doing actuarial work. It also offers a spreadsheet environment to do fast math and formula replications.

Zamperini explains that, rather than using paper and pencil in different testing environments, the CAS Fall Exams will be completely standardized — that means everyone will have the same testing experience. The monitor, computer, mouse, noise-canceling headphones are all the same at Pearson Professional Centers, which has locations

across the globe. The new approach also eliminates the need for volunteers to proctor exams.

The difficult decision to cancel Spring Exams propelled the CAS Admissions Committee to pursue a previously established longer-term goal of standardization through computer-based testing. Such an accomplishment meant an all-hands-on-deck and time-sensitive approach free of egos, Armstrong says. “What we thought took 18 to 20 months could happen in four to six months,” he says of the project. The number one goal is to ensure a robust, fair administration of exams.

“We pretty much had to change everything in our processes,” Zamperini explains. Maintaining the integrity of the exam process meant working to ensure the highest levels of security possible in a virtual environment, accounting for candidate and proctor safety, simplifying registration, engaging in more thorough communications, converting questions for a computer-based environment and supporting virtual grading.

Even the place of testing had to change. Armstrong explains that employers traditionally provided free space and proctors for testing, but that was not possible in a COVID-19 situation.

Thankfully, the CAS was well-positioned to transition the testing venue from employer-based locations to a choice of hundreds of testing areas across the globe. Last year the CAS’s Syllabus and Examination Committee’s Computer-Based Technology Task Force chose a vendor called Pearson VUE. In January staff contracted the computer testing company to offer virtual testing for the 2020 MAS-I and MAS-II exams in November. The partnership enabled the CAS to secure dates for the Fall Exams.

The transition from in-person to virtual testing was a “massive volunteer effort,” Zamperini says. The move included converting questions to an electronic format. Volunteers are part of the CAS’s Syllabus and Examination Committee, which is made up of roughly 800 volunteers.

But the effort is not yet over. For next year’s exams, volunteers have already started writing questions. Usually, Exams 7 and 9 are offered in the spring, and Exam 8 in the fall; all exams are planned to be presented next spring.

## Saving the Spring Meeting

**V**olunteers and staff were able to save the Spring Meeting by making major modifications, thanks to a pilot project in October 2019. Initially, the pilot project responded to the CAS's Employers Advisory Council seeking ways to reduce transportation costs.

The approach made sense for other reasons as well, says Nora Potter, CAS international and online professional education manager. Offering the In Focus Seminar virtually also made sense because it allows the international audience to participate, explains Potter, who found the vendor and facilitated the CAS's first virtual meeting. She adds that since the topic for the In Focus Seminar changes every year and attracts different audiences, the virtual format allows more flexibility.

Members of the Planning Committee were passionate about making sure that the Spring Meeting was going to

happen. The Planning Committee reached out to speakers, which was not a typical task, and the speakers were trained how to use the platform. Volunteers and staff from other departments learned how to use the virtual platform to help run the sessions.

"We had to turn around in five weeks what we normally do in eight weeks when working with a virtual vendor," Potter explains. The biggest challenge was persuading speakers to get on board with delivering virtual presentations, says David Core, CAS's director of professional education and research. Speakers had to meet technical equipment requirements at home without their company's IT department support.

"The Spring Meeting Committee wanted to do as many sessions as they could do," Potter recalls. Ultimately, the number of Spring Meeting sessions dropped from 40 to 25, Core notes. Still, the meeting offered 14.5 continuing education hours, only slightly less than the usual 15 to 16 hours.

**March 12.** The **CAS Board of Directors Meeting** is postponed until virtual availability.

**March 13.** Carter-Bey approves the **virtual Spring Meeting**. "Not only did our CEO and our leadership support us in our quick move to virtual, but so did the members," Dean says. "They trusted us to make it happen and let us run with it."

**March 16.** The **CAS Board of Directors Meeting** takes place virtually.

CAS employees take work home, not knowing when they would physically meet again at the Arlington, Virginia headquarters. Working virtually will continue into 2021.

**March 17.** This day marks the first all-CAS staff virtual workday. Fortunately, Dean says many employees had already begun teleworking about twice a week, easing the adjustment.

The **Spring Meeting** is the first to go virtual. (See sidebar, "Saving the Spring Meeting.") Announcements are sent to potential attendees.

**April 1.** The CAS signs a contract with its virtual platform vendor to offer the **Seminar on Reinsurance** online from June 1 to 2.

**April 7.** **Spring Exams** are postponed until November 2020. The CAS Board decides to move forward to standardized computer-based testing for exams, creating a safer and more

efficient process. (See sidebar, "Exams Anew.")

**April 13.** Planning and preparation begin for the new **CAS Student Central Summer Program** for college students who lost their internships due to the pandemic. (See sidebar, "CAS Introduces New College Actuarial Summer Program.")

**April 14.** The CAS signs a contract with its virtual platform vendor to offer the **Ratemaking, Product and Modeling Seminar** as a virtual event July 28-29.

**May 11-13.** The CAS's first large-scale online event, the **CAS Spring Meeting**, goes virtual with 732 attendees.

**May 22.** The CAS announces the **Student Central Summer Program**. Demand compels creation of a second, modified version for students who did not lose their internships.

**June 1-2.** The virtual **Seminar on Reinsurance** takes place, drawing 443 attendees.

**June 15.** The eight-week **CAS Student Central Summer Program** begins. The six-week program starts on June 29.

**June 17.** The CAS signs a contract with its virtual platform vendor to offer the **Annual Meeting** November 9-12.

**July 7.** For the **Casualty Loss Reserve Seminar (CLRS)**, the CAS signs a contract with its virtual platform vendor to offer the event September 15-17.

**July 21.** For events in 2021 (**RPM, Spring Meeting, Rein-**



## CAS Introduces New College Actuarial Summer Program

**W**hen CAS President Steve Armstrong learned that in-person internships were drying up due to the COVID-19 pandemic limitations, he came up with an idea. What if the CAS were to offer students a meaningful alternative?

What he did not expect, however, was the enthusiastic demand for the new CAS Student Central Summer Program. Specifically, more than 630 students enrolled in the program.

The summer program provided college students the opportunity to learn skills, network and acquire technical know-how in critical domains in the “property-casualty actuarial space,” says Dr. Victor R. Carter-Bey, the CAS’s CEO. He explains that, besides offering a play-book to gain actuarial experience, the summer program also builds greater relations between the CAS and students.

Volunteers were also enthusiastic. “The actuaries thought back to how they would have felt had their first summer internship been canceled,” says Tamar Gertner, CAS director of engagement, “and immediately wanted to help.”

In a mere six weeks, the 50-member University Engagement Committee and staff formed a task force to develop an eight-week program for students whose internships were lost or greatly modified. About 155 students from seven countries representing 70 universities took part in the CAS Internship Program, which included live webinars, assignments, a case competition and mentorship.

The program’s popularity also spurred the committee to develop an abbreviated offering for the 475 students who did not lose their traditional internships but still wanted to participate. The independent program was condensed to six weeks, but did not include the case competition and mentorship.

Program planning began on April 13. Gertner says that they were fortunate to have the curriculum already available, thanks to a catalog of material, including case studies

and competitions, which volunteers had been assembling for more than seven years. The educational information was originally developed to encourage actuarial professors, who tend to have expertise in life and health insurance, to introduce exercises specific to property-casualty coverage, she adds.

Starting Monday, June 15, the eight-week program covered topics including an introduction to P&C in-

surance and Excel, along with data visualization, ratemaking, reserving and predictive modeling. The abbreviated six-week program started on Monday, June 29. Both were completed on Friday, August 7.

Besides producing and assembling educational material, the task force found 94 mentors for the students. Gertner observes that students in the eight-week course ranked mentorship as the best part of the program. Those in the six-week independent program appreciated the opportunity to learn the material at their own pace while leveraging a private LinkedIn page developed for participants who wanted to collaborate on the material. Additionally, 23 CAS volunteers served as webinar presenters and 19 as case competition judges.

**Gertner observes that students in the eight-week course ranked mentorship as the best part of the program.**

# STUDENT CENTRAL SUMMER PROGRAM



surance and CLRS seminars), the CAS signs a contract with its virtual platform vendor to provide a virtual back-up, if needed.

**July 28-29.** Although a much smaller event with eight sessions instead of the usual 60, the virtual **RPM Seminar** still attracts 346 attendees.

**August 7.** College students successfully earn certificates for the first **CAS Student Central Summer Program**.

**September 15-17.** Core reports that the virtual **CLRS** draws 672 attendees, which was far more than expected.

**November 9-10.** The first virtual **Annual Meeting** will offer three complimentary webinars and three additional days of educational content. The CAS expects more than 750 attendees.

