

# actuarial REVIEW

VOL 48 / NO 5 / SEPTEMBER-OCTOBER 2021

PUBLISHED BY THE CASUALTY ACTUARIAL SOCIETY 

## Beyond Triangles:

Capturing Insights From  
New Analytic Technology



CAS Research Roundup 2021

Meet the 2021 CAS University Award Winners



**Trusted by actuaries  
worldwide.**

[www.actuarialcareers.com](http://www.actuarialcareers.com)  
800.766.0070


Pauline Reimer, ASA, MAAA

**PRYOR**  
*Executive Search*


# The Perfect Fit...

**It Takes One to  
Know One...  
An Actuary  
Placing Actuaries**

To have Pauline personally advise you on finding your perfect fit, please contact her at:

 pauline@ppryor.com

 www.ppryor.com

 (516) 935-0100 x 307 or  
(866) 6-ACTUARY

For five decades, local, national, and international insurance communities have benefited from Pryor's exceptional recruitment services.

Our renowned Actuarial, Risk, and Modeling Division has been directed by Pauline Reimer, ASA, MAAA, for the past thirty-five years.



Celebrating  
**30 YEARS**  
in Actuarial  
Recruitment



**Browse our Remote and P&C jobs: [www.dwsimpson.com/job-seekers](http://www.dwsimpson.com/job-seekers)**

### **Manager and Pricing Actuary (Pennsylvania/Remote)**

Worldwide insurance group is seeking a senior level ACAS or FCAS with 5+ years of actuarial experience and demonstrated experience managing actuarial functions and leading others. This individual must possess the knowledge to make rate filings across all states and most lines of business, the ability to price large accounts, the ability to develop rates to support new coverages, and the ability to work with data in support of this work. Candidate must be highly organized, possess superior attention to detail, and have excellent project management and communication skills. Proficiency in Microsoft Office and SQL is required. (#50896)

### **Actuary - Risk Management (Missouri/Remote)**

One of the world's leading providers of re/insurance has an exciting opportunity for a student actuary or ACAS with at least 5 years of P&C actuarial experience to further develop their career within an international business environment. The focus of the role will be on reserving, economic valuation, and financial reporting. Candidate should have actuarial valuation and reporting experience, knowledge of statutory and regulatory environments in the US, and outstanding interpersonal and communication skills. Must be able to work under pressure and be fluent in English, Spanish is a plus. IFRS experience is highly preferred. (#51100)

### **Consulting Actuary (CA/FL/NJ/OH/TX/Remote)**

Join a team that knows how to handle their workload without working overtime. Consulting client with multiple locations across the nation is in search of a designated ACAS or FCAS with 6+ years of actuarial experience. This individual will be responsible for preparing and managing the completion of reserve analyses, rate level indications, competitive research, and rate/rule filing support, as well as the development of pricing for new products. Candidate should have a strong understanding of advanced actuarial concepts, a reserving background, and excellent communication skills, including the ability to deal with clients and handle multiple projects. Proficiency in Excel, Word, and Access is required. Management experience strongly preferred. (#51223)





### **Product and Actuarial Manager (Virginia/Remote)**

Drive change and innovation in the industry. Virginia based insurance company has a great opportunity for a CPCU, ACAS, or FCAS with at least 8 years of product management, actuarial, underwriting and/or insurance marketing experience as well as 3 years' management experience. This individual will manage the strategic development and implementation of new and existing insurance products as well as optimize the ability to profitably grow the Property and Casualty business. Strong leadership, effective communication, and excellent analytical skills are required. Candidate must have demonstrated product management expertise, advanced MS Office skills, and knowledge of developing long-term profit and growth strategies that yield results. (#51323)

### **RETAINED - Chief Actuary, Vice President of Actuarial (Arizona)**

Chief Actuary role! Well-established P&C company with over a century in business has a great opportunity for a senior level FCAS with at least 10 years of experience to lead the actuarial department. This individual will have broad strategic and executional responsibility spanning all core actuarial functions. Candidate must be a strategic thinker, possess extensive leadership experience, and be able to solve both actuarial and business problems. A background in Personal Lines is preferred, but Commercial Lines experience is also acceptable. Must have strong pricing skills, reserving is a plus. (#51167)

**Sign up for actuarial job updates, today!** Simply register at <https://jobs.dwsimpson.com>

    | [www.dwsimpson.com](http://www.dwsimpson.com) | (800) 837-8338 | [actuaries@dwsimpson.com](mailto:actuaries@dwsimpson.com)



## departments

### 4 EDITOR'S NOTE

- Building for the Future

### 6 PRESIDENT'S MESSAGE

- An Actuary with an Action Plan: A Conversation with Sarayyah Baksh, FCAS, ACIA

### 8 READER RESPONSE

- Further Reflection on Pronouns

### 10 MEMBER NEWS

- Comings and Goings
- The CAS Will Hold 2021 Annual Meeting in Person
- Calendar of Events
- In Memoriam
- In Remembrance
- Spotlight on Diversity
- Thank You to 2020-2021 Society Partners

### 36 PROFESSIONAL INSIGHT

- Ethical Issues
- Jane Austen, Actuary?

### 42 VIEWPOINT

- In My Opinion

### 44 SOLVE THIS

- It's a Puzzlement



FSC  
LOGO

## on the cover **Beyond Triangles: Capturing Insights From New Analytic Technology**

By ANNMARIE GEDDES  
BARIBEAU

Reserving actuaries  
are challenged to look  
beyond triangles to  
improve reserving practices.

**30**



## **CAS Research Roundup 2021** **16**

By BRIAN FANNIN, ACAS, CAS RESEARCH ACTUARY

In the “wild, woolly world of CAS research,” Fannin identifies an emerging theme.

## **Meet the 2021 CAS University Award Winners** **26**

Four universities have won the coveted 2021 CAS University Award for fostering the development of the next generation of P&C actuaries.

*Actuarial Review* (ISSN 10465081) is published bimonthly by the Casualty Actuarial Society, 4350 North Fairfax Drive, Suite 250, Arlington, VA 22203. Telephone: (703) 276-3100; Fax: (703) 276-3108; Email: ar@casact.org. Presorted standard postage is paid in Lutherville, MD. Publications Mail Agreement No. 40035891. Return Undeliverable Canadian Addresses to PO Box 503, RPO West Beaver Creek, Richmond Hill, ON L4B 4R6.

The amount of dues applied toward each subscription of *Actuarial Review* is \$10. Subscriptions to nonmembers are \$50 per year. Postmaster: Send address changes to *Actuarial Review*, 4350 North Fairfax Drive, Suite 250, Arlington, Virginia 22203.

# actuarialREVIEW

The magazine of the  
Casualty Actuarial Society

**Editor in Chief**  
Grover M. Edie

**Managing Editor and  
Director of Publications**  
Elizabeth A. Smith

**Graphic Designer**  
Sonja Uyenco

**Marketing & Corporate  
Relations Manager**  
Clarisa Figueroa

**Associate Editor**

## Copy Editors

Colleen Arbogast	Rebecca Knackstedt
Rebecca Armon	David Levy
Daryl Atkinson	Ana Mata
Karen Ayres	Stuart Montgomery
Nathan Babcock	Katrine Pertsovski
Sean Bailey	Shama S. Sabade
Glenn Balling	Eric Savage
Robert Blanco	Michael Schenk
Sara Chen	Robert Share
Meng-Fang Chung	Craig Sloss
Todd Dashoff	Rebecca Sze
Charles Grilliot	Sukaina Visram
Stephanie Groharing	James Weiss
Julie Hagerstrand	Radost Wenman
Kenneth S. Hsu	Ian Winograd
Wesley Jenq	Gerald Yeung
Rob Kahn	Yuhan Zhao

**Humor Editor**  
Michael D. Ersevim

## Downtime

## Explorations

Glenn G. Meyers	James C. Guszczca
Donald F. Mango	Stephen Mildenhall

## Puzzle

Jon Evans  
John P. Robertson

## Advertising

Al Rickard, 703-402-9713  
arickard@assocvision.com



Expertise. Insight.  
Solutions.®

For permission to reprint material from *Actuarial Review*, please write to the editor in chief. Letters to the editor can be sent to [AR@casact.org](mailto:AR@casact.org) or the CAS Office. The Casualty Actuarial Society is not responsible for statements or opinions expressed in the articles, discussions or letters printed in *Actuarial Review*. To opt out of the print subscription, send a request to [AR@casact.org](mailto:AR@casact.org).

Images: Getty Images

© 2021 Casualty Actuarial Society.  
[ar.casact.org](http://ar.casact.org)

**editor's**NOTE By ELIZABETH A. SMITH, AR MANAGING EDITOR

## Building for the Future

For as long as I have been with the CAS (24 years this past June), the organization has constantly examined its path, always with an eye to the future. It seems as if the CAS has been in an age of enlightenment and a renaissance since its inception in 1914. We have documented evidence in the *Proceedings* and the CAS centennial history book of the care and concern CAS members have taken to ensure that the actuarial profession grow and adapt and, most impressively, be ready to take on the next challenges and opportunities. The CAS renaissance has taken place in many different areas, some of which some members were a bit wary and not in complete support, but time marches on and the Society has progressed.

To borrow a phrase from CAS Research Actuary Brian Fannin, I found a definite theme emerging when putting together this issue of *Actuarial Review*: building for the future. Fannin's feature story rounds up all of the CAS's research work taking place over the last year and describes the Research Council, a new structure that directs actuarial research strategies.

Our story on the 2021 CAS Universi-

ty Award Winners strongly demonstrates our theme. These schools are educating the best and brightest to become members of the actuarial profession. This is the sixth year for this award, and each

**It seems as if the CAS has been in an age of enlightenment and a renaissance since its inception in 1914.**

year the winners up their games in terms of what they are doing to create bridges between students, educators and potential employers. University students benefitting from these programs will one day join our members' places of employment. What a boost to the CAS pipeline of potential members!

In the latest presidential video series, CAS President Jessica Leong talks with Sarayyah Baksh, a recent CAS Fellow who is working her action plan into a fascinating actuarial career. All CAS members, especially potential CAS members, should watch this innova-

*Editor's Note, page 8*

*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.

SEND YOUR COMMENTS AND SUGGESTIONS TO:

*Actuarial Review*

Casualty Actuarial Society

4350 North Fairfax Drive, Suite 250

Arlington, Virginia 22203 USA

Or email us at [AR@casact.org](mailto:AR@casact.org)

**Follow the CAS**





# CARFAX Mileage Data Helps You Avoid Premium Leakage and Remain Competitive

---

Learn More

[CarfaxForInsurers.com](http://CarfaxForInsurers.com) OR





## An Actuary with an Action Plan: A Conversation with Sarayyah Baksh, FCAS, ACIA

*For my President's Message columns, I will be talking to distinguished actuaries who embody the new Envisioned Future for the CAS. Videos of these interviews will be available as Web Exclusives on the Actuarial Review website and the CAS YouTube channel.*

Sarayyah Baksh is an actuary without borders. She grew up in Trinidad and Tobago, went to college in Canada, and her career has spanned the Canadian, Latin American and European markets. She's currently living in Paris, a personal dream of mine.

Her impressive career is not an accident as Baksh is also an actuary with a plan, represented in the acronym SPAN.

### **S is for skills.**

You should know your technical skills inside out, backward and forward. As for soft skills, Baksh says it's important to know how to work on a team, how to interview and, especially, how to communicate. Baksh has come a long way from her first internship interview, where she didn't prepare and went in thinking "I'm going to show them how great I am; they are going to love me; and I'll make a joke or two." Baksh keeps her presentation skills honed with speaking engagements,

most recently for the nonprofit *Actuaires du Monde* (formerly Actuaries without Borders) and for actuarial science clubs at the Trinidadian and Jamaican campuses of the University of West Indies, available on YouTube at [bit.ly/SBaksh\\_UWI](https://bit.ly/SBaksh_UWI). Although she enjoys presenting, it doesn't come without its

### **... Baksh's approach to her life and career ... [is] thoughtful, open and clearly gets results.**

challenges — she gets butterflies leading up to speaking engagements and makes sure to rehearse multiple times — but once she gets started and finishes, the sense of accomplishment is fantastic.

### **P is for professionalism and persona.**

When you are early in your career, think about what kind of person you want to be in a professional setting. Do you have a role model? For Sarayyah, her mom was her role model, with a successful corporate career and sharp entrepreneurial skills — and this advice is not just for actuaries starting out. I remember when I took my first leadership role at work. I asked myself, "What kind of leader do I want to be?"

### **A is for action plan.**

Baksh advises actuaries to think deliberately about their career paths and to re-evaluate those plans every couple of years to make sure that it is still what they want. Ask yourself where you want to go and what are the steps you're taking to get there. Sarayyah Baksh has

been very deliberate about her career, and she hasn't been afraid of taking risks.

### **N is for networking.**

Share your action plan with your network and they might be able to help you. Baksh wanted a job that could hone her Spanish language skills. By sharing this with her network, she landed her job in Miami. That job would have never been available to her if she had kept her wish to herself.

I love Baksh's approach to her life and career. It's thoughtful, open and clearly gets results. I appreciate that Baksh has shared a very actionable path forward for actuaries to think about their career. ●





# DON'T STAY UP LATE SETTING RESERVES.

## (UNLESS THAT'S YOUR THING.)

**STILL STRESSING OVER DEADLINES? GET SOME PEACE OF MIND WITH ARIUS.** Our cloud-based and desktop P&C reserve analysis solutions automate, streamline, and add reliability to your entire reserving process. Find out why companies like yours rely on Arius every day for better, more efficient analysis.

[arius.milliman.com](http://arius.milliman.com)

Milliman **Arius**<sup>®</sup>

**Editor’s Note**

*from page 4*

tive video series. There is so much to learn from actuaries who have excelled in their careers and are changing the definitions and roles of actuaries in the business world.

Borrowing another phrase, this time from *AR* writer Annmarie Geddes Baribeau, reserving is an actuary’s “bread and butter” and one of the key services in the actuarial arsenal. In our cover story, Baribeau delves into some of the fundamental changes taking place in reserving as well as the obstacles to progress among practitioners. Be prepared to learn something new about an established practice.

Finally, this past July the *AR* team lost a long-time member, Marty Adler, a writer/editor of the Downtime column. Marty was a wonderful man and a heck of a table tennis player. He will be dearly missed.

Thank you all for reading! I hope you enjoy this issue of *AR*. ●

**ACTUARIAL REVIEW LETTERS POLICIES**

*Letters to the editor may be sent to ar@casact.org or to the CAS Office address. Please include a telephone number with all letters. Actuarial Review reserves the right to edit all letters for length and clarity and cannot assure the publication of any letter. Please limit letters to 250 words. Under special circumstances, writers may request anonymity, but no letter will be printed if the author’s identity is unknown to the editors. Event announcements will not be printed.*

**Further Reflection on Pronouns**

**Dear Editor:**

I recently re-read the article “The Importance of Pronouns: A Nonbinary Actuarial Analyst’s Perspective” by Arius Johnson, after hearing concerns about the “political” nature of the article. I would encourage everyone to do the same and judge for themselves whether this is truly a public policy article, as I suspect that doing so will lower the temperature of recent discussions as to whether the CAS is becoming politicized.

Arius Johnson begins with a description of their experience coming out in the workplace, followed by concrete suggestions of ways to show courtesy and professional respect to transgender colleagues in the workplace. Nowhere in the article did I find public policy recommendations — the article is about

etiquette, not politics. Moreover, an article about workplace conduct is exactly the type of content I would expect to see published by a professional association. Given that the author explicitly recommends for readers to “encourage your colleagues to [disclose pronouns] if they feel comfortable, but don’t force anyone to do so,” it is quite a stretch to suggest that they are advocating for a government policy on this topic.

As a cisgender male, it’s impossible for me to personally experience the same events as the author, so the only way I can learn about these experiences is by listening and reading. I would like to thank Arius Johnson for taking the time to describe their experience, recognizing that the work effort in highlighting the experiences of underrepresented groups often falls disproportionately on the members of those groups.

