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BY ANNMARIE GEDDES BARIBEAU

Promising to transform insurance, an emerging technological movement takes root.

Actuaries Versus Artificial Intelligence

BY JIM LYNCH

What Do Actuaries Do? What Will They Do?



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editor's NOTE by elizabeth smith, *Ar* managing editor

New Year, New Website

est wishes for a wonderful new year from the staff of *Actuarial Review*!

We are getting 2018 started right with a brand new dedicated website for *AR*. You will find it easier to navigate on desktop, plus it looks great on a phone or tablet. We also will be featuring web exclusives for our online readers. Of course, the print copy is still available for those of prefer the feel of paper.

And now for a brief look back.

I am compelled to relay more of the story about a mistake in our last issue. Taylor Krebsbach, the subject of our Downtime column, was so pleased to see her story about being a beekeeper, but she noticed a problem all too familiar to her: Her last name was misspelled.

Krebsbach graciously wrote to the author Laurie McClellan that she had "too many bees to make up for the missing 'b' in my last name."

Not only is she gracious, but she's punderful!

This kind of error happens all the time, and it's especially bothersome when it involves such a nice person. I thank Taylor Krebsbach for taking it so well. I take full responsibility for the error and have had the online version corrected. And in the spirit of the error, I will gladly take my lumps.

Yours truly, Elisabeth Smyth

Corrections

The November/December 2017 contains some errors.

In the Downtime column, "Meant to Bee," Taylor Krebsbach's last name is misspelled as Kresbach.

In Explorations, "In Praise of Value at Risk," the first column on p. 49 repeats the definition of *v* for sample *X* unnecessarily and confusingly. Also, both lines of Figure 1 are erroneously labeled with X; the right-hand side should be labeled Y. And on p. 49, in the first and third columns, the variable *n* should be greater than or equal to (\geq) the respective numbers 2 and 3, not less than (\leq). Thanks to Jim Muza, FCAS, for alerting *AR*.

In the 2017 CAS Volunteer Honor Roll, Avraham Adler was omitted.

The *AR* regrets the errors. The November/December issue is updated online.

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

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Strength in Numbers

"Alone we can do so little; together we can do so much." — Helen Keller

feel very fortunate to be the president of the CAS, a strong organization that is recognized as the premier educator and credentialing body of propertycasualty actuaries. We have grown tremendously over the past two years; our membership has increased by 14.5 percent — from 6,937 in 2015 to 7,943 in 2017. We also had 3,832 candidates sit for exams in the last year.

Our success as an organization is due to our volunteers and their efficient collaboration with our outstanding CAS staff. One out of every three members volunteers. That means we have 2,468 volunteers working to make the CAS a stronger organization every day. This volunteer rate is higher than that of other nonprofit organizations and actuarial organizations. This allows the CAS to continue to produce outstanding educational offerings. During my term, I will continue to support and to reward our volunteers. They are the lifeblood of the CAS.

At the 2017 CAS Leadership Summit, we had three sessions focused on educating and rewarding volunteers. We started with a four-hour morning workshop titled "Engaging and Motivating Volunteers." The goal of the session was to help our chairs and vice chairs run their committees more effectively and to get their members more engaged in the work.

In the afternoon I led a discussion on how committee chairs can work more effectively with CAS staff. The discussion was fueled by a survey that I developed with our Leadership Development Committee. We have a very talented staff who can provide even more resources to make our committees run more efficiently. We will continue to provide additional information on this topic throughout the next year.

We also launched a new volunteer recognition program at the Leadership Summit. While we have several volunteer awards (e.g., lifetime achievement), these programs reward a small number of people. Our new program is intended to reward more members. We know that many of our volunteers are going above and beyond their duties on a daily basis to make the CAS better. Therefore, our goal is to recognize 25 percent or more of our volunteers.

Throughout my term, I will continue to support our volunteers and will look for ways to reward them, to make their the Leadership Summit on OLA's formation and strategic direction.

We were also very fortunate to have Sharon Robinson and Kwame Davis speak on behalf of the International Association of Black Actuaries' (IABA) activities, and they provided a summary of the 2017 IABA Annual Meeting. I attended the meeting and it was a wonderful event. It had a variety of educational sessions, time for networking, and a session to celebrate IABA leaders. Two of the leaders honored were CAS members: Sharon Robinson and Ollie Sherman.

I am very proud of the progress we have achieved in diversity; however, we still have a lot of work to do. I will continue to work to strongly support OLA and IABA, and to strengthen the partnership

We know that many of our volunteers are going above and beyond their duties on a daily basis to make the CAS better. Therefore, our goal is to recognize 25 percent or more of our volunteers.

lives easier, and to provide them with the tools to increase the efficiency of their committees.

I would also like to share with you two other priorities that I focused on at the Leadership Summit: (1) diversity and (2) the Strategic Education Task Force.

It was my honor to give one of the CAS's first S'well Volunteer Awards to Alejandro Ortega for his great work in officially forming the Organization of Latino Actuaries (OLA). The CAS and I have been very supportive of Alejandro and OLA. Alejandro also presented at between the CAS and both organizations. I am working with OLA and IABA to hold a day for high school students (targeting minority students) in Chicago to expose them to the actuarial profession. I have also enlisted the help of the SOA and The Actuarial Foundation, and they are both supporting the effort. If the program is successful, we plan to work with these organizations to introduce it to other cities. We are also working with the SOA to support LGBT members of the actuarial community.

The last item I would like to discuss

President's Message, page 8

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memberNEWS

President's Message

from page 6

is education. As the premier educator and credentialing body of propertycasualty actuaries, the CAS must constantly improve our education in order to maintain this position. I am sure many of you are aware that Nancy Braithwaite, our past president, focused on the importance of education and the need to constantly innovate during her presidential year.

The CAS Board formed a strategic education task force to evaluate several items. I will report back to you throughout my term on the progress of the task force. We want to continue to attract and educate actuaries who not only have technical knowledge but also business acumen and superb presentation skills. We need to provide the education necessary for our members to succeed in the next year and to anticipate the skills that they will need in five or ten years. Therefore, we constantly review our syllabus material. We recently introduced two new exams: Modern Actuarial Statistics I and II. These new exams will test statistical knowledge, which is the foundation of predictive analytics. The task force is working on many items, which I will share in the future as the work progresses. I will be discussing predictive analytics at length with you during my term as I believe it is a growth area for our profession.

I am very proud of the work that The CAS Institute (iCAS) and our subject matter experts are doing. As of this writing, iCAS has more than 360 members from 15 countries. Through the Experienced Practitioner Pathway, 78 Certified Specialist in Predictive Analytics (CSPA) designations have been awarded and 144 people have registered for the exams. I frequently meet with employers and leaders from other actuarial organizations throughout the world and both groups are very excited about our designation and work in predictive analytics. There is great demand for individuals with skills in predictive analytics. If you are interested in learning more about iCAS and the CSPA designation, I strongly encourage you to listen to a recently recorded, free webinar (you can find it on the iCAS website at http:// thecasinstitute.org in the Professional Education section).

In closing, I am honored to be your president, and I am very excited about the number of great initiatives we have in progress. Also, in case I was not clear enough, THANK YOU to all CAS volunteers! You make the CAS work!

Editor's Note: For more details about the 2017 CAS Leadership Summit, read Brian Brown's post on the CAS Roundtable blog.

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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.