**November 10-13.** The first computerized and standardized MAS-I and MAS-II tests are offered virtually.

**November 19-December 9.** CAS Exams 5 through 9 are the first of their kind to be offered in a computerized, standardized format.

Looking ahead to 2021, five meetings are planned so far in either fully virtual or hybrid environment, two of which are already scheduled. They are:

- **March 15-17, 2021. Ratemaking, Product and Modeling (RPM) Seminar and Workshops** (online only).
- **May 23-26, 2021. CAS Spring Meeting, Orlando, Fla.** (in-person or hybrid).

Details for the Reinsurance Seminar (June), CLRS (September) and Annual Meeting (November) are yet to be determined.

## The future as far as we know

Although adjusting to the COVID-19 pandemic required a formidable effort by volunteers and staff, it also inspired the CAS community to discover better ways to serve the property-casualty actuaries now and in the future.

The response to the lockdowns and travel restrictions arising from COVID-19 concerns fast-tracked the already intended transition for exams from paper-and-pencil to computer-based standardized testing. The CAS Student Central Summer Program is now permanent, encouraging college students toward the P&C actuarial profession.

Until the COVID-19 crisis abates, virtual and hybrid meetings will continue. Besides switching to virtual meetings and exams, the new CAS chief learning officer, Jennifer Naughton, will help the CAS adapt to the differences in adult learning styles by packaging and presenting material differently.

Naturally, the CAS and its members look forward to holding in-person meetings again. “A lot of members do want to gather — not just for knowledge and professional education, but for networking, collaborating and exchanging of ideas,” Carter-Bey says. The CAS has been offering hybrid events through livestreaming since 2015. He expects more hybrid meetings in the future because they allow both in-person and virtual gatherings. ●

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*Annmari Geddes Baribeau has been covering insurance and actuarial topics for nearly 30 years. Find her blog at [www.insurancecommunicators.com](http://www.insurancecommunicators.com).*

# Volunteers Make Things Happen: *Galvanizing Efforts to Advance Inclusion, Equity and Diversity*

By MICHELE LIFSHEN

*With 2020 coming to a close, the CAS celebrates the efforts of all its volunteers. In this issue, we train the spotlight on a committee that thrives on the spirit of collaboration: The Joint CAS/SOA Committee for Inclusion, Equity and Diversity.*




As with the world at large, 2020 has been a watershed year for social consciousness within the actuarial field as a groundswell of advocates and allies are banded together now more than ever in pursuit of equality, equity and diversity within the profession.

Yet this culmination of tremendous dedication and volunteer efforts has been years in the making. Mallika Bender, FCAS, is devoted to leveling the playing field for underrepresented minorities in the actuarial profession. She became involved in the CAS Diversity Committee in 2015 and started leading it in 2017. In 2018, the CAS, SOA and the International Association of Black Actuaries (IABA) sponsored a joint groundbreaking study about diversity and inclusion that raised greater awareness of disparities in the actuarial field and the barriers impeding more Black, Latinx<sup>1</sup> and other minorities from entering the profession.

“The more and more we worked with the SOA, the more we realized that we should be working together officially because we were trying to solve the same problems,” Bender explains of the establishment of the Joint CAS/SOA Committee for Inclusion, Equity and Diversity (JCIED) in 2019. The JCIED combines three different committees across the CAS and the

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<sup>1</sup> Latinx is a gender neutral term.



SOA and includes representatives of the CAS, SOA, IABA, Organization of Latino Actuaries (OLA), The Actuarial Foundation and the newly formed Sexuality and Gender Alliance of Actuaries (SAGAA). Taking on the role of co-chair of the JCIED, Bender works to amplify the combined work of committees and stakeholder organizations as well as galvanize fellow leaders in support of underrepresented minorities at various stages of entry into the field.

### **Breaking barriers to the profession**

Bender's own story epitomizes many of the prohibitive hurdles that work against infusing the actuarial field with greater diversity and illustrates her passion and willingness to devote so much of her time to the JCIED. "I am South Asian, and I had never heard of the profession," she reflects. "I studied math and enjoyed it so during my senior year that I bought a book about careers for math majors





and started looking at it alphabetically: accountants, actuaries ....” The practical outcomes and business applications of the profession appealed to Bender so she did not get much further into the book.

Her entry into the field began by taking her first actuarial exam. “If I passed, I’d try to become an actuary — if I didn’t, then I’d go do Teach for America.” Bender did pass and was able to start in an entry-level position in 2007. But, she was lucky because, at that time, it was still possible to find employment as an actuary by taking just one exam with no actuarial internships under her belt.

Today, that type of entry into the field is rare. Most positions require two to four exams and one or two internships to even be considered for a position in the profession. And despite more schools now offering actuarial science programs and the increased popularity of the actuary profession, underrepresented minorities still have been left behind as many students remain unaware of the field.

### Raising awareness early

“When young people are just starting to think of their careers, they hear about professions through word of mouth, and that keeps us very homogenous,” echoes Rose Barrett, FCAS, who has been serving as the co-chair of the JCIED’s Career Encouragement Working Group. “One of the key barriers to entry, especially for underrepresented minorities, is awareness of the profession,” Barrett reiterates. “The reason why people become actuaries is because they know someone who is an actuary. If you don’t have someone in your network who is an actuary, you probably would never have heard of the

**“Being in the actuarial profession is highly lucrative ... the wealth gap between white families and Black and Hispanic families is enormous — by a factor of 10 or more,” Bender notes. “I think that if we were to be adequately represented across these groups, it would be a big step towards narrowing that wealth gap in the United States and more broadly.**



field or so you’d never pursue what you’d need to become an actuary.”

One of the Career Encouragement Working Group’s most vital initiatives has been the annual High School Actuarial Day. Launched in 2018, the program initially began with two national events and then expanded in 2019. Because of the pandemic, the event was held virtually this year, enabling high school students to still meet each other, learn about the actuarial field and engage in a math and word problem competition. In addition to providing opportunities to network and study with others pursuing actuarial careers, the program assists with financial support for actuarial study materials and exam preparation, internships, college scholarships and actuarial

exam fees.

### Rethinking hiring practices

“Our work is so vital to support students early in the process,” emphasizes Regina Kintana, ACAS, who has stepped up to volunteer her time and expertise as the next co-chair of the JCIED’s Career Encouragement Working Group. “The way actuaries are built is that many believe, ‘Well, if you pass the exams, you can become an actuary,’ but I think many of my colleagues don’t consider the equity issue. If a student doesn’t have \$250 to pay for each exam, that is a major barrier to advancing into the actuarial field.”

Kintana offers insightful actions that companies, recruiters and hiring managers can take to ensure that the actuarial workforce is diverse:

- Rethink your GPA requirements for new hires. If they are

too high, then you are potentially eliminating students who have had to work during school.

- Create graduate fellowship programs and admit career changers and recent grads to your internship programs. People from underrepresented groups often find out about the actuarial profession “late.” Rather than penalize them, instead create opportunities for this population.

- Offer scholarships that include internships to underrepresented groups. Help students from these groups with tuition costs and give them an opportunity to gain real-world actuarial experience.

- Reach out to the Organization of Latino Actuaries and International Association of Black Actuaries whenever you have early career job

openings. OLA and IABA can refer great candidates for you to interview and hire. Sponsor key events that these organizations hold throughout the year.

- Partner and network with organizations that support your target audience. For example, to increase your Latinx representation, sponsor the Association of Latino Professionals for America (ALPFA), a sister organization of OLA; attend their events and build relationships.

## Narrowing the wealth gap

For all the good work happening, still Black, Latinx and other minorities each make up only 2% of all working actuaries. Alex

**“Most people want to be comfortable at work and desire authenticity, especially after four years of college when you could be yourself and you didn’t have to hide your identity,” Gentile says.**  
**“If your company doesn’t want to support you from day one and asks that you put on a facade of someone you’re not, you don’t want to go back into the closet.”**



profession is highly lucrative ... one of the outside things I’ve learned more recently is that the wealth gap between white families and Black and Hispanic families is enormous — by a factor of 10 or more,” Bender notes. “I think that if we were to be adequately represented across these groups, it would be a big step towards narrowing that wealth gap in the United States and more broadly. That is something that we should be doing as a profession,” she says.

## LGBTQ empowerment and inclusion

While groups like IABA and OLA are changing the way companies look at recruiting, others are focused on advancing

Knights, FSA, an IABA member and another member of the JCIED’s Career Encouragement Working Group, points to the IABA’s recommendations for increasing the number of successful Black actuaries. These include:

- Partnering with local middle and high schools that have a majority Black population to sponsor career days or shadowing opportunities.
- Recruiting where diverse talent is and beyond traditional actuarial programs, particularly historically Black colleges and universities, known as HBCUs, and schools that IABA Scholarship recipients attend.
- Focusing on acumen and demonstrated aptitude leadership potential rather than number of exams passed and traditional methods for evaluating leadership experience.