— Craig A. Sloss, Ph.D., FCAS, FClA  
(he/him/his), Actuarial Review Editor ●





# Boost your pricing process with advanced analytics

Akur8 is the next generation pricing platform for P&C insurers



## Deliver speed-to-insights

Find the best predictive signal at a fraction of the time by reducing time-to-modeling by 10X, empowering teams to focus their limited resources on decision-making and fine-tuning.



## Increase collaboration across teams

Collaborate more effectively, onboard new team members quickly, and transition projects easily thanks to documentation notes and an easy to use interface created for actuaries.



## Ensure compliance through transparency

Minimize costly compliance issues & risk of adverse selection thanks to higher controls and transparency over the rate making process.



## Boost Performance

Modernize processes and become leaders in pricing sophistication by enhancing the capabilities and toolset of your actuarial teams.



[www.akur8.com](http://www.akur8.com)

For more information or to request a demo, please contact:

North America  
Boriana Trifonova  
[boriana.trifonova@akur8-tech.com](mailto:boriana.trifonova@akur8-tech.com)

Other regions  
Brune de Linares  
[brune.delinares@akur8-tech.com](mailto:brune.delinares@akur8-tech.com)

## They trust us:



Duck Creek Technologies

Munich RE

XCEEDANCE



wefox



## COMINGS AND GOINGS

**CAS Fellows Janet G. Lindstrom and Katy J. Bradica** have been included in *Insurance Business's* Elite Women 2021, the magazine's annual list of distinguished women in insurance. This list recognizes businesswomen for their achievements and initiatives in 2021 and highlights their professional accomplishments and contributions to the industry. An influencer and change-maker in the insurance industry for over 30 years, Lindstrom is the executive vice president, chief transformation officer for Arch Insurance North America. She is passionate about mentorship, serving as a mentor through Mentium 100 and is Arch's executive sponsor for the insurance group's mentoring program. Bradica is chief pricing actuary at AXA XL and leads a team of actuaries and data scientists dedicated to improving risk selection and pricing. Known for her diversity and inclusion initiatives, Bradica is the executive sponsor for RISE, a business resource group dedicated to developing colleagues from underrepresented racial and ethnic groups.

**Brian Duperreault, ACAS**, executive chair of AIG's Board, is the recipient of the 2021 *Business Insurance* Lifetime Achievement award for outstanding accomplishments in the insurance and risk management sector. He will receive the award during a virtual ceremony on September 30. During his nearly 50 years in the insurance sector, Duperreault transformed some of the biggest companies in the industry. For more on Duperreault, see his video interview with CAS President Jessica Leong on the CAS YouTube Channel.

**Dale Porfilio, FCAS, MAAA**, has been named chief insurance officer at the Insurance Information Institute (Triple-I). Porfilio has nearly 30 years of senior-level insurance industry executive experience with three publicly traded companies. He was most recently a senior vice president and corporate chief actuary at Genworth Financial, where he was responsible for the actuarial practice for all product lines and countries. Porfilio will also work closely with other Triple-I subject matter experts to develop industry insights and analyses, act as a media spokesperson on thought leadership matters and deliver board-level presentations at industry events and to Triple-I member companies.

**Gary Haase, FCAS**, will join CNA as chief operating officer from Catalina Holdings (Bermuda) at the start of the 4th quarter of 2021. Haase occupied various leadership roles during two decades at Catalina Holdings, gaining expertise in operational management and strategy, actuarial science, complex reinsurance commutations and practical application of big data and analytical technology solutions for the insurance industry. He is currently Catalina's Group chief operating officer and occasionally teaches graduate-level courses in statistics and data analysis at the New York University Stern School of Business.

**Larry A. Haefner, FCAS**, CNA's former chief actuary, will serve as the organization's interim CFO. During a 13-year career at CNA, Haefner was closely aligned with the company finance team. His cross-functional understanding of

CNA paired with his proven expertise in the P&C insurance business will ensure a smooth transition for the company.

**Daniel Linton, FCAS, MAAA**, and **Roberto Perez, FCAS, MAAA**, have joined Pinnacle Actuarial Resources, as the consulting firm's senior consulting actuary and consulting actuary, respectively. Linton was previously a partner and consulting actuary at Select Actuarial in Nashville. His work included reserving and forecasting in alternative risk markets with a focus on large deductible, self-insured entities including Fortune 500 corporations, captives and municipal risk pools. Perez has been in the P&C insurance industry since 2016, most recently for The Hartford. His experience includes pricing for commercial automobile and commercial multiple peril, and loss and premium reserving including general liability, commercial automobile and workers' compensation. Linton and Perez volunteer on the CAS Syllabus and Examination Committee and Perez serves on the CAS Latin America Regional Committee. ●

EMAIL "COMINGS AND GOINGS" ITEMS TO [AR@CASACT.ORG](mailto:AR@CASACT.ORG).

See real-time news on our social media channels. Follow us on Twitter, Facebook, Instagram and LinkedIn to stay in the know!

# The CAS Will Hold Its 2021 Annual Meeting in Person

The CAS is excited to announce that the 2021 CAS Annual Meeting will be a hybrid event with options for in-person or virtual attendance. The in-person component will be held in California at the Marriott Marquis San Diego Marina from Nov. 7-10, 2021. With livestreaming over multiple days and in two different rooms, virtual attendees will have more opportunities to participate than ever before.

“After more than a year of virtual events, I’m ecstatic to have the chance to end my presidential term at an in-person Annual Meeting,” said CAS President Jessica Leong. “I am especially looking forward to welcoming and congratulating our new Fellows and Associates in person.”

The 2021 Annual Meeting will feature an onsite experience that provides more ways for attendees to engage with each other during sessions and networking events, both of which will enhance learning opportunities and the onsite experience. These networking opportunities will include connecting with Regional Affiliate members, first-time attendees, industry peers and DE&I affiliates’ members. In-person sessions will have significantly enhanced group interaction as part of the program and expanded CE opportunities not available to the virtual audience.

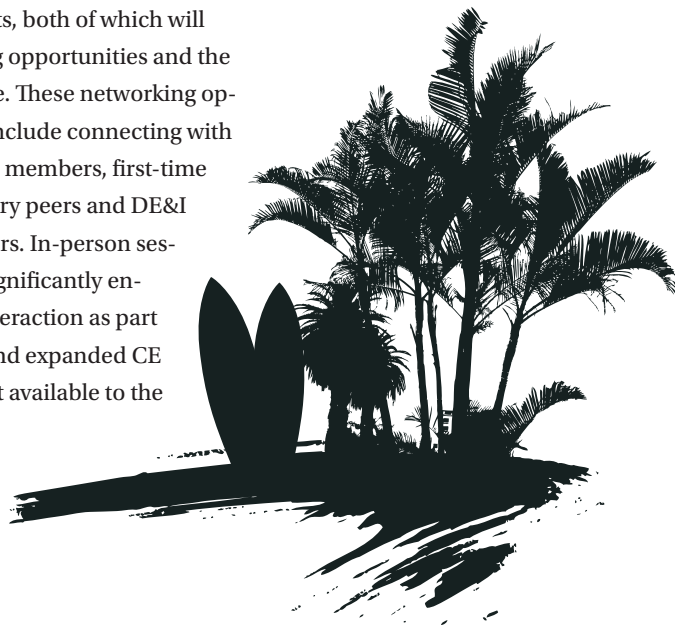
Annual Meeting sessions will be

delivered in two ways:

- In-person panels and speaker presentations livestreamed to the virtual audience.
- Highly interactive sessions delivered in person only.

“Our Annual Meeting has long been an opportunity for our members to see each other year after year, fostering the sense of community that the CAS is famous for,” said CAS CEO Victor Carter-Bey. “We are delighted to be able to offer options for those that want to attend in person or from their own homes or offices.”

The CAS is committed to following all local health guidelines to protect the health and safety of eventgoers. Space will be limited, and a sellout is expected, so hopeful attendees are encouraged to register early to secure their spot. Registration opened August 2021. ●



## CALENDAR OF EVENTS

**November 7-10, 2021\***

Annual Meeting  
Marriott Marquis San Diego  
Marina  
San Diego, CA

**May 15-18, 2022**

Spring Meeting  
Disney's Coronado Springs Resort  
Orlando, FL

**May 17-20, 2022**

Actuarial Colloquia  
(hosted by the CAS)  
Disney's Coronado Springs Resort  
Orlando, FL

\* Visit [casact.org](http://casact.org) for updates on meeting locations.

## IN MEMORIAM

Martin Adler (FCAS 1969)  
1934-2021

James T. French (ACAS 1968)  
1931-2021

Dale A. Nelson (FCAS 1965)  
1935-2021

Paul M. Wiegert (ACAS 1975)  
1937-2020

## IN REMEMBRANCE

*In Remembrance is an occasional column featuring short obituaries of CAS members who have recently passed away. These obituaries and sometimes longer versions are posted on the CAS website; search for "Obituaries."*

### The Songbird

#### Andrew W. Moody (FCAS 1997)

1952-2020

Andrew "Andy" Moody of Madison, New Jersey, died unexpectedly in November 2020.

He was born in Bangor, Maine, the son of Dwight Campbell Moody and Frances (Drew) Moody. He grew up in West Hartford, Connecticut, graduated from Central Connecticut State University and began work in an actuarial training program at the Aetna Insurance Company in Hartford. There he met Rebecca Murr and married her in December 1979. He held positions at Crum and Forster, Signet Star Reinsurance Company, Platinum Re and finally Renaissance Re, from which he retired in March 2020. Moody was an active member of the Presbyterian Church of Madison and the Harmonium Choral Society. He enjoyed photography, crossword and jigsaw puzzles, and Legos. In his later years he turned to bicycling for exercise in place of his long-time hobby of running.

One of Moody's many friends described him as having a "great mind for trivia" and a "quirky sense of humor that always pushed you to think harder." He was known for his passion for music and his lovely singing voice. Another friend said, "It was such a joy to sing with Andy in Harmonium. What a joyful spirit. What a beautiful voice. What a tender heart. He will be greatly missed."

His brother Peter Moody and sister

Christine DesRoches predeceased him. In addition to his wife, he is survived by his children, Peter and Sarah; siblings Dwight, Stephen, Caroline Mandly, Elizabeth Merz, Constance Knott and Abigail Ashley; his siblings' spouses; and numerous nieces and nephews and their families.

### The Civic-Minded Nature Lover

#### Edward R. "Ted" Smith (FCAS 1966)

1931-2019

Edward R. "Ted" Smith, 87, of Grantham, New Hampshire, died in October 2019.

He was born in Waterbury, Connecticut, to Seymour and Marilla (Atwood) Smith and graduated from Watertown High School in Connecticut and Union College in Schenectady, New York. After serving in the U.S. Air Force (1954-1956), he went to work for The Hartford Insurance Group. He worked there for over 35 years, rising to the level of executive vice president and chief actuary before retiring to New Hampshire in 1989.

While living in Connecticut, Smith became involved in civic activities, chairing the Avon Planning and Zoning Board, and serving on the Selectboard and the Board of Trustees for the Avon Congregational Church. He also served as chair of the Juvenile Diabetes Research Foundation in Hartford. In retirement, Smith became a member of The First Baptist Church of New London. He volunteered for and served on the board of The Fells, a historic estate in Newbury, New

Hampshire, that was once owned by the 19th-century American statesman John Milton Hay. Smith loved to boat on Lake Sunapee with his grandchildren. He also enjoyed landscaping and playing bridge. For about 20 years, he owned a second home in Sanibel, Florida, where he volunteered his time for the organization Care and Rehabilitation of Wildlife.

He is survived by his wife of 60 years, Martha (Forristall) Smith; three children, Richard (Anne) Smith, Douglas (Kathleen) Smith, and Cynthia (Michael) Amatucci; and six grandchildren and two step grandchildren.

### Civil Rights Actuary

#### John M. "Jack" Bragg (ACAS 1957)

1921-2019

John Mackie Bragg died in April 2019 at the age 97. A former president of the Society of Actuaries, he was born in Winnipeg, Manitoba, Canada. At 19 he joined the Royal Canadian Air Force, serving in World War II. He earned a bachelor of commerce degree from the University of Manitoba and was persuaded to pursue actuarial science instead of physics. His career began with The Great-West Life Assurance Company and then the Life Insurance Company of Georgia (LOG) recruited him to establish its actuarial department. His career climb with LOG ranged from chief actuary to president, to CEO and chairman. In 1978 he started his own consulting company, Bragg Associates Inc., which was in business until 2019.

Bragg was a prolific contributor to actuarial literature, but one of his greatest achievements was the abolition of racial pricing at the LOG; this triggered ending the practice throughout the industry in the early to mid-1960s. He served as president of the American Council on

Life Insurance and as a member of the International Consulting Actuaries Society, and he was an elder and choir member at Trinity Presbyterian Church. Reportedly, he was the Atlanta Braves' #1 fan.

Bragg is survived by his children Ian, Nancy Bragg Koppes and Linda Bragg Cuthbertson; eight grandchildren; and three great grandchildren. He was predeceased by his wife Joan Ellen Griffin and his eldest son David George Wilfred Bragg.

**Actuary, Mayor, Financier, Farmer  
Glenn Oakes Head (ACAS 1953)  
1925-2012**

Glenn Head, the former chair and major shareholder of First Investors Consolidated Corporation (FICC), died in 2012. He was born in Peoria, Illinois, and grew up in Springfield. As a boy, he worked at a Dr. Pepper bottling plant and at a local bowling alley. He attended the University of Illinois, Urbana-Champaign, and in 1947 he worked at the Farm Bureau Life Insurance Company of Iowa. He earned his FSA in 1952 and served as chief actuary and director of the U.S. Life Company from 1953 until 1962. First Investors' owners hired him in 1962 to start a life insurance company, which became First Investors Life (FIL). He and partner David Grayson acquired control of the holding company, FICC, through

a leveraged buy-out in 1968. FICC also owned a broker dealer, First Investors Corporation, and an investment advisor, First Investors Management Company. Later on, Head was responsible for FICC building a transfer agent and acquiring a savings bank. When Head and Grayson acquired First Investors, it was primarily a sales organization, with \$55 million in assets. Upon Head's retirement in 2004, the First Investors Funds had over \$6.6 billion in assets.

As a member and president of the Board of Education for Madison, New Jersey, Head attracted the attention of local Republicans, who encouraged him to run for mayor, which he won in a three-way contest in 1972. His other pursuits included earning his commercial pilot's license and farming soybeans and corn.

He married Carol Atwood in 1954; the couple celebrated their 50th wedding anniversary in 2004. Survivors include his children and grandchildren.

**The Statistics Professor  
Donald C. Weber (ACAS 1959)  
1925-2013**

Donald C. Weber, 88, of Oxford, Ohio, passed away surrounded by family. He was born in Wausau, Wisconsin, to Walter and Florence (Hinke) Weber. He grew up in Marathon City, Wisconsin, and enlisted in the U.S. Navy, serving in

WWII and the Korean Conflict. In between his two enlistments, he attended the University of Wisconsin, graduating with a degree in education in 1949. He returned to the University of Wisconsin after his second enlistment, this time earning a master's degree in mathematics in 1954. He worked as a teacher and an actuary in North Dakota and Wisconsin for several years before returning to graduate school at North Carolina State University in 1963. He earned a Ph.D. in biomathematics from North Carolina State in 1970. He spent the rest of his career as a professor of statistics at Miami University, starting in 1967 and retiring in 1989. He married Elaine Dorothy Steckling at Zion Lutheran Church in Wausau in 1957.

Weber was a devout Christian and long-time, active member of Immanuel Lutheran Church in Hamilton, Ohio. His other passions included teaching, travel, classical music and Miami sports, especially basketball and football. He was preceded in death by his brother Allan. His survivors include four children, Lynn (Steven) Rohr, Mark (Becky) Weber, Heidi (Per) Sorensen, and David (Beth) Weber; nine grandchildren; sisters Joan Weber and Lois Caraway; and sisters-in-law Margaret Weber and MaryAnn Steckling.