CALENDAR OF EVENTS

March 19-21, 2018

Ratemaking, Product and Modeling (RPM) Seminar & Workshops Fairmont Chicago Millennium Park Chicago, IL

May 13-16, 2018

Spring Meeting Boston Marriott Copley Place Boston, MA

June 4-5, 2018

Seminar on Reinsurance New York Marriott at the Brooklyn Bridge New York, NY

June 26-27, 2018

Underwriting Collaboration Seminar InterContinental New Orleans New Orleans, LA

September 5-7, 2018

Casualty Loss Reserve Seminar (CLRS) & Workshops Anaheim Marriott Anaheim, CA

November 11-14, 2018

Annual Meeting Caesars Palace Las Vegas Las Vegas, NV

COMINGS AND GOINGS

Seth Ruff, FCAS, was recently appointed partner and head of reinusurance solutions at TigerRisk Partners. Ruff joins TigerRisk from Swiss Re, where he spent 17 years, most recently as president of U.S. P&C Core Partners Group and president of Swiss Re Underwriters Agency, Inc. Ruff began his insurance industry career as an actuarial consultant with PricewaterhouseCoopers.

RSA Canada has appointed **Steve Cohen, FCAS**, to the newly created role of senior vice president and chief underwriting officer. Prior to joining RSA, Cohen was the executive director, personal lines, with Aviva Canada where he was responsible for personal lines pricing, underwriting and product development, as well as broker quality assurance.

Matt Sondag, FCAS, has joined Wise F&I in the role of actuary, director of contractual risk management. Sondag has over 20 years' experience in the insurance industry working in roles responsible for projecting loss costs, forecasting claim payments and delivering documentation of business results to risk partners.

Turab Hussain, ACAS, CERA, has been appointed to the position of chief risk and actuarial officer at PartnerRe Ltd. Hussain has more than 20 years' experience in the insurance and reinsurance industries. Hussain will join PartnerRe from The Hartford Financial Services Group, where he has served as chief insurance risk officer since 2014.

Mary Jo Kannon, ACAS, MAAA, has joined Huggins Actuarial Services Inc. as a consulting actuary. Kannon has over 25 years of experience in a wide variety of traditional and nontraditional actuarial services, including reserve estimation and risk management diagnostics for self-insureds, reinsurance pricing and commutations, and claims predictive modeling.

EMAIL "COMINGS AND GOINGS" ITEMS TO AR@CASACT.ORG.

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NOTICE — 2017 Annual Report of CAS Discipline Committee to the Board of Directors

Background

The CAS Rules of Procedure for Disciplinary Actions (as amended May 3, 2009, by the Board of Directors) requires an annual report by the Discipline Committee to the Board of Directors and to the membership. This report shall include a description of its activities, including commentary on the types of cases pending, resolved and dismissed. The annual report is subject to the confidentiality requirements.

2017 Activity

One case was resolved and resulted in a recommendation for expulsion. The subject actuary has appealed the decision of the Discipline Committee. The appeal is ongoing and will be resolved by December 16, 2017. There are no additional cases pending before the committee.

-Pat Teufel, Chairperson of the 2017 Discipline Committee

October 16, 2017

Addendum: On November 28, 2017, the Appeals Panel upheld the findings of the Discipline Committee. 🗢

Get to Know the CAS Trust Scholarship Winners

ate McCoy, Lily Cook and Jacob Akstins are the 2017 winners of the CAS Trust Scholarship. The trio were selected by the CAS Trust Scholarship Committee and presented with checks at the CAS Annual Meeting in Anaheim, California. last November.

McCoy, a senior at Drake University double majoring in actuarial science and business administration. was this year's recipient of the \$10,000 CAS Trust Scholarship.

"I am so honored to be named a CAS Trust Scholarship recipient. I am constantly amazed by how supportive the actuarial community is to those aspiring to succeed in the field. The CAS is full of outstanding leaders, technical experts, and academic scholars and I can't wait to join the organization when I receive my ACAS and then FCAS," she said. McCoy served as the 2016-2017 co-president for her school's Gamma Iota Sigma chapter and is currently interning at Travelers, within the personal insurance, actuarial pricing sector. Her internship allows her to analyze auto business profiles to determine the difference between lost and retained policies. "The property and casualty industry is attacking new challenges every day and I look forward to helping solve these issues."

Cook, a senior at the University of Wisconsin-Eau Claire (UWEC) working towards a major in actuarial science and a minor in information systems, was awarded a \$5,000 CAS Trust Scholarship. "I am truly grateful to be one of the 2017 CAS Trust Scholarship recipients. This scholarship is meaningful to me because it will allow me

to focus my time on academics and extracurricular activities this upcoming school year. During my senior year, I plan on continuing to







Kate McCoy

study for actuarial exams, leading the UWEC Triathlon Club as a co-captain and beginning my full-time career by applying to entry-level actuarial positions," Cook said. Cook took on a summer internship at Travelers Insurance in the public sector. She's gained exposure to underwriting leadership, working with finance employees and actuaries from other business units. "After experiencing this rewarding career through two summer internships, I am confident that as a property and casualty actuary I will be provided with ample opportunities to challenge myself and grow as a young professional. I would like to thank the many professors, mentors, family members and classmates who have encouraged me to think positively, stay motivated and always look for opportunities to develop."

Akstins is a senior at the University of Illinois at Urbana-Champaign major-

Lily Cook Jacob Akstins ing in actuarial science with a business minor. He was awarded a \$5,000 schol-

arship through the CAS Trust. "What entices me about actuarial science is not the pure math, finance, or economics aspect. I believe in innovation. Our past, present, and future (particularly, our political climate and social movements) are constantly morphing the world as we know it," Akstins said. Akstins has also contributed to the CAS Student Central website as a Student Ambassador, writing on subjects such as "Developing Oneself as a Holistic Actuary." Akstins was busy last summer, interning at CNA Financial Corporation, focusing on specialty pricing. "Risk's rate of evolution is certainly extremely positive, and, while our tools are improving, we can only remain nimble if we engage in creative inquiry to challenge the status quo. After all, our work directly impacts the lives of countless individuals and businesses."

D.W. Simpson Makes CAS Trust Donation

he Trustees for the CAS Trust are pleased to announce that D.W. Simpson Global Actuarial Recruitment donated \$10,000 to the Trust in 2017. This brings the total contribution by D.W. Simpson to the Trust to \$210,000 over the past several years. The CAS sincerely thanks D.W. Simpson and its employees for its continued support of the CAS mission to advance actuarial science.

CAS STAFF SPOTLIGHT

Meet Michael Cafarelli, Volunteer and Committee Coordinator

elcome to the CAS Staff Spotlight, a column featuring members of the CAS staff. For this spotlight, we are proud to introduce you to Michael Cafarelli.

- What do you do at the CAS? I have recently taken over as the volunteer and committee coordinator. I previously worked as an Actuaries' Resource Center Representative.
- What do you enjoy most about your job?

I enjoy the friendly, team-focused environment and the changing dayto-day duties. I truly enjoy making connections and look forward to more interactions with volunteers in the upcoming year. I am

excited for the years to come!

- What's your hometown? I was born in Silver Spring, Maryland, and have continued to live around the Washington, D.C. area.
- Where'd you go to college and what's your degree?
 I attended the University of Maryland, Baltimore County, where I

received a BA in theatre with an acting focus, BS in psychology and a minor in music vocal performance.