“Being in the actuarial



LGBTQ workplace equality as well as personal identity and inclusion empowerment.

CAS members Matthew Gentile, FCAS, and Jake Akstins, ACAS, co-founded the Sexuality and Gender Alliance of Actuaries (SAGAA) with the support of the JCIED, which helped craft and amplify their groundbreaking session “LGBTQ+ Identities and Allyship.” The session drew a combined audience of nearly 500 people at the 2020 CAS Spring Meeting and follow-up webinar. Akstins and Gentile have been actively shoring up their volunteer-based organization by launching a LinkedIn page, hosting a virtual kickoff meeting and inviting key LGBTQIA+<sup>2</sup> leaders to sit on its board. With the goal of reaching a wider audience in the actuarial community, they wrote a Pride Month blog in the summer and continue to share content twice a week.

“We’re in the early stages but definitely making our way and focused on making an impact,” says Gentile, who met his co-chair while participating in diversity trainings when he and Akstins both worked at CNA.

“Our main mission for SAGAA is to create a safe space to facilitate connections between LGBTQIA+ actuaries and allies in order to engage in community-wide dialogue about LGBTQIA+ issues,” adds Akstins.

SAGAA stands upon three main pillars comprising its goals: (1) networking opportunities for its members and with allies; (2) professional development, which includes allyship training as well as a resume book and resources for LGBTQIA+ students that speak the language of actuaries by incorporating percentiles, stats and numbers; and (3) company education that includes sharing best practices to help make workplace culture more inclusive, such as adding pronouns to staff profiles and emails and interactive sessions with workplace scenarios to critique.

Akstins and Gentile are sensitive to workplace culture and point out a generational disparity regarding how younger employees view themselves in terms of feeling comfortable at work. “One of the things I hear all of the time is that many people will be retiring, and we need to get young people interested in the insurance industry. But very often insurance is not the first choice of a recent college graduate. They want to go work for Facebook or Amazon or one of the big names,” Gentile remarks. “There are significant reasons why people are

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<sup>2</sup> A common abbreviation for lesbian, gay, bisexual, pansexual, transgender, genderqueer, queer, intersexed, agender, asexual and ally community.

attracted to companies that enjoy a certain vibe. Sometimes older, senior leaders don't really understand why dress codes and the company culture are such important issues. But if I am someone who is non-binary, I don't want to have to adhere to a gendered dress code. Those types of things really become a struggle and an issue for employees who identify outside the gender binary."

Gentile points out that this conversation really needs to happen across the insurance industry. "Most people want to be comfortable at work and desire authenticity, especially after four years of college when you could be yourself and you didn't have to hide your identity," Gentile says. "If your company doesn't want to support you from day one and asks that you put on a facade of someone you're not, you don't want to go back into the closet. It's a huge deterrent to people and really inhibiting us from bringing in diverse talent."

### Bringing diversity to leadership

Another important subgroup of the JCIED concerns diversity in leadership. Co-led by Roosevelt Mosley, FCAS, the subgroup recently completed its major action plan around education and opportunity for members of underrepresented groups. The proposed 2020 SMART Goals are expected to be approved in the next month or so and include creating a library of leadership development materials focused on encouraging diversity; mentoring and supporting diverse leaders; coordinating partnership opportunities with the IABA, OLA and SAGAA; and implementing leadership orientation trainings and boot camps on the value of diversity and how to encourage more diversity on their committees.

"As an entire profession, the challenge will be gathering the information that we have and recognizing what we don't have," Bender says of the JCIED's profession-wide dashboard tool under development. The tool will dynamically illustrate the diversity of leaders and membership as it changes over time. To that end, the JCIED hopes to track and compare advances to an industry benchmark. "Bringing that information together across both associations into a combined view will be a really interesting thing for people to refer to and track the effectiveness of our efforts," concludes Bender.

### What the future holds

As we approach 2021, there are ongoing opportunities for CAS members passionate about diversity, inclusion and equity to

## Addressing Systemic Racism and Bias

### Are there rating factors being affected by systemic racism that we have allowed to flow into our models?



The whole industry has begun to focus on this question over the last few months, from the regulators to insurance companies and, of course, actuaries. We hold ourselves to high

standards when it comes to setting rates, but there is still the possibility that systemic racism has contributed to biased insurance outcomes. Actuaries have the unique combination of analytical skills, insurance industry knowledge and innovative thinking needed to evaluate the current situation and help develop solutions such that insurance works for everyone. We hope to see more activity on this in coming months.

— Mallika Bender, JCIED co-chair

### Are gender identity models changing for LGBTQIA+ clientele?



The vast majority of insurance products still have built-in gender binary without an in-between identity choice for something other than male or female.



Actuarial departments are leaps and bounds ahead of other areas within many companies in terms of inclusion, so we hope to be seeing a greater push for change across the industry.

— Matt Gentile and Jake Akstins,  
SAGAA co-founders

become involved. The recently formed CAS Diversity Impact Group offers high-impact, low-commitment opportunities as a micro-volunteering network for members to make a difference and stay in the know. ●

*Michele Lifshen (she/her/hers) is a writer and artist based in Arlington, Virginia.*



## ETHICAL ISSUES

### Actuarial Professionalism in Transactions

*Ethical Issues is written by members of the CAS Committee on Professionalism Education (COPE). The column's intent is to stimulate discussion among CAS members. Therefore, positions are sometimes stated in such a way as to provoke reactions and thoughtful responses on the part of the reader. The opinions expressed by readers and authors are for discussion purposes only and should not be used to prejudge the disposition of any actual case and do not modify published professional standards as they may apply in real-life situations.*

**T**his article deviates from our familiar format of posing a hypothetical case with questionable circumstances and actions and asking the reader to consider both sides of the case. The following case is based on real events; the names have been changed to protect those involved. The facts imply that ethics were broken or severely bent, so we discuss how an extension to our traditional actuarial ethics relate to the case.

In the early 2000s, An Insurance Company (AIC) bought the reserves of Generic Reinsurance Company (GRC) through a loss portfolio transfer (LPT). AIC did this to be able to show an increase in their carried reserves. Stock market analysts at the time saw the increase of reserves as a good sign, totally missing the disconnect between absolute reserves levels (higher because of new exposures) and increased reserve adequacy. AIC's strategy worked and was rewarded with an increase in their stock price. AIC's management thought that taking advantage of the analysts' poor understanding of reserve adequacy was a fair play.

It was revealed years later that the LPT was always intended to be unwound. Instead of GRC paying AIC for taking on GRC's reserves, AIC paid GRC

to be able to carry the reserves on AIC's books for a few years. This was documented in a secret side agreement. AIC didn't buy the reserves, they "borrowed" the reserves instead. The unwinding of that transaction, along with other accounting problems, led to large fines for

guidance that, had it been in place and followed at the time, would have raised critical flags that could have exposed the risks that the transaction posed. If subsequent deals were measured against those flags instead of the tarnished reputation of "finite risk," the damage

**The reputational damage to both firms was substantial. It affected more than the two companies involved; all of finite risk reinsurance took a reputational beating. As a segment of the reinsurance industry, finite risk reinsurance was never the same.**

AIC and legal problems for individuals of both companies who were involved in the transaction.