## The CAS Institute Announces New CSPAs

**T**welve individuals have earned The CAS Institute's Certified Specialist in Predictive Analytics credential as of June 2021. For more information about The CAS Institute, visit [thecasinstitute.org](http://thecasinstitute.org).

Alp Can, FCAS, CSPA  
Allie Cashion, CSPA  
Greg Coffman, FCAS, CSPA  
Dianne Estrada, FCAS, CSPA  
Kenneth Hsu, FCAS, CSPA  
Zach Johnson, FCAS, CSPA

Eugene Korol, FCAS, CSPA  
Xuan Li, FCAS, CSPA  
Ryan McAllister, FCAS, CSPA  
Jason Nikowitz, FCAS, CSPA  
Nancy Ross, FCAS, CSPA  
Alexander Segal, Ph.D., CSPA ●

## Spotlight on Diversity

As part of its Strategic Approach to Diversity, the CAS has developed a series of infographics to better understand the current state and to track the progress of our diversity efforts.

In celebration of National Hispanic Heritage Month in the United States (Sept. 15 to Oct. 15), *AR* presents “Latinx Members in the CAS.” The CAS is dedicated to increasing the representation of Hispanic and Latinx candidates and

members at all levels of leadership in our actuarial community.

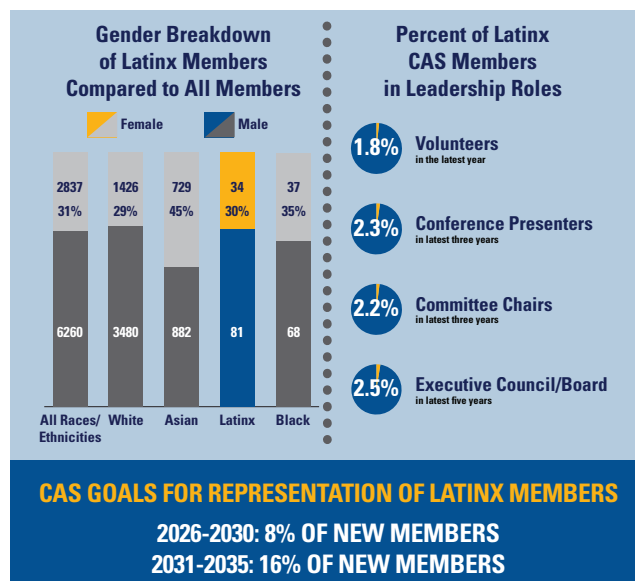
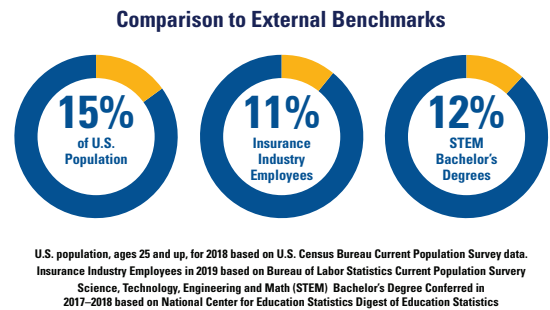
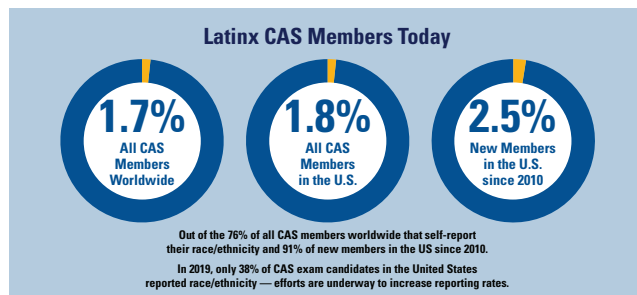
The CAS welcomes member feedback on the Spotlight on Diversity infographics. ●



## CAS SPOTLIGHT ON DIVERSITY 2020 LATINX MEMBERS IN THE CAS

Membership data as of June 2020

The CAS is sharing demographic data of members and candidates, along with our goals for demographics in the future, to be transparent about our diversity and hold ourselves accountable.



YOU CAN HELP US GET THERE.

JOIN THE DIVERSITY IMPACT GROUP AND SHARE YOUR IDEAS AT [COMMUNITY.CASACT.ORG](https://community.casact.org).

If you want to make sure that your demographic information is included in these metrics, please log on to the CAS website and update your membership profile.



# Thank You to 2020-2021 Society Partners

The CAS appreciates the support of the 2020-2021 Society Partners.

## DIAMOND PARTNERS



## PLATINUM PARTNER



## GOLD PARTNERS



## SILVER PARTNERS



## BRONZE PARTNERS



# CAS RESEARCH ROUNDUP 2021

By **BRIAN FANNIN, AGAS, CAS RESEARCH ACTUARY**

It's that time again! This is the time when we talk about what's happening in the wild, woolly world of CAS research. As usual, there are a lot of different things going on, but if there's one theme that emerges, it's building for the future. A lot of our time and thinking on research has been on new ways of sourcing, conducting and disseminating it. To be clear, that's not all we've been doing. All of that forward thinking has taken place against the backdrop of our standing research committees and publishing areas continuing the work that they've been doing for years.

## **New Research Council**

Probably the most tangible manifestation of this development effort comes in the form of a new operational body. By now, you have heard about the structural changes that the CAS has embarked on in our effort to remain efficient and resilient. Committees are now working groups; working groups may create task forces for specific projects, and so on. For research, this means a significant change. Over the course of many years, the CAS Executive Council has served as the authoritative body which monitors and approves research activity. This mechanism has worked quite well, but we felt that there were ways it could be improved. Beginning soon, the role of the Executive Council in research will be phased out and replaced with a Research Council.

So, what does this mean? One specific effect is a shift in the direction of research ideas. Historically, the CAS Executive

Council had a passive role that involved approving proposals that originated from any of our standing research committees, CAS leadership or from the membership at large. This ensured that there was a control mechanism in place to ensure that our research budget was being used prudently. The Research Council will still have authority over how funds are spent, but it will go beyond that. In the new configuration, we expect that they will establish research priorities for each fiscal year. To be clear, the Research Council will set a research agenda that is informed by input from our standing research working groups, but they will broaden our reach and incorporate the needs and wants of stakeholders outside the profession. This is something that we have always tried to address, but we are now acting in a very deliberate way.

There are three principal benefits to this revision. First, there will be greater clarity around research priorities for the CAS as an organization. The Research Council will serve as the single conduit through which ideas are vetted and overall strategy for research takes shape. Second, by bringing additional perspectives onto the Research Council, we will ensure that our research work will continue to reinforce the relevance and market value of the work done by CAS members. Finally, by placing the Research Council in a proactive, decisive role, we hope that we can shorten the turnaround time between idea and publication.

## **A few of our current projects**

Looking at some of the work underway in 2021, it feels as though a shift in direction has already begun. One example

is the new way in which we're producing content. Research is typically conducted in one of two ways: The CAS will contract with a third party to carry out research that we deem relevant, or alternately, volunteers will submit completed work to appear in either the *E-Forum* or *Variance*.

One of our current projects uses a different approach. The CAS research actuary and several volunteers have contracted with a data provider to examine social inflation in liability claims. This is unique for several reasons. First, the idea and plan grew from a series of conversations among CAS leadership and staff. Second, rather than outsourcing the work to an external researcher, we looked for volunteers to carry it out. This meant adding volunteers to the service agreement between the CAS and the data vendor, which is a first for the vendor. Until now, the vendor had only engaged in two-party contracts. Third, and finally, this represents something of an experiment in how to utilize volunteer capacity. Instead of passively accepting work from volunteers (which we love to support and will continue to do!) the CAS, as an organization, developed a specific research project and then went looking for volunteers to carry it out.

We have also been proactive in identifying research opportunities related to race and insurance pricing. The events of the recent past have amplified the importance of this issue in the United States and the rest of the world, and the CAS has responded. We are aware that this is a sensitive and complicated topic with a long history. Moreover, it demands a fusion of domain knowledge, data-centric analysis and an awareness of the interplay between public institutions and private enterprise — sounds like a perfect research topic for a CAS actuary.

At the moment, we have no fewer than four workstreams generating content that can help our members and the broader public understand the issues surrounding race and insurance pricing. This includes an explanatory paper that walks through various definitions of disparate treatment and disparate im-

**We have also been proactive in identifying research opportunities related to race and insurance pricing. The events of the recent past have amplified the importance of this issue in the United States and the rest of the world, and the CAS has responded.**

pact, work that examines the history of regulation of rating factors and an overview of how companies may develop methods to gauge the level of disparate impact in their models.

### Technology

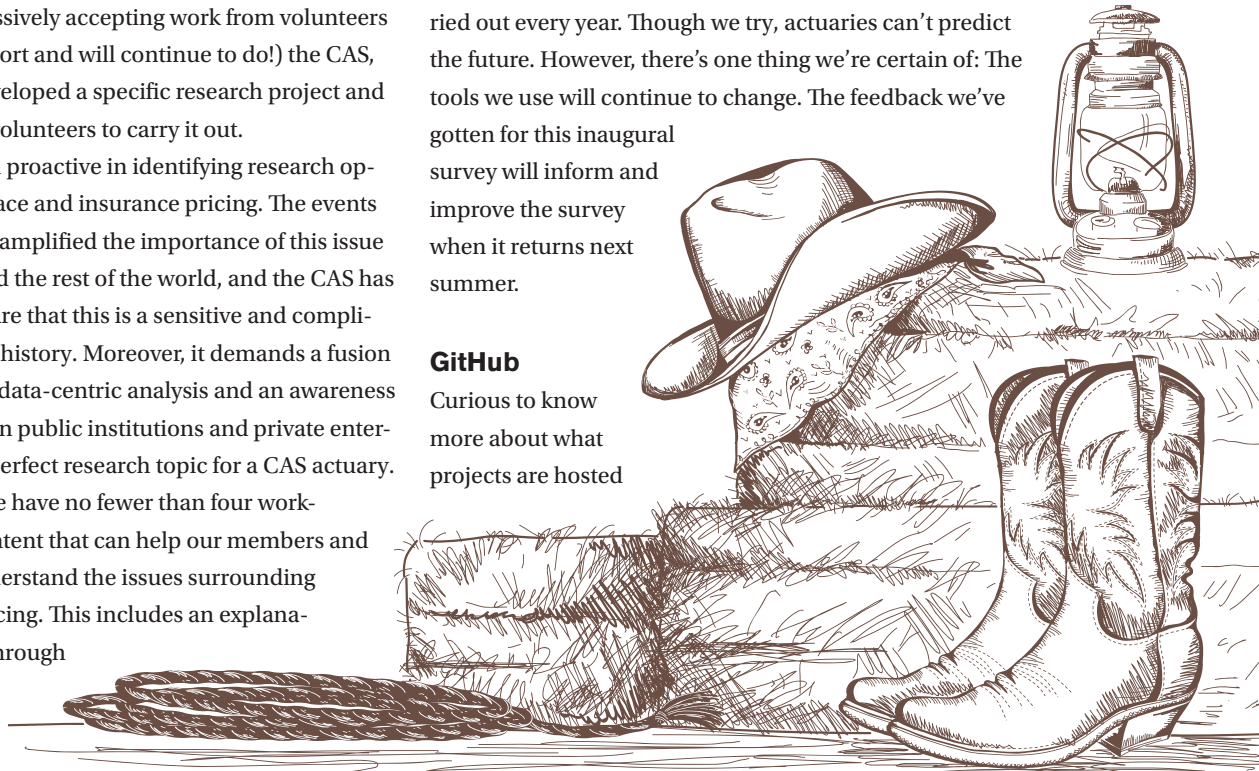
Every CAS member and candidate should have seen a request to participate in a survey on how they use technology in their work. The questions we addressed were meant to be clear and pragmatic. For example, where do actuaries stand on adoption of scripting tools like R, Python or MATLAB? Are newer members more likely to use emerging platforms like Google Sheets, Tableau and the like? What skills do our members want to develop over the next 12 months? We had over one thousand

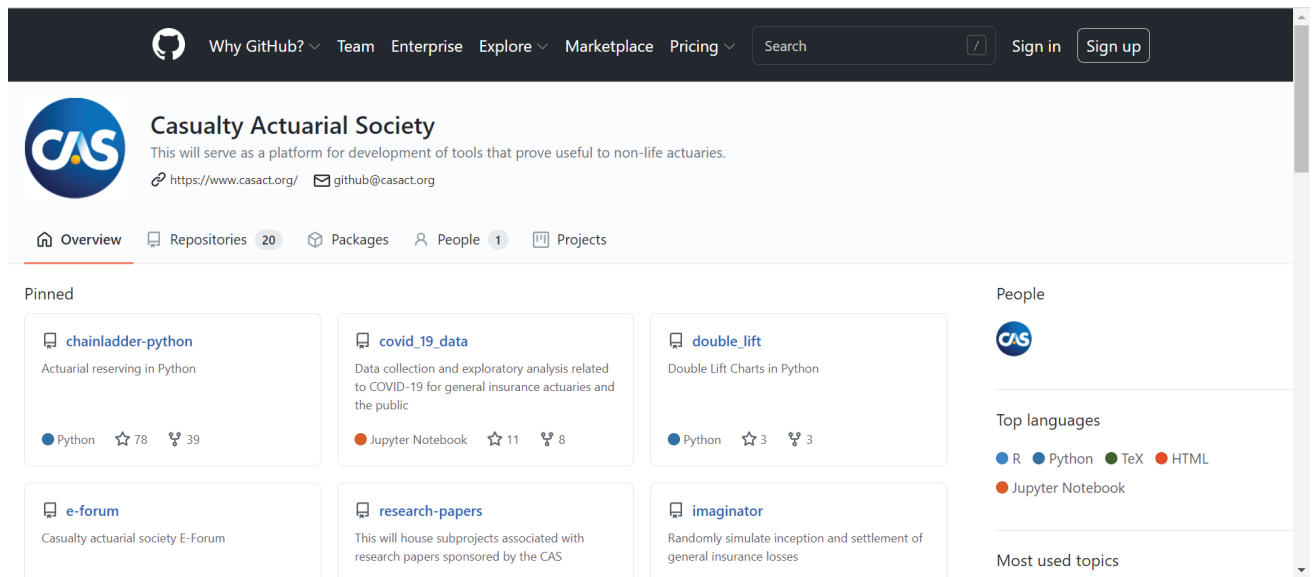
responses and are beginning to comb through the results. You should see a high-level summary of the data shortly.

This has been christened the first *annual* technology survey, meaning that we are expecting to see this survey carried out every year. Though we try, actuaries can't predict the future. However, there's one thing we're certain of: The tools we use will continue to change. The feedback we've gotten for this inaugural survey will inform and improve the survey when it returns next summer.

### GitHub

Curious to know more about what projects are hosted





The CAS GitHub page.

by the CAS on GitHub? You can always visit the page itself at <https://github.com/casact>. We've also begun publishing a basic set of metrics about activity. As I write this, we have over 1,400 commits across 18 repositories.

By the time you read this, the number of repositories should number at least 19 as we add another package, which may be used to analyze loss reserves. Caesar Balona and Ron Richman have taken the techniques described in their paper "The Actuary and IBNR Techniques: A Machine Learning Approach" and implemented them in a Python package called "tryangle." If you are already familiar with the Python "chainladder" package, this one is for you. If you're not familiar with the Python "chainladder" package, what are you waiting for?

If you'd like to learn more about how to use Git and GitHub, be sure to check out our series of microlearning videos on the topic: <https://www.pathlms.com/cas/courses/18181>.

## Other news

In May of this year, the paper "AGLM: A Hybrid Modeling Method of GLM and Data Science Techniques" was awarded the 2021 Hachemeister Prize. This paper demonstrates a novel technique that adapts the GLM framework to handle instances when the data set has a large number of features. The model-

ing method is highly flexible, yet retains explanatory power that can sometimes be lost when one uses non-linear techniques like random forests or gradient-boosted machines. The net effect is to unite the attractive elements of GLMs and more modern statistical learning methods.