• What was your first job out of college?

My first job out of college was acting at Imagination Stage on a production of Disney's *Mulan*. I still take freelance professional acting gigs throughout the year. I also worked at the International Spy Museum for six years before making my way to the CAS.



Michael Cafarelli

of the apartment, I try and check out as many of the great theatrical productions as possible in the D.C. theatre community — unless I am rehearsing for one.

• What's your favorite travel destination?

In the U.S., it's a split between New York for attending shows and

overall atmosphere, and Naples, Florida, for more of a low-key relaxing environment. Outside of the U.S., I have only visited London and the Philippines, but I hope to expand my international travel horizons in the

international travel horizons in the near future!

• Name one interesting or fun fact about you.

In 2016 I received a Helen Hayes Award (the Washington area theatre awards) nomination for best actor in a musical. That year the cast I was a part of, *Avenue Q*, won the award for best ensemble in a musical.

• Describe yourself in three words. Approachable, reliable, musical.

 What's your favorite weekend activity?

I spend most of my weekends hanging out with my fiancé and our cats, Bazille Pembroke (who only has three legs) and Gordon Atticus (who only has four teeth), while listening to our collection of obscure musicals on vinyl records. Outside

DOWNTIME BY PETER ROYEK

Dream it. Believe it. Achieve it.

ach year, New Jersey Special Olympics solicits volunteers to provide inspirational slogans for the backs of volunteer T-shirts to be worn at Special Olympics events. The headline of this story comes from the T-shirts that we volunteers wore at the New Jersey Special Olympics Summer Games this past June. I take these words to heart, as I am a dedicated volunteer at Special Olympics events in New Jersey and completely enjoy the experience while giving my whole self to the endeavor.

The Special Olympics started in the 1960s by Eunice Kennedy Shriver, sister of U.S. President John F. Kennedy. According to the Special Olympics website, the organiztion is "a global movement of I first became involved with Special Olympics about 10 years ago through a family friend who is a mentor and coach to a group of local residents. The enthusiasm, preparation, courage and skill of the athletes are both amazing and inspiring. After that first event, I was hooked.

Up until this past year, I would volunteer at one to two local events each year for bowling, track or swimming. Athletes who medal at these local events move on to either regionals or directly to state, depending upon the sport. This past year, I have gotten more and more involved in volunteering at New Jersey Special Olympics bowling and track events. In 2017 I volunteered at every event that led up to, and included, the

"Let me win. But if I cannot win, let me be brave in the attempt." — The Special Olympics Motto

people creating a new world of inclusion and community, where every single person is accepted and welcomed, regardless of ability or disability. We are helping to make the world a better, healthier and more joyful place — one athlete, one volunteer, one family member at a time."

When my two daughters were growing up, I was a coach or volunteer at every one of their extracurricular activities throughout their school years, whether they were sports, theater or otherwise. Now that my younger daughter is in college, I have a bit more free time to dedicate to other interests. state championship for both sports five all-day events in total. I will be volunteering for at least those same events in 2018. I also took part in a 3K run on December 3, 2017, that raised funds for New Jersey Special Olympics.

I attempt to make a personal connection with each athlete with whom I interact. I spend the day high-fiving and cheering on athletes on every attempt whether strike or gutter ball, first place or last place — to celebrate their efforts. Over the years, I have seen many of the same athletes at the events; some of the athletes have become my friends. I have gotten to know them personally,



Peter Royek

and we share laughs and stories. My good friend, Rhonda, is the athlete I've known the longest. She calls me "Uncle Petey." We always joke about how much younger she is than I am, though she is only seven years my junior.

The days I volunteer are some of the best days of my life! I leave each event with the sincere and humbling feeling that the athletes have helped me so much more than I have helped them. While my hope is to make a difference in the lives of the athletes, even if for one day, I know that I have become a better person from these experiences.

I know that we are all busy and don't have a lot of time to do all of the things that we would like to do. As a member of the CAS Committee on Professionalism Education (COPE), I also feel it is important to give back to our profession. However, if you are able to, I urge my fellow members to give some extra time to whatever local event or organization makes a difference in your community.

Peter Royek is senior vice president & actuary for Toa Reinsurance Company of America in Morristown, New Jersey.

ARECA Hosts Seminars in Shenzhen and Bangkok

sia REgion Casualty Actuaries (ARECA), the Casualty Actuarial Society's Regional Affiliate in Asia, recently hosted two successful educational events for CAS members and risk professionals in 2017: a seminar in Shenzhen, People's Republic of China, on November 14 and another in Bangkok, Thailand, on November 17.

The Shenzhen seminar was held at the Ping An International Finance Centre. It featured general insurance experts from consultancies such as KPMG and PwC, and new tech companies such as Ding Ran Technology and Zhong An Insurance. The audience included risk professionals, academics and actuarial science students from Shenzhen, Hong Kong and other cities in southern China. The Bangkok seminar was held at the Royal Orchid Sheraton Hotel and explored topics such as rice insurance, cyberrisk and blockchain technology. This year's panel discussion invited two experienced CAS members, Kevin Dyke, FCAS, from the Department of Insurance and Financial Services in Michigan, and Scott Yen, FCAS, from Etiqa Insurance in Malaysia, to share their knowledge in the regulatory space and Asia markets. The seminar also featured drawings for prizes such as the latest Apple Watch Series 3.

CAS Immediate Past President Nancy Braithwaite and CAS International Ambassador Bob Conger attended both seminars and updated attendees on CAS initiatives, including The CAS Institute's Certified Specialist in Predictive Analytics (CSPA) credential and the CAS's newly announced Technology Based Examination (TBE) process.

For presentations from both seminars, visit the ARECA page on the CAS website.



- 1. CAS Immediate Past President Nancy Braithwaite speaks at the seminar in Bangkok.
- 2. Scott Yen, FCAS, (center) makes at point at the Bangkok seminar.
- 3. Herbert Desson, FCAS, of Generali Thailand (left) presents Ashish Jain with a gift from the CAS. Jain, who works for AIR Worldwide, spoke at ARECA's seminar in Bangkok.
- 4. Shenzhen seminar attendees and presenters.





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CAS Announces 2018 Young Researchers Competition Winners

eng Shi, Ph.D., and Jonathan Charak, FCAS, MAAA, have won the 2018 Young Researchers Competition. The winners will receive a monetary prize and be recognized in person at the 2018 International Congress of Actuaries (ICA) in Berlin on June 4-8.

For the purpose of the competition, the CAS defines "young researchers" as actuarial academics or practitioners who achieved their highest designations or advanced degrees no more than five years prior to the 2018 ICA. A CAS selection committee chose winners based on the quality, relevance and potential contribution of the applicant's research to the property-casualty actuarial field.

Peng Shi is an associate professor in the risk and insurance department at the Wisconsin School of Business, University of Wisconsin-Madison. He is the Charles & Laura Albright Professor of Business and Finance. He teaches for the bachelor of business administration program in actuarial science and the Ph.D. program in actuarial science, risk management and insurance. His research interests include predictive modeling, multivariate analysis, longitudinal data and insurance economics. Peng Shi has published papers in ASTIN Bulletin, Journal of Risk and Insurance and Journal of the American Statistical Association. For his research, he has won the Casualty Actuarial Society's Charles A. Hachemeister and Ronald Bornhuetter Loss Reserve Prizes. He has a doctorate in business, with a minor in economics, from the University of Wisconsin-Madison.