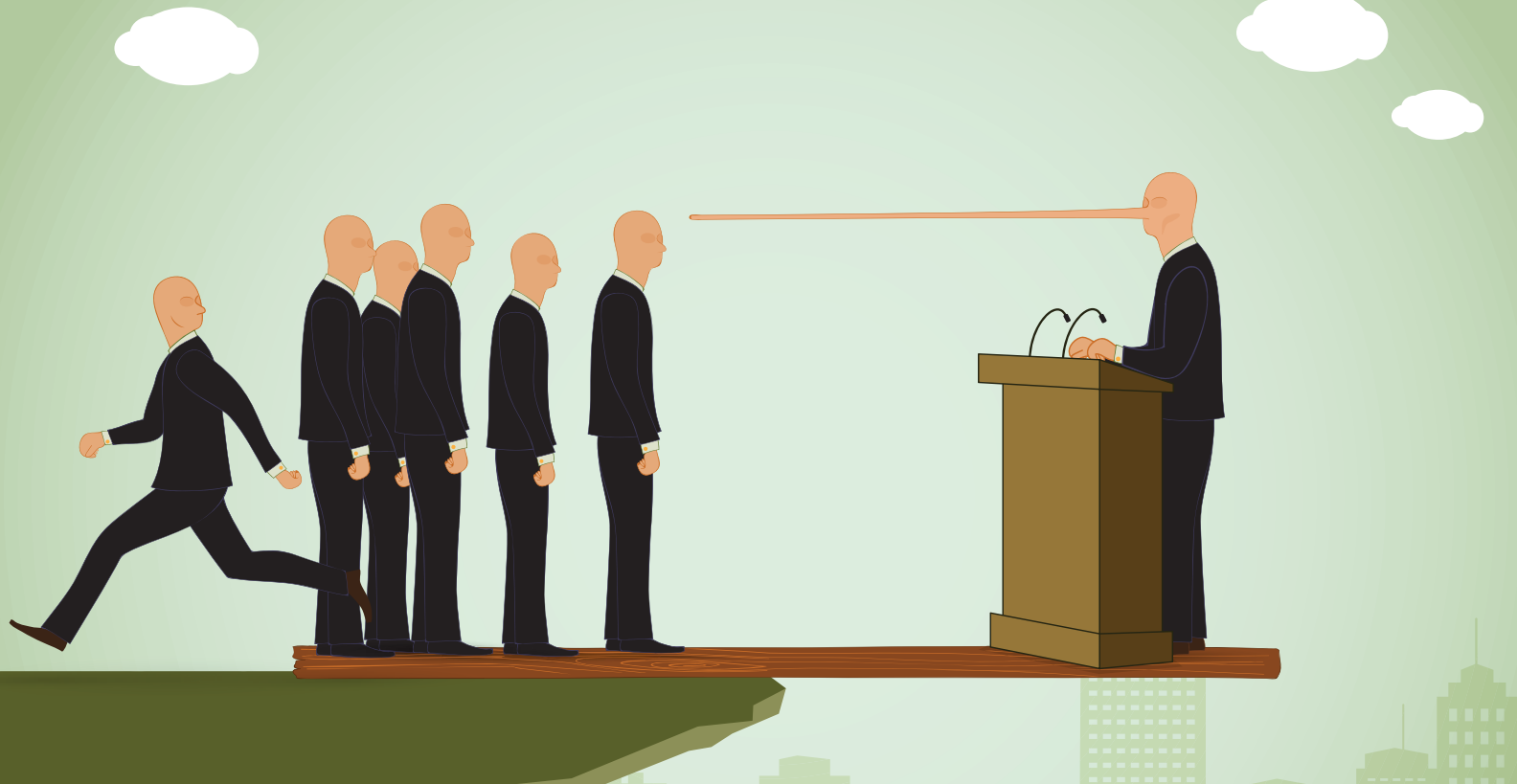
The reputational damage to both firms was substantial. It affected more than the two companies involved; all of finite risk reinsurance took a reputational beating. As a segment of the reinsurance industry, finite risk reinsurance was never the same. It's arguable whether there were abuses beyond this case, but nonetheless, many clients steered away from deals that had previously been considered non-controversial because people heard "finite risk" and associated it with this transaction.

This article discusses subsequent

to that part of the reinsurance market might have been dramatically reduced. Before we get into that discussion, we will explore the context within professionalism.

"Professional Integrity" headlines the CAS Code of Professional Conduct as Precept 1. Building beyond that key element of integrity, ethics encompass other components of actuarial mores. That broader scope combines the Code of Conduct, Statements of Principles and Standards of Practice that can be viewed as a collection that defines our actuarial ethics.

"Complex Structured Financial Transactions (CSFT)" (*OCC Bulletin*



2007-1<sup>1</sup>), a bulletin of the U.S. Department of the Treasury, Office of the Comptroller of the Currency, draws attention to elements in transactions that could give rise to heightened legal or reputational risks. It applies to structured financial transactions in many industries but was likely motivated by problems in the banking world. The insurance industry has its share of conceivable problems, though this article only addresses a couple examples.

After reading this article, consider if you recall cases where actuaries challenged such offences. A natural desire to please clients combined with pressure from company management, stockholders or boards of directors to produce profits warrants a reminder of potential pitfalls.

The LPT transaction outlined above raises questions on each of the features in the CSFT bulletin.

The CSFT bulletin warns against undocumented (or secret) side agreements. Without knowing about the side agreement in this case, the whole nature

of the LPT looked normal and appropriate. With knowledge of it, the actual operation of the transaction exposed other flagged features.

The bulletin flags concerns if there is lack of economic substance or business purpose. It further highlights the particular concern of circular transfer of risk. The AIC-GRC deal appeared to be

purpose was to increase the reported level of reserves without AIC actually taking on the reserve risk itself. That was the circular transfer of risk. The LPT appeared to transfer reserve risk to AIC, then the side agreement guaranteed that GRC would take the risk back.

The bulletin also flags questionable accounting, tax or regulatory objectives.

**Because of the secret side agreement to unwind the transaction, there was in fact no lasting economic substance. The stated business purpose of the LPT — to transfer GRC reserve risk to AIC — was a mirage.**

substantial. LPTs are valuable to manage loss risk, control the size of liabilities in the balance sheet, and achieve reserve diversity or reduce volatility. Yet because of the secret side agreement to unwind the transaction, there was in fact no lasting economic substance. The stated business purpose of the LPT — to transfer GRC reserve risk to AIC — was a mirage. The undisclosed business

In this case, the goal to post reserves was a reasonable objective. But the bulletin also warns that the accounting needs to follow the substance of the transaction. In this case, AIC reported the transaction inconsistent with the substance of the deal by not accruing for the return of reserves that would happen once the side agreements were fulfilled. An interesting element here is

<sup>1</sup> <https://www.occ.gov/news-issuances/bulletins/2007/bulletin-2007-1.html>

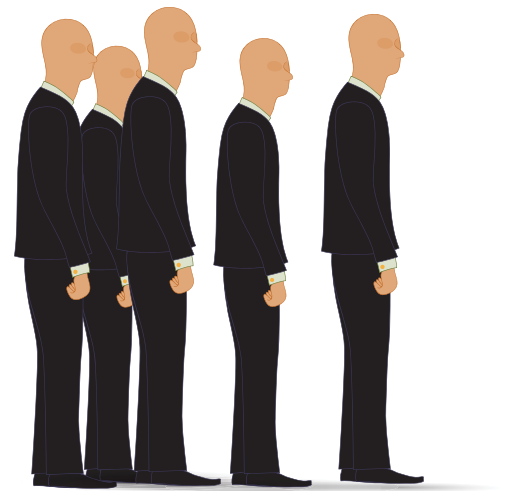
that the accounting treatments of AIC and GRC were different. AIC accounted for the LPT as reinsurance, while GRC accounted for the transaction as a deposit. Because there was insufficient risk transferred, deposit accounting was the appropriate treatment of the deal. Despite correct accounting by GRC, the reputational and legal problems landed as much on them as they did on AIC.

The bulletin warns of two other characteristics that could give rise to increased reputational risk. Material economic terms outside of market norms could signal suspicious behavior elsewhere. Also, disproportionate compensation relative to the risk transferred or services provided might flag a potential problem. Elements of the AIC-GRC transaction could have triggered either of these two flags. What would the right price have been for a full risk-transfer LPT? Was the fee paid to the reinsurer for the side agreement appropriate for borrowing reserves?

For purposes of playing out the issues, this article is using an extreme case. Actuaries often face similar questions with more subtlety.

A recurring example is the use of commission swings where the commission adjusts based on actual experience. They work by the setting minimum and maximum commissions that would be payable for poor or good experience, respectively. Initially the commission payment equals a provisional rate somewhere between the min and max. Commission pays for the reinsurers' share of insurance company expenses. When higher than those expenses, it creates an override to reward the company for sharing their good business. When lower, it creates a burden on the company since they will need to pay for

**Actuaries' obligations go beyond the parties involved in transactions. Many of the CFST-inspired questions can remind us why the public needs actuaries.**



expenses from other business or even policyholder surplus.

Commission swings could create potential reputational problems in two main ways.

1. By its nature, a commission swing creates a circular transfer of risk. As reinsurers pay more loss within the range of the swing, those losses are reimbursed by the ceding company through return commissions. If the minimum commission is significantly below the company's expenses, the insurer and reinsurer should be sure that the company can afford the extra share of expenses they would need to cover. If the company can't afford that reimbursement, then they wouldn't be adequately protecting their surplus despite having reinsurance in place for that very purpose.
2. If the company fails to accrue for return commissions after losses would require it, then they would be misstating their financials. While this is an accounting failure, sometimes actuaries are best positioned to notice the risk and should communicate it to assure account-

ing follows the substance of the contract terms.

Here are some questions motivated by the CSFT bulletin that both the insurance and reinsurance actuaries should consider for commission swings.

- Can the insurance company afford to accrue for return commission and will they appropriately do so?
- Is the objective of the commission swing to encourage the regulator to allow a company to operate with excessive leverage?
- Are the terms consistent with market norms?