The Hachemeister Prize Committee also noted the following as particularly strong papers:

- "Discrimination-Free Insurance Pricing" by Mathias Lindholm, Ronald Richman, Andreas Tsanakas and Mario V. Wüthrich.
- "Silent Cyber Assessment Framework" by the Institute and Faculty of Actuaries' Cyber Risk Investigation Working Party (Simon Cartagena, Visesh Gosrani, Jasvir Grewal and Justyna Pikinska).
- "Cyber Claim Analysis Through Generalized Pareto Regression Trees with Applications to Insurance" by Sébastien Farkas, Olivier Lopez and Maud Thomas.

These projects are just a few of the noteworthy developments happening with CAS research. Space doesn't permit us to mention everything that's going on, so be sure to scroll through the latest *E-Forum* or have a look at our calendar of upcoming webinars. As always, if you have questions, comments or research ideas that you'd like us to explore, you can reach me at [bfannin@casact.org](mailto:bfannin@casact.org). ●



# ANNUAL MEETING

*November 7-10, 2021 • San Diego, CA  
Marriott Marquis San Diego Marina*

# Graphical Representation and Regression Formulation of Link Ratios



Thomas Mack identified the stochastic regression model that underlies volume weighted average link ratios. Other authors, including Murphy and Venter, have developed these ideas further. A graphical representation and regression formulation of link ratios makes it clear what assumptions underpin the methods and extensions thereof.

	0	1	2	3	4	5	6	7	8	9
1981	5,012	8,269	10,907	11,805	13,539	16,181	18,009	18,608	18,662	18,834
1982	106	4,285	5,396	10,666	13,782	15,599	15,496	16,169	16,704	
1983	3,410	8,992	13,873	16,141	18,735	22,214	22,863	23,466		
1984	5,655	11,555	15,766	21,266	23,425	26,083	27,067			
1985	1,092	9,565	15,836	22,169	25,955	26,180				
1986	1,513	6,445	11,702	12,935	15,852					
1987	557	4,020	10,946	12,314						
1988	1,351	6,947	13,112							
1989	3,133	5,395								
1990	2,063									

1 Unit = \$1

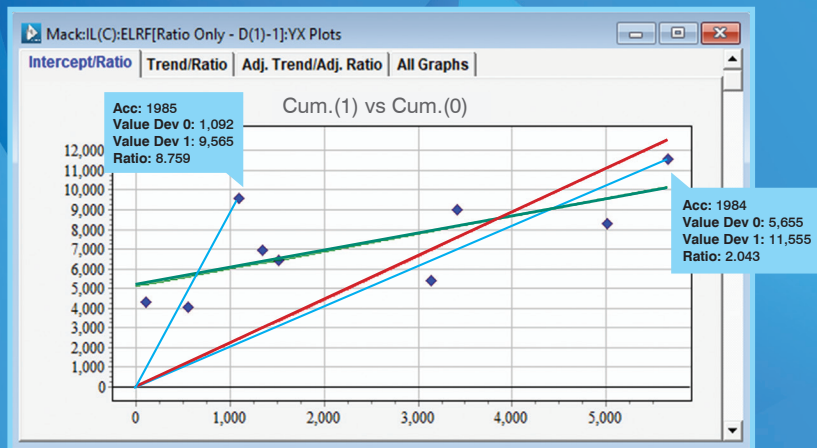
**"There is pleasure in recognizing old things from a new viewpoint."**  
Richard Feynman

Consider the (diagonally opposite) Incurred Loss triangular data from the American Reinsurance Association.

In general, each link ratio ( $y/x$ ) is the slope of the line from the number pair ( $x,y$ ) to the origin.

The graph below plots the cumulatives in development year one versus the cumulatives in development year zero for accident years 1981 to 1989.

The caption on the right is for the point (5,655, 11,555) corresponding to accident year 1984. The caption on the left is for the point (1,092, 9,565) corresponding to accident year 1985. The slope of the blue lines represent the corresponding link ratios – which is 2.043 for 1984 and 8.759 for 1985.



Accordingly, an average link ratio, equivalently average trend, is an average slope through the origin.

This means that the method can be formulated as a regression (Mack (1993)).

Let  $y(w)$  denote the cumulative in development period  $j$  for accident year  $w$  and  $x(w)$  the cumulative in the previous development period,  $j-1$ .

We can write,

$$y(w) = b * x(w) + e(w), \dots (1)$$

where  $b$  is the slope of the line (equivalently, the average link ratio), and  $e(w)$  is the difference between the actual value  $y(w)$  and the corresponding point on the average link ratio line ( $b * x(w)$ ).

When actuaries use link ratios there are two critical assumptions:

- The expected value of the next cumulative is conditional on the previous cumulative multiplied by an unknown factor.
- The selected link ratio (factor) is optimal for prediction.

The optimum value of  $b$  is found by weighted least squares estimation according to the scale of the error terms  $e(w)$ .

Let the variance of  $e(w) = v * x(w)^{\text{delta}}$

For the following values of delta (0, 1, 2):

- 0, or constant variance, the weighted least squares estimate of  $b$  is the volume squared weighted average link ratio.
- 1, the weighted least squares estimate of  $b$  is the volume weighted average link ratio – sometimes called the chain ladder ratio.
- 2, the weighted least squares estimate of  $b$  is the arithmetic average link ratio.

In the graph (previous page), the red line is the best least squares line through the origin and the green line is the best least squares line that includes an intercept. The latter appears to be a better model.

Murphy (1994) extended the regression formulation to include an intercept term.

$$y(w) = a + b * x(w) + e(w), \dots (2)$$

where  $a$  is the intercept term, but  $b$  is no longer the average link ratio.

Given that the intercept is positive in the previous graph, the slope of the line with an intercept term is less than any average link ratio (through the origin).

We can obtain visual indications of whether a line with an intercept (Murphy (1994) method) or a line through the origin (Mack (1993) method) is better.

Most importantly, the focus should be on the incremental model, Venter(1998), even if  $a = 0$ :

$$y(w) - x(w) = a + (b-1)*x(w) + e(w), \dots (3)$$

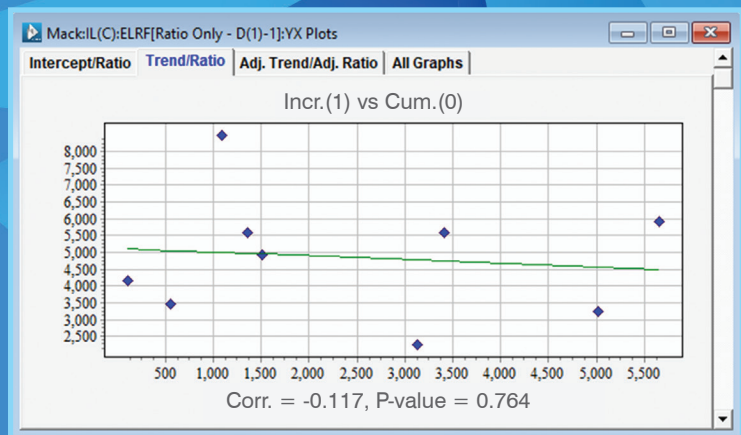
where  $y(w) - x(w)$  is the incremental data point.

When you use a link ratio to project the cumulative in the next period in essence you are only projecting the next incremental as you know the current cumulative. This is the reason all the focus should be on equation (3) not (2).

But what if  $b$  in equation (3) is statistically equal to 1, (Venter(1998))?

Then the incrementals in development periods ( $j$ ) are not correlated to the cumulatives in the previous development period ( $j-1$ ). That is, any ratio applied to the cumulatives does not predict the incrementals!

Here is a graph (right) of the incrementals in development year 1 versus the cumulatives in development year 0.



Note that the correlation is zero (slope not statistically significant). Equivalently  $b-1 = 0$ .

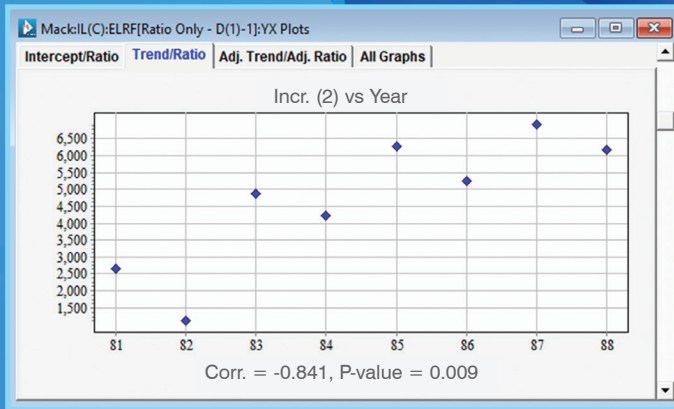
In this case, the reduced model only contains an intercept term.

$$y(w) - x(w) = a + e(w) \dots (4)$$

In this model, the incrementals across the accident years are random numbers from a distribution with mean  $a$ , and variance,  $\text{Var}(e(w))$ . If  $e(w)$  has a constant variance, then the ordinary least squares estimate of  $a$  is the arithmetic average of the incrementals  $y(w) - x(w)$ .

It turns out, if you graph the incrementals in any development period against the cumulatives in the previous period, you will note that there are no statistically significant correlations. All the b-1 parameters are statistically zero.

The assumption that the incrementals are random, might not be true. A case in point, is development period two. This suggests that we need to include an accident year trend parameter in model (3).



The equation that includes the intercept, accident year trend and slope can be written:

$$y(w) - x(w) = a_0 + a_1 * w + (b-1)*x(w) + e(w), \dots (5)$$

where  $a_0$  is the intercept,  $a_1$  is the accident year trend parameter and  $b-1$  is the incremental coefficient.

The family of models included in the **Extended Link Ratio Family (ELRF)** are represented by equation (5) between each two consecutive development years. The significance of the parameters is determined by the data.

ELRF Parameter Estimates										
Development Period	Intercept			Trend			Ratio			
	Est.	S.E.	P-Value	Est.	S.E.	P-Value	Est.	Ratio-1	S.E.	P-Value
0~1	4,849.33333	611.65863	0.00005	****	****	****	1.00000	0.00000	0.00000	0.00000
1~2	2,309.50000	744.19326	0.02103	678.00000	177.89622	0.00885	1.00000	0.00000	0.00000	0.00000
2~3	3,267.14286	883.07057	0.01009	****	****	****	1.00000	0.00000	0.00000	0.00000
3~4	2,717.66667	296.35234	0.00026	****	****	****	1.00000	0.00000	0.00000	0.00000
4~5	2,164.20000	551.44695	0.01718	****	****	****	1.00000	0.00000	0.00000	0.00000
5~6	839.50000	400.27168	0.12689	****	****	****	1.00000	0.00000	0.00000	0.00000
6~7	625.00000	24.02776	0.00147	****	****	****	1.00000	0.00000	0.00000	0.00000
7~8	294.50000	240.50000	0.43596	****	****	****	1.00000	0.00000	0.00000	0.00000
8~9	172.00000	0.00000	0.00000	****	****	****	1.00000	0.00000	****	****
To Ultimate							1.00000	0.00000	0.00000	****

Delta = 0, AIC = 738.5  
 If the test is to be conducted at an overall 5% level, a parameter would be regarded as insignificant if the corresponding P-Value is greater than 0.005116

Link ratios have no predictive power for this incurred loss development array. The optimal combination of parameters uses simply an intercept term with the exception of the regression equation between development periods 1 and 2 where an accident year trend is also statistically significant.

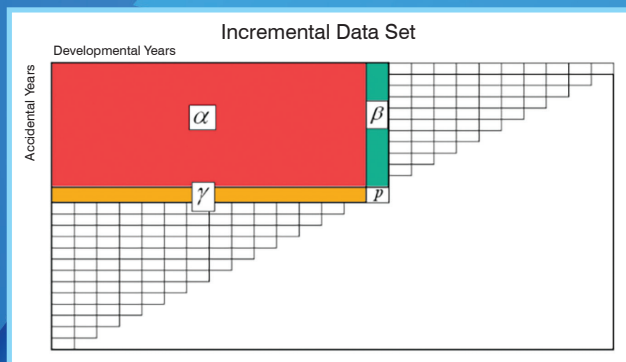
Mack, T. (1993). Distribution-free calculation of the standard error of chain ladder reserve estimates. *ASTIN Bulletin: The Journal of the IAA*, 23(2), 213-225.

Murphy, D. M. (1994, March). Unbiased loss development factors. In *CAS Forum* (Vol. 1, p. 183).

Venter, G. G. (1998). Testing the assumptions of age-to-age factors. In *Proceedings of the Casualty Actuarial Society* (Vol. 85, pp. 807-847).



# Volume weighted average link ratios do not distinguish between accident years and development years



Consider any triangle with incremental values where:

- alpha denotes the sum of the values in the red rectangle,
- beta denotes the sum of the values in the green rectangle (one development year), and
- gamma is the sum of the values in the orange rectangle (one accident year).

Let  $p$  denote the incremental value projected for the accident year represented by the gamma values for the next development year.

The value alpha represents both the aggregate of the row sums in the red rectangle and the aggregate of the column sums.

The volume weighted average when you cumulate the triangle in the traditional way is  $(\alpha + \beta) / \alpha$ . If you cumulate the triangle for each development year down the accident years, then the volume weighted average is  $(\alpha + \gamma) / \alpha$ .

Accordingly:

$$p = \gamma \left( \frac{\alpha + \beta}{\alpha} - 1 \right) = \frac{\gamma\beta}{\alpha}$$

If you cumulate along the development years, and

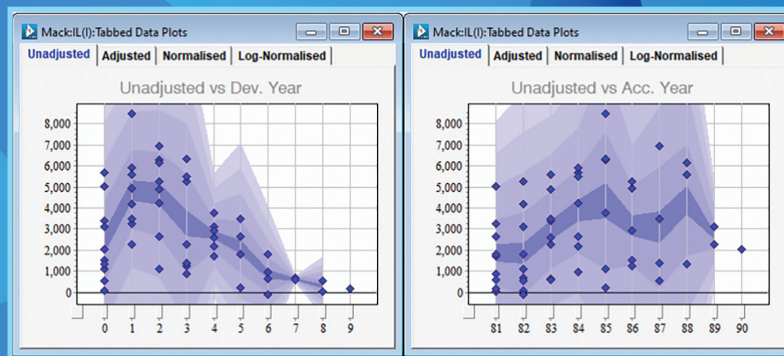
$$p = \beta \left( \frac{\alpha + \gamma}{\alpha} - 1 \right) = \frac{\beta\gamma}{\alpha}$$

If you cumulate along the accident years. QED.

We know that development years are not like accident years.

**CONCLUSION:** Link ratios have got nothing to do with the structure of the data.

For the incurred array we plot the incremental values versus development year. We also plot the values versus accident year. Note the different structure.



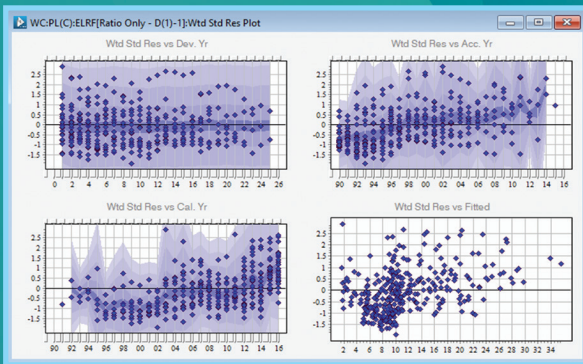
Clearly, we expect any incremental loss development array to decay to zero, but you would not expect the same pattern down the accident years.

# ELRF™ 2020

ELRF™ 2020 is for P&C actuaries who want to take advantage of the graphical representation and regression formulation of link ratios, and extensions thereof.