Peng Shi



Jonathan Charak

Ionathan Charak is an assistant vice president and actuary at Zurich. His role involves driving efficiency and execution across multiple initiatives, creating and communicating financial plans, and improving business reviews. Prior to his current role, Charak worked with senior leadership on business performance management and execution. He has spent the majority of his insurance industry career as an actuary, in both pricing and reserving roles in U.S. and Australian markets. Charak is vice-chair of the CAS Automated Vehicle Task Force and volunteers on other CAS committees. He holds a BS in mathematics and a BS in biology from Illinois Wesleyan University.

Taylor and Xu Win Variance Prize

he *Variance* Prize for papers published in *Variance* volume 10 has been awarded to Greg Taylor and Jing Xu for their paper "An Empirical Investigation of the Value of Claim Closure Count Information to Loss Reserving." The prize was announced at the 2017 CAS Annual Meeting in Anaheim, California.

The winning paper tests whether loss reserving models that rely on claim count data can produce better forecasts (in the sense of being subject to lower prediction error) than the chain ladder model (which does not rely on counts). The authors find what they believe to be a compelling narrative. For their test data, the success of the chain ladder approach is limited; one or both of the models they test based on claim count data exhibit superior performance, in terms of prediction errors, the majority of the time.

The Variance Prize honors original thinking and research

in property-casualty actuarial science. It is awarded to the author or authors of the best paper published in each volume year. To be eligible, a paper must show original research and the solution of advanced insurance problems.

For a number of years, Greg Taylor has been adjunct professor in the School of Risk and Actuarial Studies at The University of New South Wales, Sydney, Australia. Prior to his current post, he spent about 35 years as a consulting actuary. He is a Fellow of both the Institute and Faculty of Actuaries and the Institute of Actuaries of Australia. He holds doctorates in actuarial mathematics and theoretical physics. He has published three books on loss reserving,



Greg Taylor

Jing Xu

one of which is "Stochastic Loss Reserving Using Generalized Linear Models," a CAS monograph cowritten with Gráinne McGuire.

Dr. Jing Xu received his Ph.D. in statistics from Macquarie University in Sydney, Australia, in 2014. His doctoral thesis focused on developing novel techniques in survival analysis. Other research projects have been related to modeling total loss reserves for general insurance companies. His research interests are in the areas of actuarial science, statistical methodology and applied statistics in medicine or health. Dr. Xu is currently a biostatistician at Singapore Clinical Research Institute. The paper is in *Variance* 10:1.

The CAS Institute Announces New CSPAs

ollowing are the names of 22 people who have earned The CAS Institute's Certified Specialist in Predictive Analytics (CSPA) credential since mid-August 2017. The deadline for applications for the CSPA from experienced practitioners has been extended to June 30, 2018. For more information about The CAS Institute, visit www.thecasinstitute.org. Jeffrey Baer, FCAS, CSPA, The Economical Insurance Group James Boland, FCAS, CSPA, Alliant Insurance Services Christopher Cookey, CSPA, Guidewire Software Jie Dai, FCAS, CSPA, Sentry Insurance

Brian Fannin, ACAS, CSPA, Pirate Grunt LLC Greg Frankowiak, FCAS, CSPA, State Farm Mutual Automobile Insurance Co. Kristen Gilpin, FCAS, CSPA, Allstate Insurance Company Jonathan Glowacki, CSPA, FSA, Milliman, Inc. Ravid Huberman, CSPA, Menora Insurance Margaret Kong, FCAS, CSPA, Allstate Insurance Company Shaoli Li, ACAS, CSPA, AIG Ran Lin, CSPA, AIG Sunish Menon, CSPA, State Farm **Insurance Companies** Andrew Pulkstenis, CSPA, State Farm **Insurance** Companies Srinivas Reddy, CSPA, State Farm **Insurance** Companies

Andrew Remington, FCAS, CSPA, Great American Insurance Group
Anthony Salis, FCAS, CSPA, State Farm Insurance Companies
Giorgio Spedicato, FCAS, CSPA, UnipolSai Group
Yuchen Su, FCAS, CSPA, National Council on Compensation Insurance, Inc.
Bruno Tremblay, FCAS, CSPA, La Capitale
Gaétan Veilleux, FCAS, CSPA, United Services Automobile Association
Kathryn Walker, FCAS, CSPA, Pinnacle Actuarial Resources, Inc.

2017 CAS Award Recipients Honored

he CAS honors 12 exceptional CAS volunteers from 2017.

The Above and Beyond Achievement Awards

Recognizes short-term volunteer contributions during the previous year.

Peter Bothwell, FCAS, is recognized for his outstanding service on The

CAS Institute's (iCAS) Certified Specialist in Predictive Analytics (CSPA) Committee. His committee work was crucial to meeting schedules for



Peter Bothwell

syllabus writing and editing. "I volunteer because the CAS has provided me with a fun and rewarding 40-year career," said Bothwell. "We were the first analytic professionals, and the Fellows of our Society enjoy a great reputation. I want to do everything I can to preserve that."

Jill Labbadia, FCAS, is recognized for her many years of contributions to the Exam Committee, but in par-

ticular for her new responsibility of compiling, proofreading and constructing the Examiners' Report. "It is reassuring to see so many people



Jill Labbadia

not only give so much of their time, but understand and appreciate how important the process is," said Labbadia. "At some point, we were all on the other side of the fence and are fully aware of how much each exam can impact not only a candidate's career but personal life as well."

Julie-Linda Laforce, FCAS, is awarded the 2017 ABAA for her leadership and contributions to the Committee on Professional Education, most notably for establishing a peer review subcommittee.

"Volunteering has allowed me to meet and exchange with other actuaries while contributing to the profession. I truly enjoy the



Julie-Linda Laforce

interactions with the next generation of actuaries," said Laforce. "I am a better actuary because of the knowledge I have acquired in my discussions with my peers and future actuaries."

Christine Liao, FCAS, is honored for her outstanding contributions as the treasurer of the Casualty Actuaries of

Greater New York (CAGNY), a CAS Regional Affiliate. "After completing the long journey of taking the CAS exams, I had been looking for a way

to give back to the



Christine Liao

CAS and was very glad that I was able to do it through CAGNY," said Liao. "I enjoyed making an impact by providing the greatest experience for the CAGNY meeting attendees twice a year and supporting the actuarial students through scholarship." Currently, she serves as CAGNY vice president.

Scott J. Swanay, FCAS, is acknowledged for being a critical member of the CAS Working Party on Microinsurance. "Not only did his personal experience give us needed firsthand insights, but Scott also attended ev-



Scott J. Swanay

ery single call and offered valuable feedback and suggestions for how to move forward the work," wrote his nominator.

"I enjoy the sense of camaraderie that can develop among members of a team," said Swanay. "There's a sense of personal satisfaction and accomplishment that comes with volunteering that's hard to match."

Melissa Tomita, FCAS, has been given the award for her time serving as a University Liaison at Arizona State University. Her nominator noted that Tomita "is contagiously excited about actuarial science." Tomita has also served

as chairperson of the University Engagement Committee.

When asked why she volunteers, Tomita replied, "I love my profession. It has



Melissa Tomita

been such a good fit for me. I volunteer with the University Engagement Committee to ensure students have exposure to the P&C world and can determine if it would also be a good fit for them."