Actuaries' obligations go beyond the parties involved in transactions. Many of the CFST-inspired questions can remind us why the public needs actuaries. Actuaries' professional guidance can help them recognize misleading or overly complex transactions that create insolvency risks otherwise hidden.

Suggested further reading within the actuarial ethic are the Code of Conduct, Precept 1 on "Professional Integrity" and Precept 13 on "Violations of the Code," as well as ASOP 7 on "Analysis of Insurer Cash Flows." ●

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## GitHub and Continuous Integration By BRIAN FANNIN, FCAS, CAS RESEARCH ACTUARY

I love errors. I mean, I just absolutely love them. Mistakes are the things that reveal to me all of the things that I think I know, but actually don't. Don't get me wrong, I love the positive validation that comes with answering something correctly. Perfect score on my exam? Don't mind if I do. But errors are even better. Getting something right tells me what I've done. Mistakes tell me what I need to do.

Submitting an R package to CRAN<sup>1</sup> is a great place to pick up errors. There are a battery of tests that any package must pass before being posted to CRAN, and they're all interesting in their own way. There's the fairly obvious: "checking extension type ... Package." (Measure twice, cut once.) There are the slightly obscure: "checking serialization

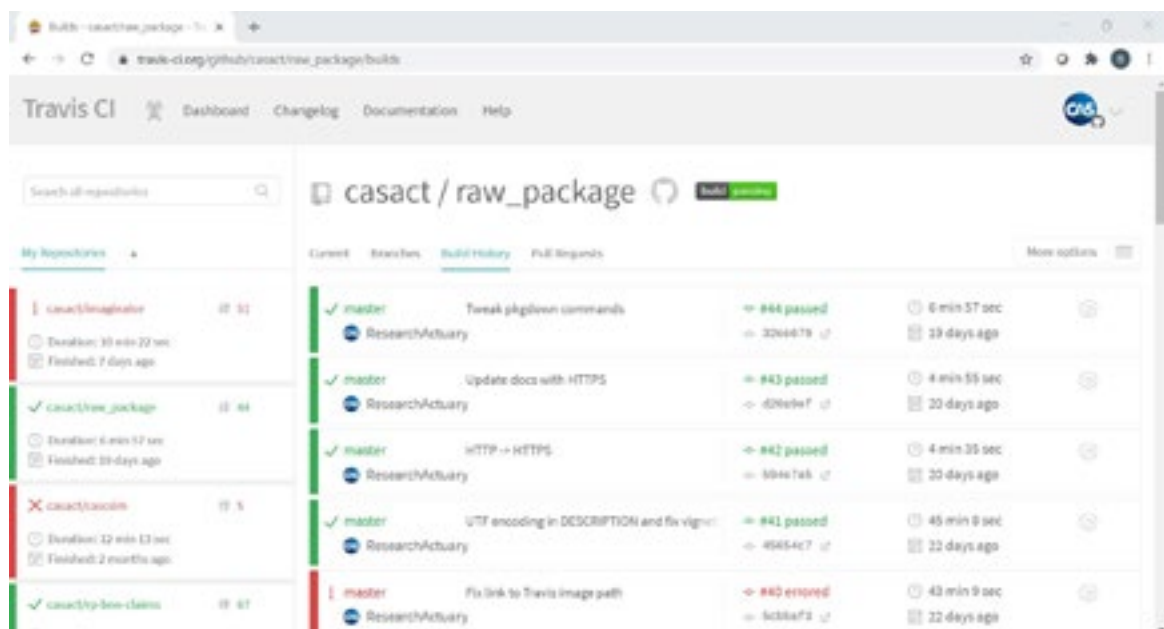
versions." (I'm glad someone's looking in on that.) And then there are the rather interesting: "checking for detritus in the temp directory." ("Detritus," you say?) This is all very good and reasonable stuff, and it's a big reason why the R ecosystem has flourished. Users know that all CRAN packages have passed a set of basic checks to ensure that they will work, as advertised on multiple platforms. For me, though, I just love fixing all the tests that I *don't* pass the first time around.

Just as much as errors, I also love being lazy. If you ask me whether it's raining, I don't even want to look out the window; I'll just call the dog in and see if it's wet. (I wish I could take credit for that folksy saying. I first heard it on a Redd Foxx record.) I've spent countless

hours and a lot of late nights figuring out new ways to wallow in my own indolence. It's fair to say that I won't rest until I can do nothing but rest. So you can imagine how happy I was when I figured out how to learn about my own mistakes *and* be lazy at the same time!

It turns out there's a way to have the CRAN check run *automatically* whenever your repo (repository) gets pushed to a git-based cloud platform like GitHub, BitBucket or GitLab. This is possible through the magic of "continuous integration." What does continuous integration mean? Simply put, it's a way to automate software construction whenever one component changes. This could be anything from running a set of tests, building a website or pushing a model to production.

**Figure 1: Travis build history**



<sup>1</sup> <https://cran.r-project.org/>

In this article, I'll focus on the testing. Software is complex. Even straightforward systems involve many different elements, any one of which could be changing at any given time. At enterprise scale, where components are designed and built by multi-person teams and need to be integrated, this gets really complicated really fast. Changes made to one component need to be individually tested, but we also need to ensure that the whole system can accommodate the changes. Enter continuous integration (CI), which automatically runs those tests whenever any changes are detected in any component.

There are a number of options in the marketplace that vary in terms of open versus closed license and pricing.

Travis<sup>2</sup> and AppVeyor<sup>3</sup> are two of the more popular options, but Wikipedia lists<sup>4</sup> about a dozen others. Travis is the first one I started to use and the one I'll discuss here.

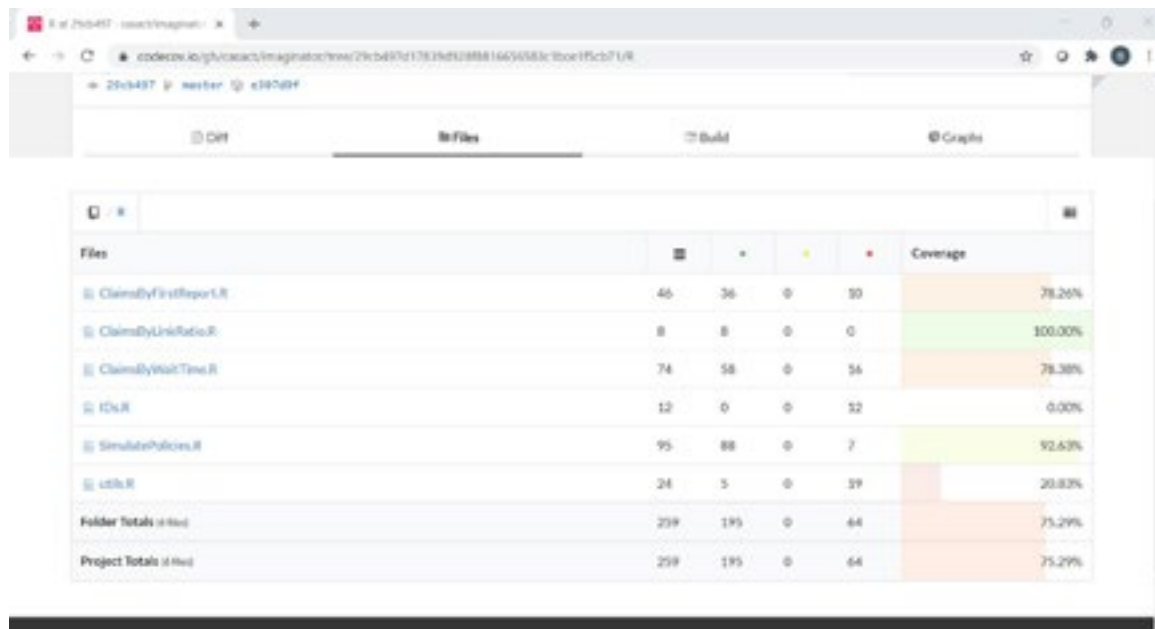
Years ago, I built the R package *raw* (R Actuarial Workshops) to ease the hassle of providing data and a basic setup for attendees of the CAS R workshops. Though the package is pretty basic, even something as simple as *raw* has been built and rebuilt many times. Figure 1 shows a history of package builds. All of the builds were done by Travis in response to a push of the repo up to GitHub. Note how easily my laziness gets accommodated. I was going to push to GitHub anyway, but Travis is now doing work for me!