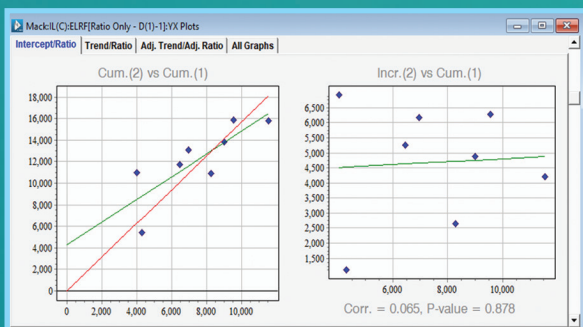
All this, coupled with the power of a relational database are included in ELRF™ 2020. All the information in the database including data, models, and results, are a mouse click away. Accessing data and information through the ELRF™ 2020 application is a pleasure.

Triangle Group	Line of Business	Reserves Held	Survival Ratio	Loss Ratio
7710 Ins Co_22502_WC_10x10	D-Workers Com...	5,934	3.40	54.32
A.I.M. Mutual Ins Co-s (G)_18555_WC_10x10	D-Workers Com...	241,288	4.39	63.39
Accident Ins Co, Inc._12674_WC_10x10	D-Workers Com...	14,965	3.40	64.50
Acuity, A Mutual Ins Co_468_WC_10x10	D-Workers Com...	233,652	3.53	56.73
AF GIP (G)_18680_WC_10x10	D-Workers Com...	1,539,997	3.29	56.96
Agricultural Workers Mutual Au_3276_WC_10x10	D-Workers Com...	504	9.88	30.57
Aioi Nissay Dowa Ins Co Ltd. G_14231_WC_10x10	D-Workers Com...	304	2.24	32.38
Alaska Timber Ins Exchange_1773_WC_10x10	D-Workers Com...	3,294	3.95	53.20
Alfa Ins GIP (G)_1106_WC_10x10	D-Workers Com...	0	(None)	-4.57
Allegheny Corporation GIP (G)_18640_WC_10x10	D-Workers Com...	72,184	5.68	64.44
Allianz US PC Ins Co-s (G)_18429_WC_10x10	D-Workers Com...	159,316	5.03	421.35
American Contractors Ins GIP L_18067_WC_10x10	D-Workers Com...	84,248	3.87	85.52
American European Ins GIP (G)_18709_WC_10x10	D-Workers Com...	712	3.75	72.08
American Family Ins GIP (G)_124_WC_10x10	D-Workers Com...	209,601	4.19	63.71
American International GIP (G)_18540_WC_10x10	D-Workers Com...	3,598,627	4.72	77.85
American Millennium Ins Co_512_WC_10x10	D-Workers Com...	0	(None)	(None)
American National Ptnn & Cas G_2947_WC_10x10	D-Workers Com...	136,433	6.75	66.98



The Extended Link Ratio Family (ELRF) modeling framework provides diagnostics for testing assumptions.

Residual plots versus development period, accident period and calendar period are also used to assess model specification error. Any patterns in the residual plots show features of the data that the method is not describing.



The Y versus X and Y - X versus X plots (left) provide diagnostic testing of the intercept and ratio minus one. Formal tests are provided in the regression tables.

Here there is no relationship between the incremental Incurred in development period 3 with the cumulative Incurred in development period 2. Link ratios do not have predictive power.

## ELRF™ 2020 Standard:

- Over 144 link ratio methods including Bornhuetter-Ferguson and Expected Loss Ratio Methods
- Link ratio methods formulated as regression estimators
- Extensions including intercept (Murphy) and constant accident year trends for each development year
- Diagnostic tools
- Bootstrap distributions by accident year, calendar year and total

## ELRF™ 2020 Professional:

- COM API
- Extended report templates
- Server database (Oracle & SQL Server)

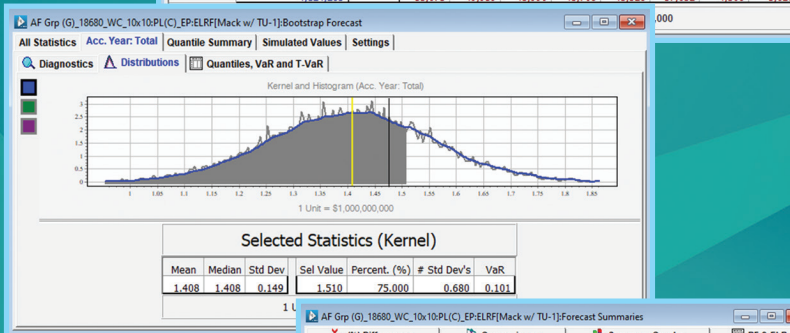
ELRF™ 2020 affords benefits at warp speed unlike any other reserving product.

AF Grp (G\_18680\_WC\_10x10PL(C)\_EP:ELRF[Mack w/ TU-1])YX Plots

Incremental | Cumulative

### Accident Period vs Development Period (Incremental Forecast)

	Cal.Per.Total.	0	1	2	3	4	5	6	7	8	9	To Ultimate	Outstanding	Ultimate
2017	459,089	165,413	180,975	86,185	45,201	21,397	8,104	364	8,476	5,100	3,294	62,505	154,440	630,736
	425,971	165,413	206,731	104,152	17,054	17,623	23,490	27,294	2,077	2,114	1,808	7,782	50,906	50,906
2018	540,683	216,759	237,151	111,171	56,106	26,559	10,059	452	10,521	6,330	4,089	77,585	302,872	782,908
	596,920	216,759	263,277	24,872	20,249	20,827	27,751	32,286	2,501	2,528	2,125	9,990	68,601	68,601
2019	670,110	272,838	298,506	132,317	66,778	31,611	11,972	538	12,522	7,534	4,866	92,343	658,987	931,825
	741,422	272,838	29,936	29,141	23,321	23,789	31,658	36,870	2,935	2,927	2,419	12,605	92,226	92,226
Total Fitted/Observed		2020	2021	2022	2023	2024	2025	2026	2027	2028	Total To Ultimate		Total Reserve	Total Ultimate
Cal. Yr Totals		4,054,475	490,808	228,594	114,679	56,174	28,104	19,037	22,146	11,623	4,866	561,035	1,537,066	5,661,351
		4,124,285	53,073	49,959	45,990	45,708	45,328	37,052	4,306	3,626	2,419	****	173,696	173,696



AF Grp (G\_18680\_WC\_10x10PL(C)\_EP:ELRF[Mack w/ TU-1])Bootstrap Forecast

All Statistics | Acc. Year: Total | Quantile Summary | Simulated Values | Settings

Diagnostics | Distributions | Quantiles, VaR and T-VaR

### Quantile Statistics, VaR and T-VaR (Acc. Year: Total)

% Quantile	Sample				Kernel			
	#	S.D.'s	VaR	T-VaR	#	S.D.'s	VaR	T-VaR
99.6	1.812	2.709	0.403	0.444	1.815	2.725	0.406	0.447
99.5	1.800	2.627	0.391	0.435	1.802	2.639	0.393	0.435
99.4	1.785	2.523	0.376	0.427	1.789	2.551	0.380	0.429
99.3	1.775	2.462	0.367	0.419	1.779	2.484	0.370	0.423
99.2	1.771	2.430	0.362	0.412	1.771	2.433	0.362	0.413
99.1	1.764	2.387	0.356	0.406	1.765	2.389	0.356	0.407
99.0	1.757	2.335	0.348	0.401	1.759	2.349	0.350	0.403
98.0	1.715	2.055	0.306	0.363	1.716	2.061	0.307	0.364
97.0	1.690	1.888	0.281	0.339	1.690	1.888	0.281	0.339
96.0	1.669	1.743	0.260	0.322	1.671	1.757	0.262	0.324
95.0	1.654	1.644	0.245	0.308	1.655	1.649	0.246	0.309
94.0	1.640	1.553	0.231	0.297	1.641	1.559	0.232	0.297

Mean = 1.409, S.D. = 0.149, Provision = 1.409, 1 Unit = \$1,000,000.000

AF Grp (G\_18680\_WC\_10x10PL(C)\_EP:ELRF[Mack w/ TU-1])Forecast Summaries

(%) Differences | Comparisons | Summary Graphs | BF & ELR

Acc. Yrs | Cal. Yrs | Loss Ratios | Incurred Losses

### Incurred Losses

Acc. Yr	Written Premium	Paid To			CRE	Mean		Standard Dev.
		2019	2019	2019		Outstanding	Ultimate	
2013	681,822	336,086	355,720	19,634	48,384	384,470	4,209	
2014	912,478	414,887	446,391	31,504	60,042	474,929	23,538	
2015	1,008,371	453,000	497,731	44,731	73,298	526,298	34,005	
2016	1,145,882	455,627	519,399	63,772	95,442	551,069	41,022	
2017	1,284,431	476,296	609,796	133,500	154,440	630,736	50,906	
2018	1,420,624	480,036	696,871	216,835	302,872	782,908	68,601	
2019	1,528,580	272,838	632,072	359,234	658,987	931,825	92,226	
Total	9,944,884	4,124,285	5,041,171	916,886	1,537,066	5,661,351	173,696	

1 Unit = \$1,000

## ELRF™ Best's Schedule P:

Included with a Best's Financial Suite - P/C, US subscription!

- Offline access to Schedule P data from AM Best and derived financial metrics;
- All analytical tools included in ELRF™ 2020!

Contact AM Best at [sales@ambest.com](mailto:sales@ambest.com) to learn more.



**Insureware**  
Innovative Statistical Solutions for P&C Insurance

# Meet the 2021 CAS University Award Winners

The Casualty Actuarial Society (CAS) selected four universities to receive the 2021 CAS University Award, an honor created to celebrate universities that share our commitment to fostering the development of the next generation of property and casualty actuaries.

As announced in June, the schools honored in the program's sixth year are Arizona State University, Brigham Young University, Georgia State University and University of New South Wales.

The selection process is extremely competitive, with 40 schools worldwide having sought recognition through this program. Winners of the 2021 CAS University Award Program were determined by a panel of judges from companies across the property-casualty insurance industry.

The four winning schools will each receive a \$5,000 monetary award to further enhance their programs and will be recognized at the 2021 CAS Annual Meeting, taking place November 7-10.

Meet the 2021 CAS University Award Winners and learn about the innovative ways they are exposing their students to the property-casualty insurance industry!

## Arizona State University



With this year's honor, Arizona State University's (ASU) actuarial science program becomes a two-time winner of the CAS



University Award. Since its first win in 2018, the school has continued its focus on property-casualty across its curriculum, research and industry engagement.

Five actuarial faculty members and 120 actuarial students make up the school's actuarial science program. Program highlights include:

- Launched in 2018, ACT Lab is an actuarial science consulting lab providing an organized approach to university-industry collaboration on applied real-life projects. ACT Lab takes on projects that require technical expertise and methods and that utilize undergraduate and master's students, who are supervised by actuarial program faculty, to complete these projects. Projects to date range from traditional and stochastic approaches to pricing and reserving methods to simulating profit-sharing models. ACT Lab not only provides meaningful research experiences for students, but it helps industry partners adopt new methods and approaches, recruit talent, deal with staff augmentation and uneven workflow, and outsource development projects that are not mission critical. Faculty sponsors of ACT Lab see it as an opportunity to understand the issues faced by the industry and a way to become better acquainted with the current literature.

- ASU’s core actuarial science curriculum addresses property-casualty topics through 17 different courses that feature real-life applications and guest speakers from local P&C companies. ASU’s course on ratemaking and reserving is 100% P&C content and is based on the CAS Exam 5 syllabus. The CAS’s MAS I and II exam materials are covered across a few different ASU courses. Taught by a retired CAS Fellow, ASU’s business communications course sharpens students’ public speaking and presentation skills. Upper-division and master’s courses apply course topics to real-life data; all master’s students are required to take an applied project course that involves P&C, health and pensions.
- Because of its close connections with local companies and the broader actuarial science community, ASU’s Actuarial Advisory Board attracts a large and active group of participants — 28 members representing the major actuarial employers in the area. This advisory board supports ACT Lab and generates a substantial volume of support for internships, scholarships, guest speakers, student events and more. Over the last three years, ASU has also hosted the Wholesale & Specialty Insurance Association Student Symposium both in-person and virtually, which has introduced the P&C insurance field to students from universities nationwide.

From its beginnings six years ago, the ASU actuarial science program has stayed true to its mission of graduating highly desired, current and relevant future leaders for the industry. “Faculty and students are beyond excited to have their efforts validated with this year’s CAS University Award,” said Dr. Jelena Milovanovic, ACIA, AIAA, a professor of practice at Arizona State University. “[We] will continue to be inspired by the profession’s evolution in today’s environment as well as to contribute to future innovations in the profession.”



Students in ASU’s Actuarial Science Program.

## Brigham Young University

# BYU

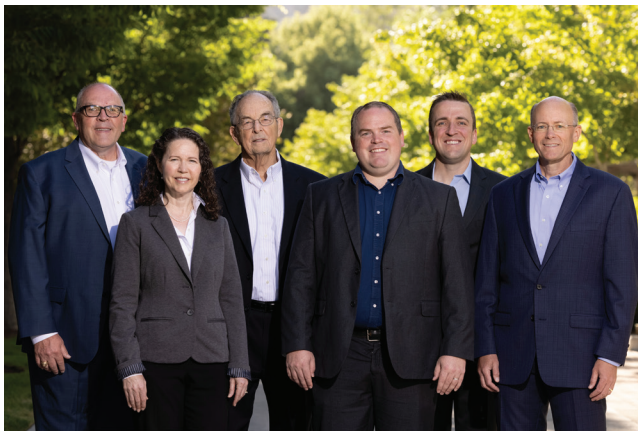
Brigham Young University’s actuarial science program of four actuarial faculty members and 150 actuarial students impressed the judges with its focus on property-casualty insurance across curriculum, research and industry engagement.

Program highlights include the following:

- The judges found BYU’s innovative research projects highly outstanding. A major focus for BYU’s program is mentored research, particularly for undergraduate students, and nearly all their projects involve students. Highlights include:
  - BYU has run an auto loss trends project since 2017 that is jointly sponsored by the CAS, the American Property Casualty Insurance Association and the Society of Actuaries. Twenty-five students have been involved in the three iterations of the project so far, and the findings have been presented at the CAS Annual Meetings two years in a row.
  - A faculty member and undergraduate student are currently working on a machine learning project in personal auto, building models that analyze a personal auto database acquired from the CAS. In the future, the code and summaries of the data will be published so practitioners and academics can use the data and build new models.
- BYU’s program has a strong focus on statistics and predictive analytics. In addition to covering actuarial-specific topics like ratemaking and reserving, students are trained to have exceptional modeling skills to prepare them for the future of the actuarial profession. Undergraduate-level courses are offered on Bayesian modeling, regression, spatial modeling and time series, along with a course on core statistical concepts. All the topics on MAS-I and MAS-II are covered within the curriculum along with many of CAS’s Exam 5 topics.
- The program has strong connections to the P&C industry, with Associate Professor of Statistics and Actuarial Program Coordinator Brian Hartman having worked for The Hartford and Liberty Mutual. The program boasts four P&C actuaries on its advisory board and has had several

P&C employers travel to Utah for campus information sessions.

“To receive such a distinguished recognition and be included among a distinctive set of actuarial programs is a humbling honor,” said BYU Academic Vice President C. Shane Reese. “We anticipate that this recognition will increase opportunities for our students, who are so well prepared for the actuarial profession. We are grateful for the excellence of our faculty, the strength of our students and the partnership with CAS.”



Brigham Young University actuarial faculty include (left to right) Scott Grimshaw, department chair; Allie Tomlinson, assistant actuarial program coordinator; Dennis Tolley, faculty; Robert Richardson, faculty; Brian Hartman, actuarial program coordinator; and Mark Brown, actuarial advisory board chair.