Scott Yen, FCAS, is awarded the 2017 ABAA for his work with the Asia Regional Committee and promotion of the CAS brand in Asia. "Scott's is the most familiar face to the members of the CAS in the region," wrote his nominator. "He made more people know about the CAS in a region where the CAS is not so wellknown."



Yen finds that working with CAS members and

Scott Yen

actuaries from other actuarial societies who have similar aspirations is very rewarding to him and the CAS. "As a result," said Yen, "some younger CAS members have embraced the aspirations and assumed key responsibilities in promoting the CAS."

The New Members Awards

Recognizes volunteer contributions during an individual's first five years from their most recent credential.

Charles Lindberg (FCAS 2015) is honored for outstanding contributions to the Exam Committee, which he joined shortly after completing earning his

FCAS. "As grueling as it was to go through the exam process, it taught me a lot about myself and how hard I can push my limits," said Lindberg. "With



Charles Lindberg

the opportunities the CAS has allowed me, it only seems fair to do my part for others. I enjoy the community, helping the CAS reach its goals and continuing to push myself."

Erin Olson (FCAS 2015) is recognized for her service on the University Engagement Committee, in particular her significant contributions to the Case Competition Working Group, which she currently chairs. "I volunteer for the CAS to get a broader picture of the work that actuaries do in the world, especially in areas outside of my own field of practice," said Olson. "What I enjoy



Erin Olson

most about volunteering is the opportunity to work with people from different companies all over the country."

The Matthew Rodermund Memorial Service Award

Acknowledges CAS members who have made considerable volunteer contributions to the actuarial profession over the course of their career.

For nearly 20 continuous years, **Eugene C. Connell, FCAS**, has served on a diverse list of CAS committees and groups. His work includes chairing the Editorial Committee and serving on the Board of Directors

(2006-2011). He is currently chairperson for both the Task Force of Continuing Education and the CAS Literature Review Board. With

a self-professed



Eugene C. Connell

"unquenchable desire to stay busy," Connell said that volunteering has given him the opportunity to meet and get to know many actuaries whom he would not have met otherwise. "Our interactions were always brain-stretching as well as relationship-building," said Connell. "The resulting friendships have been an enduring pleasure."

Since 1988, **Rhonda Walker, FCAS**, has volunteered with the Exam Commit-

tee, coordinating placement of all exam writers and graders — and she continues to do so despite being retired. Reflecting on her service, Walker said, "The



Rhonda Walker

CAS opened the door to a rewarding career for me. Volunteering has given me the opportunity to be more deeply involved with the Society and to give something back. I would strongly encourage new and experienced Fellows to volunteer for the Syllabus and Examination Committee."

Beth E. Fitzgerald, FCAS, has received the Rodermund Award for her many years of volunteerism spanning multiple committees and groups. Just some of her accomplishments include serving as part chair and other positions with the Examination Committee,

as chairperson of the Volunteer Resources Committee and as a director on the CAS Board (2009-2012). The period that stands out to her the most is when she



Beth E. Fitzgerald

served as the vice president-professional education; she started the first task force to provide continuing education through webinars and worked on the early drafts of the Code of Professional Ethics for Candidates to foster professionalism. "I volunteer to contribute to making it the great profession [that] it is." Fitzgerald said. "The CAS has a wonderful culture of volunteering, and it is one that I have embraced!"



























- . From Japan with love. Speakers from the Annual Meeting session "The Future of Auto Insurance: A Vision from Japan" presented a gift to Dave Core, CAS director of professional education and research. The speakers were part of a delegation from the Institute of Actuaries of Japan, led by Takaaki Fujii. Pictured left to right are Keisuke Nakajima, Shun Motegi, Masashi Hiratsuka, Nana Kato, Mr. Fujii, Mr. Core, Hirokazu Hirai and Tomohiro Itabashi.
- Sticking together. New Fellows and Travelers employees pose with CAS President Nancy Braithwaite. From left to right are Jonathan Parad, Jacqueline Dufficy, Braithwaite, Daniel DiMugno, Garry Sui-Tit-Tong and Erik Guffy.
- B. A solid friendship. Takaaki Fujii of the Institute of Actuaries of Japan and CAS President Nancy Braithwaite exchange gifts at a breakfast on November 7, 2017.
- 4. **Trust him.** Featured speaker David Horsager speaks on how top leaders and organizations drive business results through trust. Horsager is CEO and best-selling author of The Trust Edge.
- 5. Passing the torch. 2017 CAS Board Chair Steve Lowe (left) presents his successor, Nancy Braithwaite, with a plaque of recognition.
- 6. Celebrating New Fellows. Nancy Braithwaite addresses the group assembled at the reception for new CAS Fellows on November 6, 2017.
- 7. Family matters. Nancy Braithwaite (left) congratulates new FCAS J. Daniel Benzshawal and his wife, Allie.
- 8. Cheers!: New ACAS Terry Robinson has a laugh with some friends.
- **9.** *Chatting it up:* Daniel Yeung (center) talks with colleagues at the reception for new Associates.
- Photo booth hijinks: New Associates ham it up at their reception.
 The three copains: Stephane Caron (left) and Simon Thibault
- *(center) celebrate their achieving Associateship with colleague Jean-Philippe Le Cavalier. All three men work for Promutuel Group.*
- **12.** Almost-candid shot: Steven Baluta (center) makes eye contact with the photographer at the New Associates Reception.
- **13.** Happy new FCAS: Samantha Andrews (right) joyfully accepts her diploma from President Braithwaite. Andrews is an assistant actuary with Liberty Mutual Insurance in Boston.
- 14. Changing of the guard: Brian Brown (left) takes the helm from Nancy Braithwaite as new CAS president. Braithwaite becomes chair of the CAS Board of Directors.







memberNEWS

NEW FELLOWS ADMITTED IN NOVEMBER 2017



Row 1, left to right: Stephanie Heiser, Katelyn Jeffreys, Emily Lowery, Erin Lachen, CAS President Nancy Braithwaite, Simin Liu, Jessica Nolan, Melanie Modrick, Jeana Holewinski. Row 2, left to right: Kevin Goldsmith, Albert Hsueh, Long Huynh, François Bornais-Doucet, Yucen Yin, Seth Jackson, Anthony Kuhns, Nicholas

Mancini, Yaming Luo. Row 3, left to right: Jon Beaver, Thomas Schlund, Brian Phelps, Brian Samuelson, Newton Jennings, Kyle Gorski, Wayne Heppner, Andrew

Row 3, left to right: Jon Beaver, Thomas Schlund, Brian Phelps, Brian Samuelson, Newton Jennings, Kyle Gorski, Wayne Heppner, Andrew Dalgaard.



Row 1, left to right: Lulu Chen, Beatrix Lin, Diana Rangelova, Joseph Gerhardstein, CAS President Nancy Braithwaite, Frederick Larson, Allison Salisbury, Mary McAlexander, Corey Berg.

Row 2, left to right: Regina Chan, Brandon Bard, Robert Zolla, Alan Kessler, Amber Anseeuw, Tyler Kroetsch, Jeffrey Feder, Chunyang Fan, Christopher Schubert, Matthew Olson.

Row 3, left to right: Adam Pevarnik, Mark Cichra, Erik Miller, Nicholas Metaxas, Yi Wu, Clifford Lau, Ievgen Korol, Ross Tulloch, David McFarland.