In the listing, we can see which

code changes lead to errors and which lead to results that may pass a submission to CRAN. Green passes; red doesn't. Travis will even send me an e-mail letting me know what happened. Each entry corresponds to a specific git commit. This means that I can easily look at the source code and understand where things went wrong. Another great feature of the Travis CI setup is that it will test on multiple R installations. CRAN requires package developers to test on the development version of R. Keeping up with the leading edge of R is a slight headache even for an R enthusiast like me. Using a CI tool outsources that.

Things get even better. The basic test for R in Travis is to run the battery of CRAN checks that I alluded to above.

**Figure 2: Portion of source which actually gets tested**

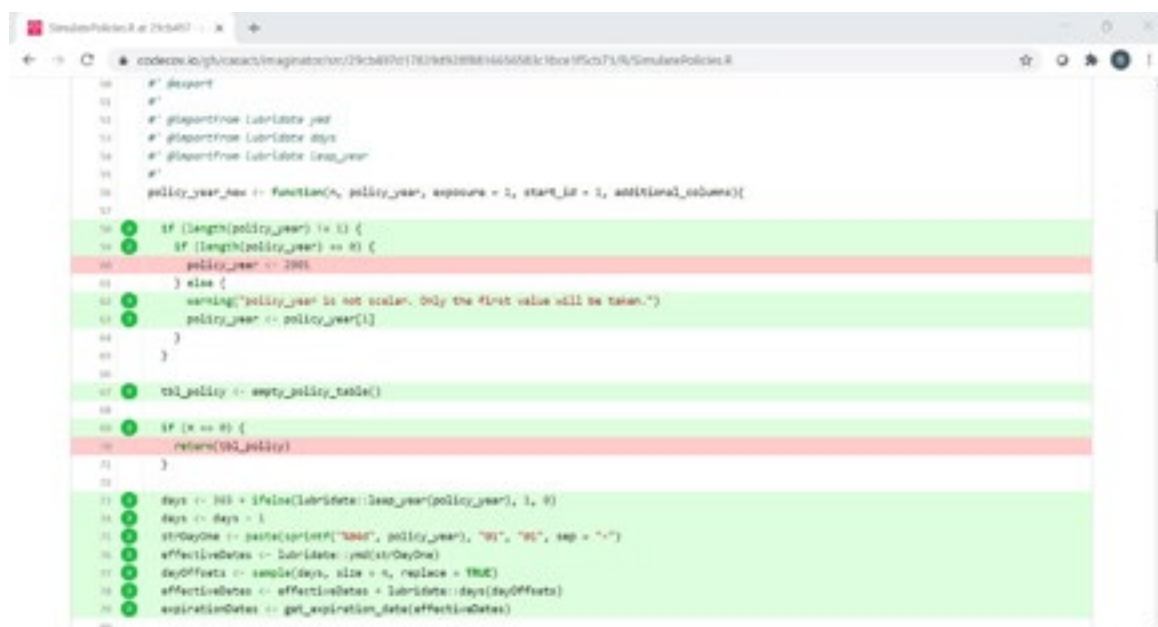


<sup>2</sup> <https://travis-ci.org/>

<sup>3</sup> <https://www.appveyor.com/>

<sup>4</sup> [https://en.wikipedia.org/wiki/Comparison\\_of\\_continuous\\_integration\\_software](https://en.wikipedia.org/wiki/Comparison_of_continuous_integration_software)

Figure 3: Which code lines are getting tested?



But CRAN checks are only as good as the unit tests contained in your package. If you don't write any tests using a framework like testthat,<sup>5</sup> you'll have no idea whether your code will even work. Ideally, we'd like to execute every line of code in our package and ensure that we're getting the results we expect. However, when I write unit tests, there's no guarantee that the tests will traverse every path of execution in the code I've written. For this, we need to look at "code coverage."

Code coverage shows how much of your source actually gets called during unit testing. For this, I use a service called Codecov (<https://codecov.io/>), but there are others out there. Whenever Travis finishes building my R package and running CRAN checks, it sends a report over to Codecov. Figure 2 shows the results from *imaginator*, a claim simulation package that I wrote. We see

a list of source files and the portion of executable lines which get tested. Note that one file "ClaimsByLinkRatio.R" is fully tested, whereas one, "IDs.R" doesn't get tested at all. The others are somewhere in between.

I can zoom in on those source files to see where I need to make changes. Take a look at Figure 3. The green lines execute during a test and red ones don't. Non-executable content like comments is ignored. In this specific instance, I'm checking to see whether a user has passed in a zero-length vector. If that happens, I'd like to give some feedback to the user or rely on a sensible default or both. However, the red shading on line 60 shows me that I don't have any tests that consider that.

This is fantastic news! It means that I have made a mistake, but I have a very lazy way to find it. I can now write a new unit test that attempts to trigger

execution of line 60. After I commit that change and push it to the cloud, do I need to do anything? I do not. Travis and Codecov do all of that for me.

So what does all this mean?

- Learn to love mistakes. They're incredibly valuable and shouldn't be wasted.
- If you start using git in the cloud, you can plug into a wide array of tools that will:
  - Increase operational efficiency ("efficiency" == "laziness").
  - Enhance transparency ("What checks did we run before we released this to production?").
  - Reduce enterprise risk ("What tests did we leave out?").

As always, I'd love to hear what experiences others have with this element of their workflow. Until then, I'm going to go take a nap. ●

<sup>5</sup> <https://testthat.r-lib.org/>



# COLLABORATIVE

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## FRESH LOOK BY STEPHEN J. MILDENHALL

# Bailey and Simon Minimum Bias Reexamined, Part 1

Actuarial Review introduces a new column, *Fresh Look*, that aims to reassess core areas in actuarial science with more current tools and practices. Part 2 will appear in Actuarial Review January-February 2021.

### Bias

Society is beset with problems of bias, inequity and unfairness. Insurance, in particular, relies on the perception and reality of fairness. Insureds will only pool their risk with one another when they believe everyone pays a fair and unbiased rate. So insurers must not only treat all insureds equitably, but they must also be able to demonstrate that they do so. However, their complex and granular rating plans make that more challenging. As a result, media and regulators have begun to question and investigate rating models. The National Association of Insurance Commissioners' (NAIC) Casualty Actuarial and Statistical Task Force drafted a white paper describing the Regulatory Review of Predictive Models and completed a Price Optimization White Paper in 2015. Following the lead of the industry, which is always taking a step back to review and modify existing literature or white papers in the face of new evidence and studies, the CAS continues to evolve and modify its communication and education on emerging topics and trends. Against this backdrop, now seems a good time to reexamine two very famous papers published in the *Proceedings of Casualty Actuarial Society*, the precursor to *Variance*, that propose minimizing bias in insurance rates.

Insurance rates should be based on data and not prejudice. Establishing fairness is challenging and encompasses

many issues, such as the use of proxy variables and differential impact. The modeler must use a rigorous and transparent framework that avoids arbitrary, unnecessary or hidden assumptions. This column explains that a generalized linear model (GLM), the natural outgrowth of minimum bias methods, satisfies these requirements, providing an ideal model-building platform. While it is possible to build a flawed GLM, it is reassuring to know it provides a neutral starting point.

It is important to remember that residual error is a modeling fact of life. An oft-quoted aphorism states, "All models are wrong; some are useful." Models simplify to be useful, but by simplifying, they omit details and cannot perfectly

U.S. actuaries are familiar with the CAS Ratemaking Principle that rates should be "reasonable, not excessive, not inadequate and not unfairly discriminatory."

Another set of criteria, almost as well known and pre-dating the CAS principles by nearly 30 years, was written down by Robert Bailey and LeRoy Simon in their 1960 *Proceedings* paper "Two Studies in Automobile Insurance Ratemaking." A 1963 follow-up by Bailey, "Insurance Rates with Minimum Bias," developed them further. It is instructive to reexamine Bailey and Simon's criteria in light of what we have learned since then and the issues we currently face as the front-line guardians of fair insurance rates.

**Insurers must not only treat all insureds equitably, but they must also be able to demonstrate that they do so. However, their complex and granular rating plans make that more challenging. As a result, media and regulators have begun to question and investigate rating models.**

replicate the real world. A statistical model balances fidelity to sample data with out-of-sample predictive power to maximize its usefulness.

An actuarial statistical model creates a rating plan to predict expected loss costs and distributions for each insured. Various standards are used to judge if a rating plan is acceptable.

### Criteria

Bailey and Simon's concern was personal automobile ratemaking in Canada. At the time, pricing used a two-way classification plan combining a (very coarse) class plan and a merit (experience) rating plan. Their four criteria are as follows, with italics in the original. A set of pricing relativities is acceptable if:

1. It reproduces the experience for each class and merit rating class and also the overall experience, i.e., is *balanced* for each class and in total.
2. It reflects the relative *credibility* of the various groups involved.
3. It provides a minimal amount of *departure* from the raw data for the maximum number of people.
4. It produces a rate for each subgroup of risks that is close enough to the experience so that the differences can reasonably be caused by *chance*.