## Georgia State University



Georgia State University’s (GSU) actuarial science program was established in 1958 and has seven actuarial faculty members and 133 actuarial students. The university particularly impressed the judges with its curriculum and teaching methods that leverage a variety of innovative techniques. These include real-world case studies and presentations on topics like ASOPs as well as practical applications using public data sets that take advantage of R, Python, Excel and other tools.

Program highlights include:

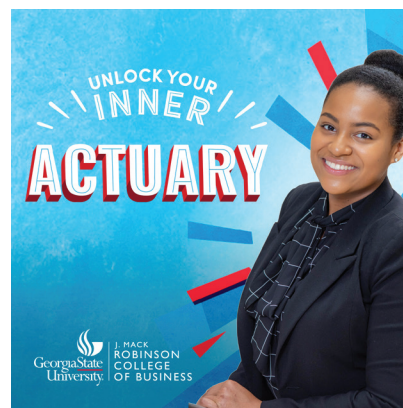
- GSU’s actuarial science program prepares students for CAS Exams MAS I and MAS II and CAS Exam 5. Actuarial

science students are required to take these courses as part of a sequence on P&C actuarial mathematics. The program supports students pursuing their property-casualty credentials, reimbursing students for CAS exams through Exam 6.

- The program’s regression modeling course covers regression, time series and generalized linear models with applications in R. Projects are assigned that use P&C data to perform various statistical tests and fit predictive models using datasets including Singapore automobile claims and Massachusetts bodily injury data.
- The program’s ratemaking and loss reserving course focuses on CAS Exam 5 materials and uses as assigned textbooks Werner & Modlin’s *Basic Ratemaking* and Friedland’s *Estimating Unpaid Claims Using Basic Techniques*. The course incorporates projects that relate the theory to the practice of P&C insurance. For example, students are asked to design rating manuals in Excel/VBA or R that use data in Chapter 2 of Werner-Modlin or to implement the work of Appendix A-D, depending on their interest in personal auto, homeowner’s, medical malpractice or workers’ compensation.
- GSU also offers innovative risk management and insurance (RMI) courses as actuarial science major electives. Their insurtech course uses real-world data to teach, focusing on applying technology (machine learning and blockchain) to insurance. Examples of successful P&C applications are studied, from startups providing specialized solutions at specific points of a P&C insurer’s value chain to full-stack insurtechs.

RMI Chair Stephen Shore and Director of Undergraduate AS Program

Stefanos Orfanos expressed deep gratitude for receiving the CAS University Award. “It is a tribute to our efforts to train actuarial students in property-casualty insurance and equip them with the skills they need to be successful in



GSU’s “Unlocking Your Inner Actuary” campaign.

their careers,” they said. The award will enable GSU to support travel to CAS meetings and to reward students for passing CAS exams. “We also place great emphasis on research that covers the full spectrum of actuarial practice and on working together with our industry partners to benefit our diverse student population and the profession,” they said.

## University of New South Wales

The University of New South Wales’s (UNSW) actuarial science



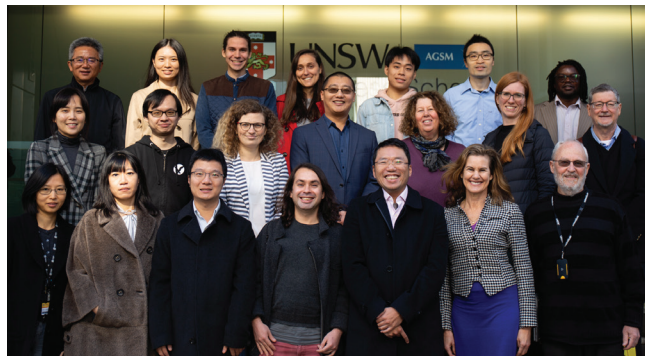
program has 16 actuarial faculty members and 1,159 actuarial students. Like the other award winners, the university focus on P&C insurance across curriculum, research and industry engagement made a strong impact on the judges. Program highlights include the following:

- Innovative degree programs combining actuarial science, data analytics and computer science, including artificial intelligence, were developed in response to student and market demand, but especially from the P&C industry that wants actuaries with more training in data science and computer science. UNSW’s actuarial courses provide a theoretical framework and practical application of important topics in property-casualty industries.
- UNSW’s actuarial data analytic applications course includes state-of-the-art statistical, machine-learning techniques and practical case studies. A group assignment and discussion questions, created via an Agile Story Wall, relate to solving business problems, one of which includes an auto-insurance pricing assignment concerning the claim management process in the context of COVID-19.
- UNSW requires a data visualization and communication course that introduces statistical and visualization tools for the exploratory analysis of data. The course helps students with essential skills for any analyst by building their abilities to present visual access to the huge amount of data that business creates.
- For the last five years, the actuarial program has engaged in the UNSW Digital Uplift/Inspired Learning Initiative,

which has led to substantial development of digital learning expertise within the school and students. Further accelerated during the COVID-19 pandemic, the teaching is digital-enabled and revolves around flipped and blended delivery pedagogy, and formative assessments using the Story Wall approach.

- UNSW’s Co-op program has been operating since 1995 and is the first such university program in Australia of its kind. It is sponsored by major P&C companies in Sydney and combines university study with practical on-site employment. It employs a professor of practice to enhance links between the university and industry thinking.
- Among UNSW’s numerous P&C research projects, the Australian Research Council Linkage project (2013-2020) has resulted in more than 20 papers in top-rated journals.
- Innovative programs such as Girls in Business Digital Camp exposes female students to careers in banking and finance, information systems and actuarial studies. Launched in 2020, the Women in Business Ambassador Program contributes to gender diversity and increases female participation in actuarial studies and information systems at the UNSW Business School.

“To prepare our students for a career in the P&C insurance industry, we have continually innovated both curriculum and teaching pedagogy,” said UNSW Associate Professor Dr. Jae Kyung (JK) Woo. “Our innovations have been facilitated and informed by our close collaboration with P&C industry partners and professional associations. We will continue to work on enhancing our program and contributing to the further development of actuarial science and the actuarial profession,” he said. ●



*Students and faculty in UNSW’s actuarial science program.*

# Beyond Triangles:

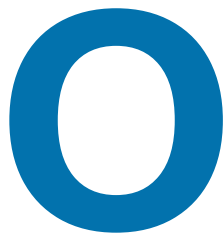
Capturing Insights From  
New Analytic Technology

By Annmarie Geddes Baribeau





**Thanks to data analytics, reserving will never be the same.**



h, reserving! It is the bread and butter of actuarial work. Required by state statutes to have an actuarial opinion, reasonable reserving estimates on insurer balance sheets essentially represent a survival-critical assurance of solvency.

At insurance companies, reserving actuaries are “people of power,” said Christopher Monsour, FCAS, data science practice regional vice president for the Americas at DataRobot. “They are the scorekeepers — the judges.”

For nearly a century, actuaries have based reserving calculations on claim cost estimates first made by claims adjusters, then aggregated through tried-and-true triangles to produce the incurred but not reported (IBNR) estimates.

But that is changing.

Thanks to technological advancements supporting more sophisticated models, some actuaries are turning the reserving process on its head. Rather than start with claims data aggregated through triangles, pioneering actuaries are beginning with unaggregated claims data. They are also applying modern models far more powerful than traditional generalized linear models at the claim, coverage and policy level.

Coming up with individual ultimate reserves first at the claim and coverage level, and then adding in pure IBNR estimated at the policy level, marks a “fundamental change in the starting point” in reserving, said Ken Williams, FCAS, staff actuary for the Casualty Actuarial Society (CAS).

“You want to analyze and then summarize, rather than summarize and then analyze,” Monsour explains, thus making it much faster to respond to new questions requiring new summarizations.

Still considered an experimental practice, more insurers are implementing this new approach to reserving.

What’s more, the new methods can improve operational practices for actuaries, claims professionals and underwriters through a feedback loop to benefit insurers’ organizational goals, said Zack Martin, FCAS, FSA, CSPA, vice president of actuarial, risk and compliance services for Frankenmuth Insurance. (For purposes of this article, models that use current technological advancement are called “advanced analytics.”)

Monsour predicts the practice will become mainstream in the next five years. “Executives will want answers faster and faster and this is how actuaries will fill the need,” he said. Despite the promising multifold benefits of applying advanced analytics to unaggregated individual claims data, there are several barriers to overcome in an industry sometimes set in its ways.

## Despite the promising multifold benefits of applying advanced analytics to unaggregated individual claims data, there are several barriers to overcome in an industry sometimes set in its ways.

### Reserving Re-Think

Fundamentally, reserving principles and practices are rooted in a rudimentary pre-computer calculation process from the 1930s that was later modernized in a 1972 *Proceedings* paper,<sup>1</sup> said Chris Nyce, FCAS, an actuarial services principal for KPMG. Calculations automated with reserving software are primarily based on formulas from the 1970s applied to data aggregated through triangles, explained Nyce, who co-authored “Loss Reserving in the Future: Innovation in a Rapidly Changing World.”<sup>2</sup>

The approach made sense in the past, said Brian Fannin, ACAS, CSPA, CAS research actuary, because triangles were available and easy to use. Although triangles have generally been sufficient for evaluating reserve estimates, some may find them limiting. “The triangle data structure is rooted in financial reporting, not statistical analysis,” Fannin observed. Detail is aggregated away to create triangles, he said, eliminating granular information that actuaries would like to see in more detail to realize the range of possible outcomes.

Even without advanced analytics, there are benefits to merely exploring claim data, said Kevin Kuo, chief technology officer at Hal9, a new firm specializing in artificial intelligence. “Just the exercise of preparing to do individual claims reserving forces you to look at the data for more perspective,” he added. “You might get the IT folks to gather more data that will allow you to do more.”

To know if a model is appropriate, Fannin recommends techniques such as cross-validation, which splits data into training and test sets that can demonstrate the level of vari-

ability in model performance for future periods. However, Fannin noted that aggregate data does not have sufficient sample points to make cross-validation meaningful, another argument favoring more granular data.

Other technology, including automation and visualization, can be applied hand-in-hand with advanced analytics for the most beneficial results. Automation supports advanced analytics by handling repetitive tasks, Nyce said, such as data manipulation. “If you can define the process, you can develop a macro to do it,” he added.

Although data presented in triangles is limited, squared triangles can serve as tools for communicating projections to management and investors, Monsour offered. Additionally, machine learning visualization tools have greatly improved in recent years, and “good visualization can drill down to show which claims features drive the model, and thus provide strategic insights,” he added.

Within a choice of drop-down menus using visualization tools, Nyce said, “You can take a look at the profitability of a book any way you want,” by aggregate, detailed or financial reporting views of the output. Without visualization and automation, seeing the same results requires a team effort to process and display the results. “You would need to have triangles broken out for segments you wanted to evaluate, but now it is easily available in the output of advanced analytics,” he said.

Perhaps most importantly, visualization can help demystify the “black box,” which is essential to moving advanced analytics for reserving forward, Monsour said.

### Bountiful Benefits

Modeling individual claims data offers multifold benefits that not only promise quicker and more detailed estimates but other advantages that can ripple through an insurance company’s operations to boost efficiency in claims, pricing and underwriting. “Generally, modeling individual claims will mean a more complex model with more moving parts than when you model at an aggregate level,” Nyce said.

Running individual claims data through advanced analytics quickens the reserving process by eliminating the need to



<sup>1</sup> Ferguson, Ronald E. and Ron Bornhuetter, “The Actuary and IBNR,” *Proceedings of the Casualty Actuarial Society*, 1972. [https://www.casact.org/sites/default/files/database/proceed\\_proceed73\\_73161.pdf](https://www.casact.org/sites/default/files/database/proceed_proceed73_73161.pdf)

<sup>2</sup> Nyce, Chris and Ian Sterling, “Loss Reserving in the Future: Innovation in a Rapidly Changing World.” <https://advisory.kpmg.us/articles/2020/loss-reserving-future.html>

use last year's reserves and repeat the same calculations for this year to redo the reserve analysis, Nyce said. Actuaries can now plug the detailed data at any valuation into the existing model using current parameters and get a known claim and pure IBNR result.

"That is where the momentum comes in!" he said. "Once you have the model, you have a set of parameters allowing you to plug the most recent data in and get an answer. You could do this a week before

**There are other advantages to applying advanced analytics to unaggregated individual claims data that can enhance decision-making across different functional areas of an insurance company.**

close to get an advanced view of the closing results, for example," he added.

Further, the reserving process can be more fully automated for a second opinion or finding complex patterns using individual claims data. Considering credibility in interpreting results, "Now an actuary can provide an IBNR estimate by choice of claim, coverage level, state, ZIP code groupings and class of business," Nyce said. "By giving actuaries access to more complete data and additional variables, actuaries can anticipate a claim's cost potential, flagging severe claims earlier," he added.

Actuaries can also see, for example, why aggregated reported losses develop differently over time. In one case, Nyce

said, underwriters were writing a significant class at a 150% loss ratio, and advanced analytics revealed the primary culprit.

When claims are better understood, reserving estimates are as well. Because models are more sophisticated up front, Monsour explained, additional work is not needed to drill down into individual claim level projections: Those details are also provided by the model.

There are other advantages to applying advanced analytics to unaggregated individual claims data that can enhance decision-making across different functional areas of an insurance company. Martin said that the ability to utilize all the data opens many possibilities.

"Just providing granularity to what is driving losses can be used for strategic decisions for underwriting and pricing," he said, including more refined insights into what is driving profitability. When reserving actuaries are developing estimates based on current claims activity that is more informative to pricing actuaries, the feedback loop of shared data between reserving and pricing actuaries becomes more robust, he explained. Underwriters can benefit as well.

The approach also improves other operational efficiencies. Detecting elements that can predict potentially severe claims supports both claims professionals and actuaries.

When claims examiners enter key terms or phrases in the text of a claims file, collecting and analyzing that data can help triage claims, resulting in more effective claims management. Certain terms can also assist actuaries to arrive at more accurate claims estimates.

Flagging the name of an opioid prescription in a claims file, for example, can signal potential complexities and difficulties in that claim, Nyce said. Of course, claims models and profitability models have been around for some time, but now one model can have multiple uses and be one version of the truth, he added.

Williams said that insurers might also make changes to achieve faster claim closure, which reduces the number of open claims requiring reserve estimates and thus the overall reserve estimate. "In the past, there were not great ways to account for that in the reserving process, but reserving at the detailed level picks it up automatically," Williams said.

Using granular claim attributes also contributes to accurately projecting losses. The models allow actuaries to get information for many different ages and types of claims at

once because they are more flexible, said Monsour. He began experimenting with generalized linear models for reserving about 15 years ago but found the machine-learning approach to be more flexible. Importantly, advanced analytics makes it easier to tell how much development is from open or closed claims, or from large claims or small claims, Monsour said. This can help actuaries determine how the reserves should be split between primary and excess insurers or between the direct insurer and excess reinsurer.

Seeing trends and patterns up front also allows actuaries to analyze claims information in ways not before possible. “Being able to forecast payments period by period until the claim is closed helps with cash flow management,” said Kuo, who wrote the CAS Research Paper, “Individual Claims Forecasting with Bayesian Mixture Density Networks.”<sup>3</sup>

Applying advanced analytics to unaggregated individual claims data supports detection of claim anomalies, new variables that become important, or complex constellations of patterns that can alert actuaries to the potential cost and duration of a claim, Nyce said.

“Locating new variables and impacts can also help actuaries better predict scenarios that may take claims longer to settle, such as the likelihood of a claim going to litigation, or help claims personnel address the reason why claimants hire lawyers,” Williams said.

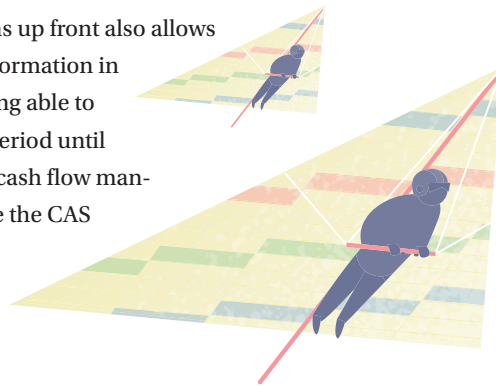
Also important, machine learning allows actuaries to make changes or adjustments, Williams said. Traditional claim reserving methods rely on assumptions based on how claims were settled in the past even though these patterns can change, he said.