Row 1, left to right: Julie-Anne Theriault-Cauchon, Jennifer Shay, Claire Wei, Yue Liu, CAS President Nancy Braithwaite, Wanyue Zhang, Tilia Tanner, Daniel Mena-Martinez, Kimberly Marxkors. Row 2, left to right: Michael DeLucca, Jacob Robertson, Joseph Lee, Daming Fan, Kaitlyn Raser-Mcleod, Ryan Vigus, Cassandra VonRueden,

Bradley Rockers, Michael Hebenstreit. Row 3, left to right: Adam Lewis, Justin Sherwin, Dev Shukla, Nicholas Foore, Kevin Keebler, Sanat Joshi, Scott Lombardo, Kevin Frisch, Bradley

Row 3, left to right: Adam Lewis, Justin Sherwin, Dev Shukla, Nicholas Foore, Kevin Keebler, Sanat Joshi, Scott Lombardo, Kevin Frisch, Bradley Cassmeyer.



Row 1, left to right: Lars Johnson, Amy Beckius, Kathryn Koch, Jing Deng, CAS President Nancy Braithwaite, Qian Zhang, Garry Sui-Tit-Tong, Paul Favale, Ya Jia.

Row 2, left to right: John Clark, Annette Berry, Michael Mazzonna, Adam Kallin, Jonathan Fesenmeyer, Lauren DuBois, Patrick Orndorf, Danielle Balser, Daniel Watt.

Row 3, left to right: Michael Cesaro, Sammany Chea, Zhe-Hao Chan, J. Daniel Benzshawel, Daniel Clayman, Matthew Barker, John Blaser, John Englebert, Robert Justice.

memberNEWS

NEW FELLOWS ADMITTED IN NOVEMBER 2017



Row 1, left to right: Hung Vuong, Doupu Geng, Chen Wang, Yunqin Li, CAS President Nancy Braithwaite, Chun Hei Leung, Alexandra Takeva, Danielle Donnelly, Samantha Andrews.

Row 2, left to right: William Thorsson, Andrew Remington, Andrew Williamson, Jonathan Parad, Erik Guffy, Jacqueline Dufficy, Daniel DiMugno, Alp Can, Jigar Gada.

Row 3, left to right: Thomas Wright, Spencer K'Burg, Alex Harris, Evan Palumbo, Jerod Hartley, Thomas Lapinski, Brendon Donahue, Justin Zaugg, Scott Kelly, Chen Chen.



Row 1, left to right: Angela Padilha, Anita Li, Michelle Rutman, Steven Ma, CAS President Nancy Braithwaite, Jonathan Prud'Homme Tasse, Fanny Duquette Murphy, Kristin Barrow, Zoe Lester.

Row 2, left to right: Robert Demarco, Daniel Fujitaki, Eric Overholser, Cullen Maricque, Luc Langlois, William Chabot, Felix Guerard, Enrique Moran, Kedi Wang, Lison Noblet, Brian Settle.

Row 3, left to right: Jonathan Baumann, Douglas Fry, Ryan Ferguson, Vincent Paradis, Britton Stewart, Etienne Girard-Proulx, Yoram Perez, Mathieu Dionne, Kyle Mathews.



Row 1, left to right: Zhouliang Li, Emily Huang, Weixin Wu, Di Nan, CAS President Nancy Braithwaite, Hao Ding, Christa Jenkins, Amanda Dawson, Maijaleena Zimmerman.

Row 2, left to right: Hong Shen, Anthony Salis, James Garbe, Raza Masood, Maya Abou Rjeili, Yecheng Meng, Melissa Anderson, Brian Joseph. Row 3, left to right: Tianchi Zou, Matthew Schwartz, Neil Schwarzenberger, Jieqing Zhu, Jon Kiefer, Jacob Orlofsky, Michael Wittmann, Corey Vaughan, Nicholas (Nick) Russel.



Row 1, left to right: Leonid Plaksienko, Yanlin Dai, CAS President Nancy Braithwaite, Li Li Lin, Mathieu Jacob. Row 2, left to right: Vladislav Gantman, Keven Grenier-Denis, Antoine Vigneault, Nikola Petkov, Marikym Hebert.

New Fellows not shown: Michael Bersch, Kelly Billings, Megan Callahan, Hyunmook Cho, Rebecca Chow, Ho Chung, Wendy Coffing, Ross Fernwood, Matthew Fredette, Matthew Gentile, Victoria Gutica, Thomas Harrington, Shimshon Herz, Bing Kun Ho, Sayali Joshi, Jeffrey Katzman, Abigail Korthals, Chee Chun Lee, Jin Fan Lim, Jonathan Lim, Mei Lin, Eamonn Long, John Nicholas, Mitchell Paden, Ryan Purcell, Amara Robbins, Dana Ryan, Wenyuan Shi, Jason Shook, David Sidney, Stewart Trego, Jasveet Uppal, Kokfai Wai, Kamolphan Weeraklaew, Ekaterina Zappacosta.

memberNEWS

NEW ASSOCIATES ADMITTED IN NOVEMBER 2017



Row 1, left to right: Logan Soich, Qianru Liu, Chunling Cong, Victor Wong, CAS President Nancy Braithwaite, Carolyn Wise, Qihui Zhu, Jacqueline Lattarulo, Zachary Johnson.

Row 2, left to right: Mohammad Tahir, Tom Mazzotti, Kristina Siclari, Utsav Shah, Shon Yim, Jeffrey Berglund, Wanessa Thibert-Leduc, Laura Campbell.

Row 3, left to right: Ethan Kim, Matthew Shockley, David Olson, Oliverio Hernandez, Cody McCaw, Yechao Zhang, Matthew Frieling, Tyler Rosacker.



Row 1, left to right: Katrina Russell, Danielle Kissinger, Rachel Corvin, Kacie Kiel, CAS President Nancy Braithwaite, Yuanjia Yin, Deepa Chaudhary, Li Huang, Alyson Weber.

Row 2, left to right: Michael Martini, Bei Li Jiang, Matthew Moore, Yang Song, Kyle Poirier, Richard Shafer, John Kowalik, Michael Marhoefer. Row 3, left to right: Sean Murray, Timothy Benham, James Alverson, Bradley Koenen, Russell Jennings, Peter Henningsen, Matthew Fox, Angelo Nasca.



Row 1, left to right: Nicole Pettis, Shira Stolarsky, Alison Guest, Kelli Takagi, CAS President Nancy Braithwaite, Lisa Kerns, Jing Jing Ma, Olivia Leung, Nichole Martella.

Row 2, left to right: Brian Babcock, Seth Root, Mikalai Filon, Taylor Caligaris, Yueting Liao, Ian Spafford, Daniel Mitte, Trevor Schaap. Row 3, left to right: Kyle Surface, David Dolfin, Ryan Blohm, Felix Lesperance, Sean Fakete, Chu-Wei Pai, Steven Murtha, Dominic Lee.



Row 1, left to right: Andrea Lamberson, Jillian Cudak, Andrew Spisak, Earon Denovchek, CAS President Nancy Braithwaite, Sophie Poulin, Sarah Fiset, Rong Li, Alan Hoi-Chi Law.