## Assumptions

The Bailey-Simon criteria rely on several assumptions.

*Balanced* by class means the average rate equals each class's experience rate, summed over the remaining classes. This formulation gives particular prominence to the average, or mean, and uses the difference from the average to measure balance (residual error). It also implies that each class is large enough to be fully credible.

The discussion of relative *credibility* appeals to the general statistical principle of weighting an estimate in inverse proportion to its standard error. Bailey and Simon give each cell's experience a weight proportional to the square root of its expected number of losses because they assume the variance of experience loss grows with its expected value.

Bailey and Simon frame the third criterion in terms of "inequity" or deviation from experience. It is worth quoting their discussion because of its topical relevance.

Anyone who has dealt directly with insureds at the time of a rate increase, knows that you

can be much more positive when the rate for his class is very close to the indications of experience. The more persons involved in a given sized inequity, the more important it is.

The ability to explain rates was as necessary in 1960 as it is today! Bailey and Simon quantified the *departure* criteria using the average absolute deviation.

Bailey and Simon addressed *chance*, the fourth criterion, using weighted  $X^2$  statistic. Based on Canadian experience, they determined that the difference between the actual and expected relative loss ratio, scaled by the former's standard deviation, is approximately represented by a standard normal distribution, justifying their selections. They then derived a minimum bias iterative scheme to solve for the minimum  $X^2$  relativities and show that the result is balanced.

Bailey's 1963 paper generalized the minimum bias iterative scheme and discussed additive (cents) and multiplicative (percents) models, as well as the need for a measure of model fit distinct from average model bias (which is zero, by design). He proposed minimum square error and minimum absolute error measures for this purpose.

Bailey and Simon's principal innovation was to calculate all class relativities at once, reflecting different mixes across each variable. Until their work, rating factors were computed one at a time, in a series of univariate analyses. (This is different from considering interactions between rating factors. Their two-factor rating plan was too simple to allow for interactions.) The minimum bias method was, and remains, very appealing: It is easy to explain and

intuitively reasonable (who doesn't want their rating plan to be balanced by class?) and is simple to program. It is no wonder it proved so popular.

## Critique

Certain aspects of Bailey and Simon's work may be tricky for today's statistically trained actuary to follow. The use of the word *bias* is nonstandard. In statistics, an estimator is unbiased if its expected value over samples gives the correct value. Bailey and Simon use *bias* to mean residual error, the difference between a fitted value and an observation, and as a measure of overall model fit. Balance is also used to describe the residual error in a fitted value.

The focus on the sample mean as a sufficient statistic for the population mean needs no explanation.

The concept of balance by class relies on the form of the linear model underlying the classification. Bailey and Simon use a two-way classification model. The rate for risks in class  $(i,j)$  is  $x_i + y_j$  in the additive model. The underlying design matrix only has elements 0 and 1. In a more general setting, including continuous covariates, the design matrix would be more complex. Some analog of balance would still apply, but it would be more complicated to explain.

Bailey and Simon place great emphasis on the concept of fully credible rating classes, meaning ones where the model rate should exactly equal the experience rate. A statistical approach quantifies the outcome distribution explicitly and produces tighter and tighter confidence intervals for the model rate, rather than insist on equality. Some sampling error or posterior uncertainty remains for the largest cells, even if very small.

**The minimum bias method was, and remains, very appealing: It is easy to explain and intuitively reasonable (who doesn't want their rating plan to be balanced by class?) and is simple to program. It is no wonder it proved so popular.**

The claim that the variance of experience grows linearly with expected losses in each class is most interesting for the modeler. It reflects a traditional actuarial compound Poisson claims generating process. A severity distribution and an annual frequency characterize each risk cell. The distribution of aggregate losses has a Poisson frequency distribution, with mean proportional to expected losses, and a fixed severity distribution. Its variance is proportional to its mean. These assumptions can fail in at least two ways.

First, there can be common risk drivers between insureds, such as macroeconomic conditions or weather. These result in a correlation between insureds. A negative binomial frequency captures the effect, replacing the Poisson. The resulting aggregate distribution has a variance of the form  $\mu(a+b\mu)$  for constants  $a$  and  $b$ , where  $\mu$  is the mean. The variance of a large portfolio grows almost quadratically with its mean.

Second, a quadratic mean-variance relationship can arise for catastrophe risks, where portfolio growth corresponds to paying a greater proportion of losses over a fixed set of events. The actuary's understanding of the loss generating process informs the possible relationship between the mean and the variance of losses in a cell. It should fall somewhere between linear and quadratic.

Bailey and Simon test the fourth

criterion, that each subgroup's experience should be close enough to its rate that differences could reasonably be caused by chance, using an aggregate  $X^2$  statistic. There is a clear opportunity to enhance model assessment using a granular, cell-by-cell evaluation of chance deviation, based on the modeled distribution of losses.

Finally, the discussion of both the third and fourth criteria introduce modeler discretion: Which measure of overall model bias should be employed? Least squares, minimum absolute deviation and minimum  $X^2$  are all mooted. The modeler should avoid unnecessary choices. Is there a better way to select a measure of model fit?

### Homework

In the next issue, we will see how modern statistics has developed the ideas presented so far. As a former college professor, I would be remiss if I didn't give you some homework to prepare. Although data science deals with massive data sets and builds very complex models, you can understand its fundamental problems by considering straightforward examples. Here are two that capture our essential conundrum. It would help if you considered how to solve them before reading the sequel.

The first is a two-way classification, with each level taking two values. As an example, imagine auto liability experience, with factors youthful operator yes/

no and prior accidents yes/no. The table shows the pure premium in each cell. You want to fit an additive linear model.

Level 2 \ Level 1	No	Yes
No	1	2
Yes	3	7

The second is a simple linear regression problem. You want to fit a line through the following data, which could represent severity over time. The covariates are a constant (not shown) and date. Dates are equally spaced and have been replaced by 0, 1 and 2.

Observation	Covariate	Observation
1	0	1
2	1	2
3	2	4

In both examples, assume the same volume of data underlies each observation, so there is no need for weights. In the first, make the Bailey and Simon assumption that the total experience across each level of each dimension is credible, i.e., the row and column totals are credible.

For partial credit, start by laying out the first question so it looks more like the second one.

The difficulty is clear: There are fewer parameters than data points, so the requested model will not fit exactly. How should you apportion the model miss? Obviously, with a clever selection of response function you can create many models that do fit exactly — or *over-fit* exactly. Please resist the urge to expound upon these and focus on the stated question. ●

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## IN MY OPINION By GROVER EDIE

## Knowledge Is Power, or Is It?

“Knowledge is power” is an often-repeated phrase. Some attribute it to Thomas Jefferson, as it appears in some of his correspondence.

The Brits attribute it to Sir Francis Bacon. Regardless of who said it, I hear it regularly.

As mathematicians, we know that we could as equally say “power is knowledge.” The word *is* means *equals*, and so the equation can be written either way. I have known many individuals in my past who thought that, because they had ascended to a certain position, they knew all they needed to know about the position to which they had been appointed. To them, power is knowledge. You might also be able to name several in your past who would say, or imply, “I am right because I am the boss.”

Many of us have actuarial credentials or advanced degrees or both. We possess an immense amount of knowledge of our industry, which is impressive. Yet some of us are powerful indeed, and others of us are not so. Why the difference?

In physics, mechanical energy can be in the form of potential energy or kinetic energy. Potential energy derives its energy from its position or positions, like a coiled spring or a weight suspended on a rope. Once the spring is released, or the rope is cut, the potential energy becomes kinetic energy.

Our knowledge is not kinetic energy, that is, energy in motion. It is potential energy. And it is very situation-

specific potential energy. The value of knowledge is topic-specific.

I have often applied actuarial principles in non-actuarial venues. I wondered what would happen if we were to apply some of actuarial standards for data to the information in our everyday lives. Actuarial Standard of Practice 23 (ASOP 23) on data quality seemed to be a good place to start. Selected sections from ASOP 23 are listed in italics, followed by my comments.

### How appropriate is the data for its intended purpose?

#### 3.2. Selection of Data

*b. select the data for the analysis with due consideration of the following:*

1. *whether the data constitute appropriate data, including whether the data are sufficiently current....*

Knowing how to differentiate an equation is knowledge specific to a given set of circumstances: It will hardly be of value when trying to survive in the jungle. Knowing which jungle plants can safely be eaten is useful in a jungle survival situation but of little value in an office setting.