By analyzing claims data more thoroughly through advanced analytics, claims adjusters can make better reserve estimates before actuaries begin their calculations, Williams observed. Rather than waiting for the next reserving cycle, actuaries can also track claims data to adjust reserves quickly due to changes such as inflationary pressure or the impact of COVID-19.

## Barriers to Adoption

Although the potential benefits of applying advanced analytics to individual unaggregated claims sound promising, there are several hurdles to overcome before the approach realizes widespread adoption.

For starters, the methods are still experimental. Martin said that there is “not a set of consistent approaches to how a practitioner would go about developing a reserve estimate



**Rather than waiting for the next reserving cycle, actuaries can also track claims data to adjust reserves quickly due to changes such as inflationary pressure or the impact of COVID-19.**

using the granular claims approaches.”

“Most companies do not have the resources to do it right,” said Kuo. Applying advanced analytics to individual claims reserving requires access to data, computing infrastructure and an actuary with data science expertise who can execute building the model, he explained. Assembling this combination is currently difficult to achieve.

Additionally, there is a lack of publicly available data concerning exposures, or policy-level information, to train models for pure IBNR, Kuo said. So, research progress has been limited for IBNR projections at the individual claims level. In general, data is probably not as much a concern for big carriers as it is for medium and small insurers. “The problem for small insurers is...they might not have enough data to build even a model on only reported claims,” Kuo explained. For prototyping algorithms, he recommended an open-source simulator for individual claims data at <https://blog.kasa.ai/posts/simulation-machine/>.

Williams offers another obstacle to implementation.

<sup>3</sup> Kuo, Kevin, “Individual Claims Forecasting with Bayesian Mixture Density Networks,” CAS Research Paper, February 2020. <https://www.casact.org/sites/default/files/2021-02/bayesian-mixture-density-kuo-1219.pdf>

Since more accurate reserving is not seen as providing a competitive advantage like pricing, it is more challenging to convince practicing actuaries and insurers to adopt it. He said that the challenge for reserving actuaries is to convince company leaders and clients of the benefits of better reserve analytics for not only reserving but potentially enterprise risk management, pricing and claims analytics.

Insurance adapts more slowly than most industries, Nyce said. Realizing the advantages of individual claim reserving, however, requires insurers to be willing to re-think 50 years of actuarial reserve practices. “However, the advantages of understanding profitability at any cut of the data, you can imagine, is a huge competitive edge,” he offered.

“The biggest challenge,” Monsour said, “is how to provide the appropriate diagnostics around the model so they are not a ‘black box.’” Nyce said that the auditing process, which is embedded in regulations, will also need to adapt.

From a practical point of view, it is easier to “stay with the triangles,” Nyce said, than use new granular data approaches. That’s because it takes creativity to understand more complex models, creating the need to audit more detailed data. “Especially when used for reserving,” he added, “there has to be acceptance and trust of the new methods by regulators and auditors.”

## Conclusion

When advanced analytics were introduced in personal lines pricing more than 20 years ago, it took more than a decade to become a best practice. Fortunately for reserving actuaries willing to push the barriers of convention, the evolution of sophisticated modeling for pricing offers a pathway of lessons learned that could advance new reserving approaches more quickly.

Insurers have also become more open to the potential that advanced analytics offers throughout their organizations. Just as insurers rely on actuaries to assure solvency, the industry’s original data scientists should lead the way for advancing new approaches to reserving.

That means reserving actuaries must challenge themselves to look beyond triangles to improve reserving practices. Fortunately, actuaries now have the CAS Institute, which offers specialty credentials in quantitative practice areas such as predictive analytics and data science — this should ease and quicken the transition from the traditional reserve methods to modern approaches. ●

---

*Annmarie Geddes Baribeau has been covering insurance and actuarial topics for more than 30 years.*



ETHICAL ISSUES

# I am Confused! Which Actuarial Standards Apply to Me?

By MICHAEL SPEEDLING AND KENNETH HSU, MEMBERS OF THE CAS COMMITTEE ON PROFESSIONALISM EDUCATION

*The Professionalism Education Committee often gets asked to clarify if the Code of Professional Conduct and the Actuarial Standards of Practices (ASOPs) apply to various scenarios. We have also received comments that the focus of these articles is generally focused on actuaries practicing in the United States. We plan to address some of these scenarios in a mini-series of articles here in the pages of Actuarial Review.*

*While the articles will be posing scenarios as they apply to credentialed actuaries, we feel that these could be the basis for leading practices for anyone doing work as an actuary whether or not they intend on becoming credentialed.*

*To make this truly a learning and professionalism experience, we want your feedback. You can send your comments and questions to [ar@casact.org](mailto:ar@casact.org).*

To start the series, we will address what we believe are the two most common scenarios for our readers:

1. A U.S. actuary sitting in the U.S. and performing actuarial work intended for a client inside the U.S.
2. A U.S. actuary sitting in the U.S. and performing actuarial work intended for a client in Canada, or a U.S. actuary sitting in Canada performing actuarial work intended for a client in the U.S.

Future articles will address U.S.

actuaries working abroad, non-U.S. actuaries sitting in the U.S. and performing work intended for a client inside the U.S., and U.S. actuaries working in non-actuarial roles.

According to the CAS's 2020 Annual Report,<sup>1</sup> approximately 82% of CAS members reside in the United States. Between 2019 and 2020, we see that the geographic proportion of membership in the U.S. slightly shrank, shifting internationally to Canada and China. It is also the CAS's mission to expand the recognition of the society internationally, as evidenced by the 20% of membership service expenses in communication and marketing, and an additional 18% of total expenses dedicated to international activities (see Table 1).

### Definitions

Before we dive into discussing the specific scenarios, let us explore some terms and definitions that are important to remember.

An individual who has been admitted to a class of membership to which

the Code of Professional Conduct (the Code) applies by action of any organization having adopted the Code is an **Actuary**. Note that when the term "actuary" is used without being capitalized, it refers to any individual practicing as an actuary, regardless of organizational membership or classification; however, Actuary (capitalized) should only be used to describe an individual who has been admitted to a class of membership.

We also define a "U.S. Actuary" as an actuary that is credentialed and resides in the United States.

A **principal** is a client or employer of an Actuary. It is the person(s) or organization(s) for which actuarial services are provided. Some examples of principals are the manager of the project, the client that hired you or the regulator that reviews your filing.

An **Actuarial Communication** can include a written, electronic or oral communication issued by an Actuary with respect to Actuarial Services. Further, examples include an actuarial memo in an email, an expert witness statement

**Table 1.**

Country	Count		Distribution	
	2019	2020	2019	2020
United States	7,389	7,516	82.3%	82.0%
Canada	1,026	1,081	11.4%	11.8%
Rest of the World	558	570	6.3%	6.2%
<b>Total</b>	<b>8,973</b>	<b>9,167</b>	<b>100.0%</b>	<b>100.0%</b>

<sup>1</sup> [https://www.casact.org/sites/default/files/2021-05/CAS\\_Annual\\_Report\\_2020.pdf](https://www.casact.org/sites/default/files/2021-05/CAS_Annual_Report_2020.pdf)

given in court or a rate filing document.

**Actuarial Services** are professional services provided to a principal by an individual acting in the capacity of an actuary.

An organization that has been accepted for full membership in the International Actuarial Association or a standards-setting, counseling or discipline body to which authority has been delegated by such an organization is a **Recognized Actuarial Organization**. In the United States, the Casualty Actuarial Society and American Academy of Actuaries are both recognized actuarial organizations. There are also recognized actuarial organizations around the world, including:

- Canadian Institute of Actuaries (CIA)
- Institute and Faculty of Actuaries (U.K.)
- Colegio Nacional de Actuarios (Mexico)
- The Conference of Consulting Actuaries (U.S.)
- China Association of Actuaries
- Actuarial Society of Hong Kong
- Singapore Actuarial Society
- Association Suisse des Actuaire

### **U.S. Actuary Performing Work Intended for a U.S. Principal**

This is the most common scenario and is probably also what is most familiar to the majority of current members and candidates. The CAS follows the Code of Professional Conduct published by the American Academy of Actuaries (AAA). From the Code, Precept 2 states, “An Actuary shall perform Actuarial Services only when the Actuary is qualified to do so on the basis of *basic* and

*continuing education and experience*, and only when the Actuary satisfies applicable qualification standards.” In the U.S., an Actuary follows the United States Qualification Standards (USQS) published by the AAA. U.S. Actuaries are held to USQS, the Code of Professional Conduct and Actuarial Standards of Practice, regardless of their membership status in the AAA. In addition, candidate members are also subject to a subset of precepts from the Code.<sup>2</sup>

AAA delegates the basic education requirements to the CAS (and other credentialing organizations), which include a series of exams, the Course on Professionalism and Validation by Educational Experience (VEE) requirements. One must meet all the basic education requirements before one is eligible to become a member and be considered meeting the basic education requirements.

An Actuary needs to have at least 30 hours of continuing education (CE) credit, of which at least 6 CEs must be organized, at least 3 CEs must be related to professionalism topics, and, at most, 3 CEs can be related to business skills. AAA also randomly audits 1% of active members each year. At the time of this article, the AAA is in the process of revising the USQS, and it is the responsibility of each actuary to assure they meet the requirements.

Lastly, on the experience requirement, an Actuary must have at least three years of responsible actuarial experience to make a statement of actuarial opinion. If an actuary does not meet this requirement, another qualified actuary should be co-signing the work that leads to a General Statement

of Actuarial Opinion (SAO). Examples of General SAOs include loss reserve opinions, ratemaking opinions, expert testimony, supporting actuarial reports and rate filings.

If an Actuary is interested in issuing a Specific SAO, such as an actuarial opinion that will be used in a National Association of Insurance Commissioners P&C annual statement, the actuary must obtain 15 CEs on relevant education related to the Specific SAO. At least six hours of this specific CE must be organized. Actuaries must also meet the experience requirement where they are under the review of an actuary qualified to issue the same SAO. Further requirements will apply to the Actuary. First, the Actuary must have three years of experience under the review of another actuary who was qualified to issue the same SAO.

### **Cross-Canadian Border Work**

There are two sides to the Canadian coin: 1) a Canadian actuary performing actuarial services for the U.S., and 2) a U.S. actuary performing actuarial services for Canada.

The Code Annotation 2-1 requires an Actuary to observe applicable qualification standards (QS) that have been promulgated by a Recognized Actuarial Organization (RAO) for the jurisdictions in which the Actuary renders Actuarial Services, and Annotation 3-1 states that an Actuary observe the applicable standards of practice (Standards) promulgated by that RAO.

This means that if you are doing work for Canada, you need to follow the Canadian QS and Standards and follow the U.S. QS and Standards for work in

<sup>2</sup> Precepts applicable to the candidates are covered by the CAS Course on Professionalism.

the U.S. regardless of where you sit! The Cross-Border Discipline Agreement,<sup>3</sup> which is between the CIA and the U.S.-based organizations, states that the “residence or physical location of the actuary is irrelevant to the determination of whether the actuary has practiced in Mexico, the United States, or Canada.” The CIA Standards of Practice<sup>4</sup> reiterate that the “work in Canada of a member of a professional actuarial organization is expected to conform to these Standards of Practice” where “work” is defined as “work that is commonly, but not necessarily exclusively, performed by actuaries in assessing, measuring, and evaluating risks and contingencies.”

This applies not only to the heavy-lifting work but also to the peer reviews or other material contributions made to

the work.

So, what if your work is relied upon? If your work was relied upon in work for another jurisdiction, but your work was not created within that jurisdiction as an intended or anticipated user, then you would not be required to comply with the QS and Standards of that jurisdiction. It is best practice to document for which jurisdictions the work was intended.

The Canadian CE requirement is more stringent in most ways than the U.S. CE requirement. Over the course of two years, the CIA requires 80 hours of continuing professional development credits, with at least 30 as “guided” activities, and a core professionalism course.

## Final Remark and Upcoming Discussions

In summary, if you are practicing in the U.S., the Actuary would follow the USQS and standards. If the work performed involved Canada, the Actuary would follow the Canadian QS and standards of practice.

In an upcoming issue of *Actuarial Review*, we will explore the application for an Actuary to practice in China, Bermuda and other countries. ●

---

*Michael Speedling, ACAS, MAAA, CPCU, CRMA, is the internal audit director for Axis Capital.*

*Kenneth Hsu, FCAS, CSPA, is a senior actuarial analyst for Uber Technologies.*

<sup>3</sup> <https://www.actuary.org/content/cross-border-discipline-agreement-1>

<sup>4</sup> <https://www.cia-ica.ca/docs/default-source/standards/sg010120e.pdf>

## Jane Austen, Actuary? By VICTORIA GROSSACK, FCAS

Janeites esteem Jane Austen as a literary genius. She used the stream of consciousness technique before it became popular. Her characters are exquisitely drawn, and her dialogue can be wickedly funny. Her novels, all devotees know, are classics.

However, what about Austen as an actuary? She never promotes herself in this regard — in fact, she never promotes herself at all, not even putting her name on her novels — but her mathematical abilities are evident in her writing. In fact, she uses math in a way that would make most actuaries proud.

### Monetary Sums, Large and Small

Austen and most of her characters are

aware of the value of money, true of all actuaries. In fact, money is often a motivator for characters’ choices in her novels. The young ladies often need husbands to support them, while the unattached gentlemen are more attracted to ladies when they have significant dowries. Mr. Darcy’s income of £10,000 per annum makes him more handsome in *Pride & Prejudice*, while Mr. Wickham only courts Mary King after she inherits £10,000.

However, Austen’s comprehension goes far beyond large, round sums. In *Mansfield Park* (Chapter 31), monetary gifts to William Price are discussed by his two aunts, Mrs. Norris and Lady Bertram.

*Mrs. Norris seemed as much*

*delighted with the saving it would be to Sir Thomas as with any part of it. “Now William would be able to keep himself, which would make a vast difference to his uncle, for it was unknown how much he had cost his uncle; and, indeed, it would make some difference in her presents too. She was very glad that she had given William what she did at parting, very glad, indeed, that it had been in her power, without material inconvenience, just at that time to give him something rather considerable...”*

*“I am glad you gave him something considerable,” said Lady Bertram, with most unsuspecting calmness, “for I gave him only £10.”*

*“Indeed!” cried Mrs. Norris, red-*



dening. "Upon my word, he must have gone off with his pockets well lined, and at no expense for his journey to London either!"

The amount of Mrs. Norris's gift to William Price is never mentioned in *Mansfield Park*, but Jane Austen told her family (*A Memoir of Jane Austen*) that it was only one pound. Besides being a perfect contrast of the miserly Mrs. Norris versus her much more generous sister, the dialogue shows how well Austen understood the importance of relatively small sums, and how much £10 would mean to a midshipman in William Price's position.

### The Distress of Debt

Another reason for seeking a marriage settlement is to deal with debt. Several of Austen's gentlemen (Willoughby in *Sense & Sensibility* and Wickham in *Pride & Prejudice*) marry to escape debt, making life choices that they would have preferred not to make.

However, marriage is not the only solution to debt. Austen's last novel, *Persuasion*, begins with the fact that the baronet, Sir Walter Elliot, has been living beyond his means and needs to "retrench" in order to regain solvency. As Sir Walter is really bad at managing money, Austen comes up with the best method for the baronet to retrench:

*"Quit Kellynch Hall." The hint was immediately taken up by Mr. Shepherd, whose interest was involved in the reality of Sir Walter's retrenching, and who was perfectly persuaded that nothing would be done without a change of abode. (Persuasion, Chapter 2)*

This change of abode is critical to the plot of *Persuasion*. It's also sound business advice, another trait found in



the best actuaries.