Row 2, left to right: Ryan Ward, Ira Blassberger, Rui Tang, Luxi He, Can Wang, George You, Andrew Dahl, Justin Mast. Row 3, left to right: Jonathan Sauer, Mark Roshak, Jean Sebastien Lavoie, Etienne Scarborough, Stephane Caron, Vincent Lacombe, Simon Thibault, Alexandre Nault-Daigle.

memberNEWS

NEW ASSOCIATES ADMITTED IN NOVEMBER 2017



Row 1, left to right: Joshua Harwood, Patryk Fital, Sarah Ijaz, Courtney Rohde, **CAS President Nancy Braithwaite**, Sandy Lowe, Colleen Gunsaulus, Stephanie Celona, Sarah Manuel.

Row 2, left to right: Michael Lange, Patrick Jung, Margret Chung, Mary Cecelia Hubach, Ryan Brown, Long Yan Huang, Brendan Lee, Hannah Evangelista, Steven Baluta.

Row 3, left to right: Nicole Feinauer, Nathan Johnson, Justin Marzinski, Frederick Ka Lap Au, Michael Mason, Timothy Murray, Joseph Barnec, Suhyeon Gim, Jonathan Yiu, Dianne Ip, Catherine Quan.



Row 1, left to right: Benjamin Bussert, Melinda Moss, Andrew Giacalone, Nicholas Troetti, CAS President Nancy Braithwaite, Christopher Kenney, Joseph Rocco, Nicholas Garvin, Griffin Winton-LaVieri.

Row 2, left to right: Travis Tanaka, Ari Walfish, Kimberly Luginbuhl, Jonathan Ravin, Danyun Huang, Ryan Yusuf, Mitchell Lueck, Christine Stefanello, Misu Kim, Xuan Hao Xu.

Row 3, left to right: Zinan Zhang, Jared Brown, Nicholas Schlarmann, Lay Choo Lim, Sherry Young, Brian O'Connor, Daniel Kuntz, Alexander Beall, Patrick Lesiewicz, Shuzi Zhou.



Row 1, left to right: Kendra Cooper, Charmaine Huang, Efua Mantey, Nicholas Zielinski, CAS President Nancy Braithwaite, Sungho Noh, Jocelyn LeBlanc-Courchaine, Dustin Hevener, Annie Champagne.

Row 2, left to right: Anthony Stachowski, David Macklem, Michael Haldeman, Ryan Williams, Jerry Zhang, Peng Seng Kuok, Erik Yost, Amanda Moll, Catherine Tremblay.

Row 3, left to right: Blake Eastman, Charles Page, Tian Lu Xue, Terence Robinson, Justin Conlon, Man Fun Yeung, Shabbar Alibhai, Kevin Town, Eliot Gregoire.



Row 1, left to right: Jason Brown, Delyan Georgiev, CAS President Nancy Braithwaite, Shi Yong Zheng, Walker Parent. Row 2, left to right: Gloria Asare, Antoine Tessier-Charpentier, Simon Jones, Renee Richard, Isabelle Richard.

memberNEWS

NEW ASSOCIATES ADMITTED IN NOVEMBER 2017



Lucas Wendt, CAS President Nancy Braithwaite, John Lambros.

New Associates not shown: Daniel Aarhus, Nicolas Annoni, Erick Arnaldo Ocadiz, Chor Leong Aw Yong, John Baier, Etai Barach, Nicholas Baron, Daniel Box, Celeste Bremen, Andrew Brouillette, Melissa Brown, Alexander Buzzell, Paul Chae, Wilfred Chan, Brian Choi, Kevin Chong, Danielle Chowdhury, Ian Deters, Meagan Dolby, Le Foo, Jonathan Garellek, Matthew Garfield, Kelly Gates, Lindsey Halsey, Kristen Hayes, Shloime Horovitz, Michelle Hrdi, Jonathan Humphrey, James Hutchins, Alexander Kapraun, James LaHood, Trenton Lehmann, Ao Li, Kevin McCarthy, Brian Norton, Stefan Peterson, William Purvis, Taylor Robinson, Craig Sloss, Lindsay Smeltzer, Xiaoqin Song, Caroline Timmer, Chung-Han Tsai, Matthew Tuite, William Wakefield, Wei Wang, Dorothy White, Yichen Wu, Chase Wurdeman, Xiaoran Zhang, Yuchi Zhang, Lirong Zhao.

Discipline Case Announcement

he Discipline Committee Panel of the Casualty Actuarial Society (CAS), acting in accordance with the CAS bylaws and applicable policies and procedures, and with consideration of the findings from the Actuarial Board for Counseling and Discipline (ABCD), voted unanimously to expel Koosh Arfa-Zanganeh from membership in the CAS for materially and willfully violating Precepts 1 and 14 of the Code of Professional Conduct (Code). The Appeal Panel of the CAS Board of Directors affirmed this decision in accordance with the CAS bylaws and applicable policies and procedures.

The Discipline Panel found that Arfa-Zanganeh materially violated Precept 1 of the Code by sending numerous inappropriate email transmissions of a harassing nature to ABCD members, American Academy of Actuaries staff, committee members and officers, Casualty Actuarial Society committee members and officers, and former employers. In addition, the Discipline Committee Panel found that Arfa-Zanganeh materially and willfully violated Precepts 1 and 14 of the Code as he failed to respond promptly, truthfully, and fully to communications made on behalf of the ABCD in connection with its inquiries into complaints filed against him by former employers. The Panel also found that he had repeatedly misrepresented his whereabouts and availability in connection with the investigations.

Actuaries Versus Artificial Intelligence: What Do Actuaries Do? What Will They Do?

By JIM LYNCH

The room was packed. I'd guess almost 1,000 people came to hear thought leaders James Guszcza, FCAS, of Deloitte and David Ingram, FSA, of Willis Towers Watson talk about data science and behavioral science at the CAS Annual Meeting in Anaheim.

They were talking, at least it sounded to me as I considered it and went back through my notes, about what it means to be an actuary today.

That's a topic a lot of us think about as our profession seems encroached upon by artificial intelligence (AI).

Once artificial intelligence, whatever it is, (Guszcza noted that the definition of AI is erratically drawn), gets cranking, it

will be machines scrubbing, collating, analyzing and concluding — yes, telling us — what we humans should think.

As actuaries we have always assumed that to the greatest brain goes the truth. In actuary versus AI, it is AI that will always win. It is smarter. It is faster. It never sleeps.

Whither us mortals?

Then Jim Guszcza started talking about chess.

Now chess should be the ultimate bummer in the battle of man versus machine. Watson beat Kasparov. Some time ago. By more than a little bit.

But the world of chess, Guszcza pointed out, has moved to a higher plane, above man, yes, but above machines, too.

The best chess in the world today is played not by a man and not by a machine, but by a team — a team of computers



and people working together.

It's called freestyle chess, though I've also read reference to it as centaur chess. Computers memorize and categorize thousands and thousands of moves and games. People apply soft skills — hard to describe but abundant and important. Together the computer and the human make a better team than either one on its own.

If you think about it, that larger phenomenon — humans create a tool that outshines them, then harness and leverage it — is as old as invention itself. Humans tamed the equine, and a skilled horseman can outrace Usain Bolt. Speed began to depend on the skill of the trainer and rider, not on the physical prowess of the individual. Cars are faster and more powerful (in horsepower) than horses, so we had to learn to drive.

It is elsewhere too: The well-tended loom outproduces the most facile weaver. The steam drill outlasts John Henry. (The "steel-driving man" folk hero would beat the machine but dies from the stress.)

It is even in the actuarial world.