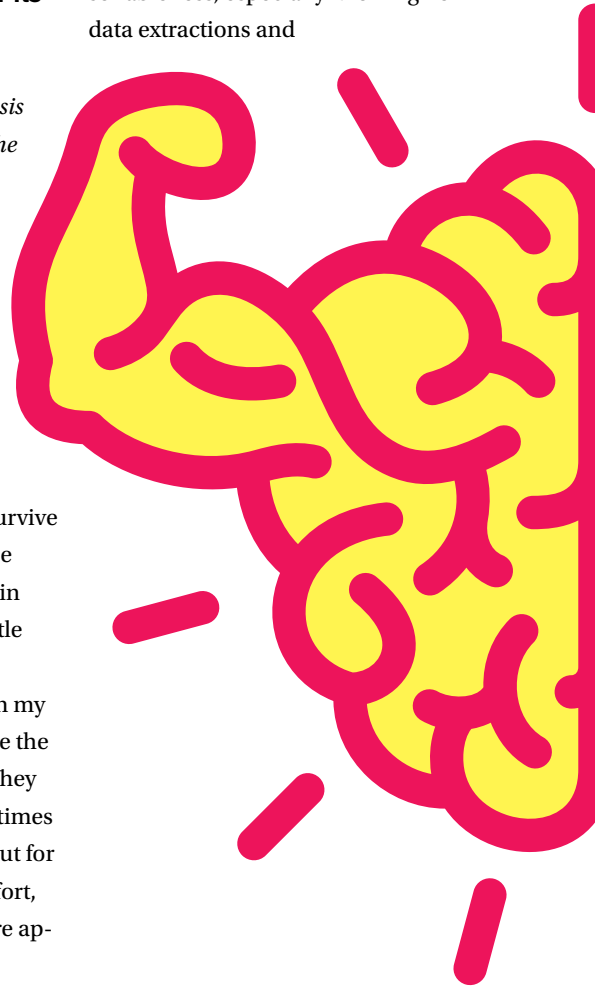
I have several thermometers in my office, which seems to have become the repository for lost thermometers. They often give different readings, sometimes differing by two or three degrees. But for the purpose of measuring my comfort, that is close enough; that is, they are ap-

propriate for their intended use.

### How reasonable and comprehensive are the necessary data elements?

*3.2.b.6. the availability of additional or alternative data and the benefit to be gained from such additional or alternative data, balanced against how practical it is to collect and compile such additional or alternative data;*

We habitually check the data for reasonableness, especially knowing how data extractions and



compilations can go awry. We also look to see if the data is comprehensive or if there are elements missing.

A recent news article stated the probability of dying of COVID-19 in Michigan was one in a million. With about 10 million people in Michigan, that would put the number of deaths at 10. But the Johns Hopkins University site lists the number of deaths in Michigan at 7,200. In other news articles, the reported death rates are in the low single digits per million. I thought the “one in a million” statistic was unreasonable.

News can be distorted when only part of the story is told, and we’ve seen a lot of that lately. Sometimes, a friend or colleague will do the same. We need to hear, as Paul Harvey used to say, “the rest of the story.”

### Is the data sufficient?

#### *3.2.b.5. any known significant limitations of the data....*

With so much attention being given to climate change, I am concerned about the precision of measurements in the past. I certainly wouldn’t use the thermometers in my office to track temperature for such a study. How were the thermometers of the past calibrated? Is that the same calibration that we use today? When measurements are being trended in the fractions of a degree, are there limitations on the “old” data?

### Cost and benefit of obtaining alternative data

#### *3.2.b.6. the availability of additional or alternative data and the benefit to be gained from such additional or alternative data, balanced against how practical it is to collect and compile such additional or alternative data....*

This item deals with the practicality of the alternate data, if available.

Many of us rely on free news feeds, but are they unbiased and accurate? What news are they omitting? Subscribing to an online newspaper or news feed can cost money, but it might be worth the cost.

### Considering bias in the samples

#### *3.2.b.7 Sampling methods, if used to collect the data*

Sampling penitentiary inmates to see what percent are in favor of more lenient sentencing will give a very different result than sampling the same number of victims of the inmates’ crimes. There are several famous surveys that later proved to be misleading due to the bias in the selection criteria, and we should

be aware of the sampling population and technique.

For us, it usually means the sampled data needs to accurately represent the population under consideration. Recall the 2016 presidential election and the erroneous polling that occurred.

For an underwriter, it means that what is reported about the risk — its physical attributes and condition, financial solidity, adherence to statutes and a host of other factors — is true and accurate.

### Considering the source

#### *3.5 Reliance on Data Supplied by Others.*

In an actuarial setting, we usually trust our data to be accurate and appropriate when it is provided by reliable sources. But outside our professional lives, we are surrounded by all sorts of erroneous data, and often an outright lie can cause action or do great damage, even though it is not true. Those in possession of the truth are sometimes powerless to combat the onslaught of falsehoods.

Is the person being quoted a competent, unbiased and knowledgeable individual on the topic? Or are they being quoted because of their fame or notoriety?

We should be careful not to believe statements without some sort of validation, and certainly not pass “facts” along without examining their accuracy. Are the statements made by a person consistent with their prior statements?

### Conclusion

I think we should consider applying the practices contained in ASOP 23 outside of our professional sphere. In short, as Abe Lincoln purportedly said, “Don’t believe everything you read on the internet.” ●



**IT'S A PUZZLEMENT** By JON EVANS

# Deserts of Prime Numbers

Define a *desert* of prime numbers as a sequence of  $k$  consecutive integers  $\{n, \dots, n + k - 1\}$  none of which is a prime number. How big can such a desert be? For any  $k$  that allows a  $k$ -sized desert, can you specify a starting integer  $n$  for a desert of size  $k$ ? Furthermore, for any  $k$ , what is the maximum number of non-overlapping  $k$ -sized deserts? Can you also specify the starting integers for a set of this many non-overlapping  $k$ -sized deserts? Even if you cannot answer all these questions for any  $k$ , can you answer them for  $k=10^{100}$  specifically?

## Ping-Pong Team Strategy

Two teams of ping-pong players, Teams A and B, face off in matches of one on one. Each match ends when a player scores one point and the losing player is eliminated from further play. Individual player strength,  $S$ , is the average number of seconds until a player gives up a point. The first team to run out of players loses.

Before each match, Team B first selects a player and then Team A selects. What are the best and worst, respectively, possible strategies for Team B and the corresponding probabilities of winning?

Team A		Team B	
Player	Strength (sec.)	Player	Strength (sec.)
A1	40	B1	90
A2	30	B2	20
A3	25	B3	15
A4	20	B4	10
A5	15	B5	5

What about for Team A? What if Team A selects first?

Here is Clive Keatinge's solution.

Because each player's loss rate is independent of the opposing player, the total time that elapses before all of the players on a team have lost is independent of the ordering of opposing players. Because the loss rate is constant for each player, the total time that elapses before all of the players on a team have lost is the sum of five exponential distributions with different rates, which is a hypoexponential distribution with probability density function

$$f(x) = \sum_{i=1}^5 \lambda_i e^{-\lambda_i x} \prod_{j=1, j \neq i}^5 \left( \frac{\lambda_j}{\lambda_j - \lambda_i} \right)$$

where the  $\lambda$ s are the loss rates. The probability that the total time exceeds  $x$  is then  $1 - F(x) = \sum_{i=1}^5 e^{-\lambda_i x} \prod_{j=1, j \neq i}^5 \left( \frac{\lambda_j}{\lambda_j - \lambda_i} \right)$ .

To produce the probability of a win for Team B, multiply the probability density function for Team A by the



probability that the total time for Team B exceeds  $x$ , and then integrate over  $x$ . If  $\lambda$ s represent the loss rates for Team A, and the  $\mu$ s for Team B, then the result is

$$\sum_{i=1}^5 \sum_{r=1}^5 \left( \frac{\lambda_i}{\lambda_i - \mu_r} \right) \prod_{j=1, j \neq i}^5 \left( \frac{\lambda_j}{\lambda_j - \lambda_i} \right) \prod_{s=1, s \neq r}^5 \left( \frac{\mu_s}{\mu_s - \mu_r} \right).$$

Plugging in the loss rates given yields a win probability of 0.4909 for Team B, regardless of the ordering of the players on either team.

A solution was also submitted by Bob Conger. ●



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Our **NORTHEAST** client plans to hire a **REINSURANCE PRICING ACTUARY** into a leadership role for Position 89315. FCAS to manage a team working on reinsurance pricing, analytics and catastrophe risk modeling. Reports to Chief Actuary.

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**CHICAGO** consulting group plans to hire a **PROPERTY AND CASUALTY ACTUARIAL ANALYST** for Position 89563. 80-95K comp. Ideal candidates will have 1-5 years of property and casualty actuarial experience. Programming skills required. Experience with pricing or capital modeling is a definite plus.