Some readers may object that the examples given so far only prove Austen had a mercenary side and do not demonstrate her understanding of mathematics. So, let's move on to passages involving annuities and livings. These also concern money, but the math is more challenging.

### Annuities and Livings

Annuities, when provided by life insurance companies and pension funds, are fairly sure things because they have enough business so they can rely on distributions and expected values. However, if you are just one individual promising an annuity to just one other individual, you can land anywhere on a distribution. It's like throwing a pair of dice: on average, they sum to 7, but you can roll anything from 2 to 12, and the probability of rolling something besides the mean is pretty good.

Jane Austen also understood this math. In *Sense & Sensibility*, she describes the dilemma a couple faces when debating whether or not to promise an annuity to Mr. John Dashwood's widowed stepmother. Here are some remarks made by Fanny Dashwood to her husband, Mr. John Dashwood:

*"... if you observe, people always live forever when there is an annuity to be paid them; and she is very stout and healthy, and hardly forty. An annuity is a very serious business; it*

*comes over and over every year, and there is no getting rid of it. ... I have known a great deal of the trouble of annuities; for my mother was clogged with the payment of three to old superannuated servants by my father's will, and it is amazing how disagreeable she found it. ... I would not pin myself down to the payment of one for all the world." (Sense & Sensibility, Chapter 2)*

Fanny Dashwood's speech demonstrates her selfishness, but Austen has also demonstrated her sophisticated understanding of the uncertainty associated with providing an annuity.

Let's move on to livings. A living is the salary of a clergyman, a fixed number of pounds, associated with fulfilling the duties of a particular parish. Austen, daughter and sister of several clergymen, understood the importance of livings. In *Sense & Sensibility*, Austen gives keen insight into the livings market, when a living for a small parish is being offered by Colonel Brandon to another. The following discussion takes place between Mr. John Dashwood and John's half-sister, Elinor:

*"Really! — Well, this is very astonishing! — no relationship! — no connection between them! — and now that livings fetch such a price! — what was the value of this?"*

*"About two hundred a year."*

*"Very well — and for the next presentation to a living of that value*

— supposing the late incumbent to have been old and sickly, and likely to vacate it soon — he might have got I dare say — fourteen hundred pounds.” (*Sense & Sensibility*, Volume III, Chapter 41)

This shows Austen’s deep understanding of the mathematics of the livings market, as well as her talent to explain the situation clearly and to use that situation for effectively displaying the personalities of her characters.

### Insistence on Accuracy

Austen’s mathematical talent is visible in many matters, such as her understanding of chance in cards and distances in journeys. Furthermore, Austen is aware that calculations and estimations must be reviewed for accuracy. The following dialogue takes place in *Mansfield Park*’s characters Mary Crawford and Edmund Bertram:

“I am really not tired, which I almost wonder at; for we must have walked at least a mile in this wood. Do not you think we have?”

“Not half a mile,” was his sturdy answer; for he was not yet so much in love as to measure distance, or reckon time, with feminine lawlessness. ...

“We have been exactly a quarter of an hour here,” said Edmund, taking out his watch. “Do you think we are walking four miles an hour?” (*Mansfield Park*, Chapter 9)

As the passage above is more than 200 years old, we’ll pass over the political incorrectness. Instead, let’s remember that all actuaries must insist on reasonable assumptions and accurate calculations.

### Proxy Variables

My favorite display of Austen’s math-

ematical ability is her use of a proxy variable. In *Emma*, the following dialogue takes place between Mrs. Elton, the local vicar’s bride, who recently arrived from Maple Grove, and Jane Fairfax:

“I do believe,” she continued, “this is the most troublesome parish that ever was. We never heard of such things at Maple Grove.”

“Your parish there was small,” said Jane.

“Upon my word, my dear, I do not know, for I never heard the subject talked of.”

“But it is proved by the smallness of the school, which I have heard you speak of, as under the patronage of your sister and Mrs. Bragge; the only school, and not more than five-and-twenty children.” (*Emma*, Volume III, Chapter 16)

The number of children in the school serves as a proxy variable for the size of the parish. It is a perfect example of a proxy variable.

### Family Connections

As we have seen, Austen repeatedly shows her understanding of mathematics. The case is proved, but there is additional circumstantial evidence. Mathematical talent often runs in families. Two of Jane’s brothers became admirals in the Royal Navy; one of them, Sir Francis Austen, rose to become Admiral of the Fleet. They could not have achieved these positions without mathematical talent. (Note: My own brother, Marshall Grossack, is also an actuary.)

Austen never used the term actuary, even though actuaries existed when she lived. After all, she was writing about romance in country villages and not about insurance companies. In her six finished novels, she only uses the word

mathematician once. This paragraph is in *Emma*, after Emma has witnessed an event — Mr. Frank Churchill’s rescue of Harriet Smith from a threatening mob — which she hopes will lead to romance:

Could a linguist, could a grammarian, could even a mathematician have seen what she did, have witnessed their appearance together, and heard their history of it, without feeling that circumstances had been at work to make them peculiarly interesting to each other? — How much more must an imaginist, like herself, be on fire with speculation and foresight! (*Emma*, Volume III, Chapter 3)

Austen’s use of the word mathematician indicates she was familiar with people who could calculate. I do not think I am being an imaginist when I maintain that this literary genius of the early 19th century had a profound understanding of mathematics and would have made a respectable actuary. ●

---

Victoria Grossack and has worked for Folksam Reinsurance and Zurich Financial Services; she currently supplies materials for the Actuarial Bookstore. She writes novels celebrating birds, Greek mythology and Jane Austen. Her Jane Austen-based novels include: *The Meryton Murders*, *The Highbury Murders*, *The Mansfield Park Murders* and *Mrs. Bennet’s Advice to Young Ladies*. Her novels can be found at Amazon.

### Citations

Lodge, David, “The best stream of consciousness novels,” *The Guardian*, January 20, 2009.

Austen-Leigh, James Edward, *A Memoir of Jane Austen*, Richard Bentley and Son, 1871.

A version of this article, “Jane Austen, Mathematician,” appeared at [janeausten-world.com](http://janeausten-world.com).

# VALUED

At the CAS, we strive to be a valued and trusted resource for risk professionals, giving them unparalleled support as they develop professionally and advance their careers. Learn more about our premier educational resources and training for the global community of property and casualty experts at [casact.org/valued](https://casact.org/valued).



**Expertise. Insight.  
Solutions.®**

[casact.org](https://casact.org)

## IN MY OPINION BY GROVER EDIE, AR EDITOR IN CHIEF

## A Tale of One Actuary

I have been in the insurance industry for a long time and met a lot of people along the way. When I read the actuarial comic in the prior *Actuarial Review*, one professional I know came to mind. His name is Martin, and he gave me permission to tell his story.

Martin was raised in a small town in the rural Midwest. As a juvenile, Martin was too short (5'2") to play basketball and too light (95 pounds) to play football. He was regularly beaten up at recess and at the local public swimming pool. Wearing thick glasses and being a "nerd" didn't help.

He enjoyed scientific experiments and wanted to work for NASA, which was the only type of scientific job his high school counselors knew to tell him about. He decided to go to college and get a degree in chemistry or physics.

Being in the first generation of his family to go to college, he picked a local teacher's college because it wasn't as intimidating or as expensive as the "big schools." He didn't know that the first job you get upon graduating has a lot to do with the school you graduated from.

His parents helped financially, and he took jobs over summer vacation to make ends meet. His least favorite job was working on a crew on a college garbage truck.

When he graduated, his chosen STEM field was flooded with unemployed experienced practitioners. There was no hope for a new graduate from an

unknown college with no experience to get a job in his field of study. He had a diploma, but no job prospects.

Just before graduation, Martin's soon-to-be father-in-law introduced him to a relative in insurance, who introduced Martin to an actuary. This was a profession Martin had never heard of before, but after spending time with the actuary, Martin decided this was the right career for him. With no exams, he had little chance of getting an actuarial job. So Martin and his newly wedded wife took a chance, moved to a large Midwest city where he applied for every job in the insurance industry that he could find.

He finally got a job as an underwriter, another profession he had not heard of before. He had to take insurance courses in order to keep his job, so studying for actuarial exams was delayed for a few years.

Once he began studying for the actuarial exams, he had to do so with no financial support and no time allotted for studying at work. He signed up for an exam prep course at his own expense. Part way through the study cycle, the "server"<sup>1</sup> went down and was not restored until after the exam date.

About that time, the branch manager fired Martin when he found out he was looking for a job as an actuary while he trained as an underwriter. Jobless, he started the job search again. He got two interview opportunities, one on either

coast. He accepted the job in New York City with the only company that would pay his way for the interview.

Moving to New York with his wife at his own expense half-way across the country wasn't easy. They found an apartment they could afford, but the commute was an hour and a half (each way) from his new job.

Once Martin had passed five exams he took a job at a well-funded startup and thought his days of changing companies were over. So, he, his wife and their newborn son moved halfway across the country, back to the Midwest.

Once there, the young couple learned that their newborn had a heart defect that would require surgery. Martin juggled the new job, new supervisory responsibilities and exam preparation, with the surgery looming on the horizon.

Martin failed Part 7 multiple times, but finally he became an ACAS. Then the startup lost funding, and Martin was once again without a job. He accepted another job "back East" and moved nearly half-way across the country, again.

He passed another exam, leaving only Part 9 between him and Fellowship. He took it, and failed it, five times. He passed on the sixth try. It took him 15 years to become an FCAS.

By the time he was a Fellow, he had become vice president and chief actuary of a top 25 insurer and father of two sons. He went on to be a vice president

<sup>1</sup> The "server" was actually the Canadian postal system, that went on strike, preventing Martin from finishing the by-mail correspondence course for Part 1.

and chief actuary of an international insurer, and an executive of a Fortune 100 company.

### Overcoming obstacles

When he made the wrestling team in high school, the bullies disappeared. He could only date short girls but ended up with the perfect wife, and they are still happily married. (She is about his height, and taller than most of his relatives.) But being in the shortest two percentile of adult males, Martin had to find another way to stand out.

NASA has seen ebbs and flow in their employment over the years, while insurance is a relatively steady employer. Martin unknowingly traded the job of his dreams for a much stabler line of work.

Working as an underwriter enabled him to view how insurance is transacted at the agent and branch office level — knowledge that he has used often in his

career. It also started him on a path to CPCU. Later, his underwriting experience and CPCU designation enabled him to be in charge of an underwriting division while still chief actuary and chief risk officer at the company for which he worked.

In New York City, his commute turned out to be a place where he could study. He turned a disadvantage, the hour-and-a-half commute, into an advantage: “study time.”

When Martin, his wife and son moved back to the Midwest, they did not know of the infant’s heart defect, but they also didn’t know that the world’s best pediatric cardiology surgeon for their son’s medical issue was in the same city that they had moved to. The move was difficult for the young couple, but God made sure their son had the best medical care available. Anywhere! The surgeon was world-renowned for performing exactly the procedure their son

needed. The surgery was successful, and Martin’s son is now a healthy adult.

### Epilogue

You may know Martin as Grover *Martin* Edie.

The purpose of this article is not to boast, but to point out that all of us have obstacles to overcome and to put perspective around one actuary’s journey.

We all have shortcomings, disadvantages and obstacles. Every one of us has something that can be used as an excuse for our failure or something to overcome and give us the resolve to succeed.

Some people are successful in spite of something. Others fail because of something. Often, it is the same “something.”

The question is “What are you going to do about it?” ●



IT'S A PUZZLEMENT By JON EVANS

## Questionable Odds

You have to guess the identity of a specific person, randomly chosen from all people currently alive on Earth. You are allowed to ask one question about the randomly chosen individual, with a “yes” or “no” answer, and receive the answer before guessing. For the answer of any such question, you will be given a list of all persons satisfying that answer. For example, you could ask: Does the person primarily reside inside California? If the answer is “yes,” you will be given a list of all persons primarily residing in California; if “no,” a list of all persons not living in California.

- Give an example of a question that maximally improves your expected probability of correctly guessing the individual.
- Give an example of a question that minimally improves your expected probability of correctly guessing the

individual.

- How would you characterize questions with improvement greater than the minimum and less than the maximum?

### Identifiable Sequences

Several readers sent in noteworthy solutions, which can be found attached to this column posted on the AR website under [bit.ly/AR\\_Puzzlement](http://bit.ly/AR_Puzzlement). Unfortunately, as of this printing, neither Steve Mildenhall nor I have yet allocated sufficient time and attention to evaluate whether any of these solutions constitute a definitive answer to the puzzle as posed. We are not otherwise aware of a definitive solution, and the puzzle may effectively be an “open problem.”

However, there is a definitive answer to a closely related problem. It is known as the Mian-Chowla sequence. Details and references can be found at The On-

line Encyclopedia of Integer Sequences (<https://oeis.org/A005282>). This sequence is recursively defined very simply as follows:  $a(1) = 1$ ; for  $n > 1$ ,  $a(n)$  = smallest number  $> a(n - 1)$  such that the pairwise sums of elements are all distinct. There does not appear to be a simpler formula or computationally much simpler algorithm than a recursive search program, where given  $a(1), \dots, a(n)$  successively larger candidates for  $a(n + 1)$ , beginning with  $a(n) + 1$ , are analyzed to determine if the new pairwise sums they produce with  $a(1), \dots, a(n)$  are all different from any of the pairwise sums already produced among only  $a(1), \dots, a(n)$ .

A known asymptotic interval bound is  $n^2/2 + o(n) < a(n) < n^3/6 + o(n^2)$ . A conjectured asymptotic growth estimate is  $a(n) \sim n^3/(\log(n))^2$ .

Note that any partition of  $a(n)$  into infinite disjoint sequences  $A(n)$  and  $B(n)$ , will automatically satisfy the identifiable condition posed by Mildenhall, although not necessarily satisfying his loosely defined “slowest growing” criterion. However, two sequences  $A(n)$  and  $B(n)$ , finite or infinite, that are jointly identifiable, do not necessarily form a union that satisfies the unique pairwise sum property of the Mian-Chowla sequence. Therefore, in a loose conceptual sense, the Mian-Chowla is a “special case” of Mildenhall’s puzzle.

Solutions were submitted by John Berglund, Ken Klinger, Eamonn Long and Tomasz Serbinowski. ●



Know the answer?  
Send your solution to  
[ar@casact.org](mailto:ar@casact.org).



**Minor adjustments  
can have a  
major impact**

Assess P/C insurers' capitalization levels across risk categories and understand how changing conditions impact the balance sheet with

## **Best's Capital Adequacy Ratio Model – P/C, US**

Examine the impact of changing risk factors with this model, consistent with the methodology used by AM Best's rating analysts.

**Learn more: [sales@ambest.com](mailto:sales@ambest.com)**

NOTE: The results or output created by use of the *Best's Capital Adequacy Ratio Model* ("Output") is for informational and internal purposes only, and such Output may not match or be consistent with the official BCAR scores that AM Best publishes for the same rating unit. The Output is not guaranteed or warranted in any respect by AM Best. The *BCAR Model* is a non-rating services product, and its purchase is not required as part of the rating process.

21.BCAR013

**Our Insight, Your Advantage™**





**Casualty Actuarial Society**  
4350 North Fairfax Drive, Suite 250  
Arlington, Virginia 22203 USA  
Phone: 703-276-3100, Fax: 703-276-3108  
www.casact.org

PRESORTED  
STANDARD MAIL  
U.S. POSTAGE PAID  
LUTHERVILLE, MD  
PERMIT NO. 171



**Sally Ezra • Claude Penland** ACAS, MAAA

actuaries@EzraPenland.com • (800) 580-3972

**EzraPenland.com**

## Our Mission Statement

Ezra Penland Actuarial Recruitment was established by Sally Ezra and Claude Penland, partners with over 40 years of combined industry experience. Our goal is to be the leading actuarial recruitment firm in the world while serving the long-term needs of clients and actuaries.

Our educated, knowledgeable and highly-trained staff will always exhibit business ethics, integrity, empathy and strong listening skills to help you reach your business goals.