Forty years ago, before the desktop computer, I'm told, actuaries worked in shifts. The early shift calculated estimates. The late shift double-checked the work.

All of those jobs were swept away by the computer, but the number of casualty actuaries keeps growing — from less than 1,000 in 1977 to nearly 8,000 today. We've done such a good job of harnessing the machines that demand for the humans is running ahead of supply. What did we do right?

We created systems that made our work more valuable. Take loss reserving for an example: We build several models to estimate ultimate losses (chain ladder, Bornhuetter-Ferguson, Cape Cod); learn the strengths and weaknesses of each; and use that knowledge in addition to everything else we know about the claims environment to select an estimate.

We didn't invent this multimodel approach. Weather forecasters consult multiple models. (It was the European model that forecast Superstorm Sandy's fateful left turn in 2012.)

But if AI is fast approaching, knowledge of the model may become as outdated as dressage at the Indianapolis Speedway.

And we aren't the only ones who will have to change. Good doctors, Guszcza said, excel at pattern recognition. Patients present a set of symptoms and doctors diagnose. They are, in their way, like old-fashioned chess players, learning a

We've done such a good job of harnessing the machines that demand for the humans is running ahead of supply. What did we do right? We created systems that made our work more valuable. massive set of symptoms, illnesses and prescriptions and applying that knowledge deftly. But that skill will shrivel in importance in the age of Watson. Doctors will have to be good at something else, just as chess players had to add a new dimension to their play.

So what will actuaries be doing? Dave Ingram discussed actuaries becoming experts at systems analysis, reaching conclusions from understanding systems of models with complex interdependencies.

That's a mouthful, I know. Think of an ecosystem as a web of interdependent actors (plants, animals, microbes, water, air, soil) and ecology as the study of that system. We'd be studying the system.

Ingram set forward systems analysis

as the next step in how people go about making decisions. We started with gut decision-making, and as we got smarter and developed better tools, we got better at making decisions.

And all the methods, just like actuarial models, have strengths and weaknesses.

The progression starts with gut logic (Ingram called it "Natural Decision Making"). It is pragmatic and reactive, he said. The gut decisions get better over time (a veteran underwriter is better than her junior partners) but are susceptible to bias.

Worse, it is hard to tell whether your instinctive behavior works. Sometimes your gut instinct works out, but only because you got lucky. And some people, he said, are lucky over a lifetime and leave this world thinking they had the magic touch.

Actuaries use gut logic, he said, when selecting a provision for adverse deviation on loss reserves. The selection in many cases comes from experience and instinct and little else.

A step up the ladder of reasoning takes us to Newtonian decision-making where actuaries tend to be more comfortable but, Ingram suggests, is the favored home of the chief financial officer.

Decisions follow the application of the scientific method or something close to it. It eliminates the subjectivity of pure instinct, which is an advantage, but it can be painstakingly slow. It also eliminates emotion completely, which can make solutions feel heartless and has the sort of shortcoming that freestyle chess addresses.

With that complexity, though, comes a big bonus, Ingram said: It shows how the system can break down. It shows what polluted water does to an estuary or what the extinction of an apex predator does to a valley. A well-designed system, he said, is like a window to the future. is that solutions focus on the expected value, a single point estimate, which is great if you want to book a loss reserve, but suboptimal if you want to understand how rickety that estimate is.

Another issue

Statistical decision-making incorporates probability, and the answer includes a range of outcomes. Actuaries operate in this area (Bayesian statistics) but often use the statistical models



as ways to come up with a single answer, only to abandon the valuable information about how robust the single answer is.

Statistical analysis doesn't eliminate bias since it can be baked into assumptions. As Guszcza noted earlier, a model that used to mete out criminal sentences seemed to perpetuate racial biases.

One final challenge with statistical models is that some people are intimidated by complex answers.

Actuaries use all three systems — instinct, scientific method and statistical analysis — to a greater or lesser degree, Ingram said.

Tomorrow's actuary may end up moving to the fourth tier of decision-making, the aforementioned systems analysis. We may soon be studying models that describe their own ecosystems.

These models are complex and often intimidating. A flow chart describing one "looks like a plate of spaghetti," Guszcza said.

With that complexity, though, comes a big bonus, Ingram said: It shows how the system can break down. It shows what polluted water does to an estuary or what the extinction of an apex predator does to a valley. A well-designed system, he said, is like a window to the future, and the description of what might happen is a story. "Stories are very powerful," said Ingram.

So actuaries would become storytellers: a sharp departure for professionals who are often frustrated by bosses who skip the data and focus on the narrative.

Here, though, the story is the answer.

James P. Lynch, FCAS, is chief actuary and director of research for the Insurance Information Institute. He serves on the CAS Board of Directors.

The Insurtech REVOLUTION

By ANNMARIE GEDDES BARIBEAU

Promising to transform insurance, an emerging technological movement takes root.

he insurance industry right now is in the midst of a sea change transformation that has no proxy nor historical precedent,"

asserts Guy Fraker, chief innovation officer for insurancethoughtleadership.com and its offshoot, Innovator's Edge, which matches insurtech companies with executives and investors.

"No industry has ever been faced with what the insurance industry faces right now," says Fraker. What distinguishes the insurance sector's metamorphosis from other industries, he explains, is the simultaneous technological change both internal and external to the industry.

The broad and evolving term for technological initiatives affecting the insurance industry is *insurtech*, though definitions vary (see "What is Insurtech?"). Poised to forever alter the insurance value chain, insurtech solutions use exponential and connected technologies to provide customer-centric insurance solutions and money-saving process efficiencies for insurers.

Insurtech is not just about applying technology, such as artificial intelligence (AI), application programming interfaces (APIs) and the internet of things (IoT), to improve the insurance value chain. From on-demand insurance for automobiles and personal property to a focus on the customer journey to achieve brand loyalty, insurtech presents new ways to think about insurance in an expanding, digitally connected world.

"There are many areas pushing an acceleration of change where insurance is going to be challenged," says Pierluigi Fasano, director of enterprise architect reinsurance and IoT group practice leader for Swiss Re, which is investing in insurtech. "Customer engagement, everything toward risk awareness, how you change the buying experience, underwriting and risk products," he adds, are some areas where insurance is undergoing transformation.

There are several ways to characterize insurtech companies that have emerged from outside the industry. Matteo Carbone, founder and director of the Connected Insurance Observatory, offers a graphic of some insurtech companies along the insurance value chain (see "An Insurtech Startup Sampler").

The insurtech revolution is here and growing rapidly. According to estimates from Innovator's Edge provided in October 2017, there are about 5,000 insurtech companies. About 50 percent of insurtech companies are working in the property-casualty space, with the other half evenly divided between life and health insurance.

Interest in insurtech is also accelerating. InsureTech Connect, purportedly the largest insurtech conference in the world, hosted 3,800 attendees in October



Five years ago, Fraker observes, "there were not that many insurance companies that had their own venture capital arms, and now some insurance companies are considering their venture capital investments as their entire innovation strategy."

2017 and is expected to draw more than 5,500 in 2018.

Converging Influences

Insurtech's growth is the result of a multiplicity of simultaneously converging influences. Expanding investment, technological tools and digital connectivity are just some of the drivers spurring the insurtech revolution.

To investors, insurtech is a vertical under financial technology or *fintech*, which introduced bitcoins, roboadvisors and digital banking. Investors see insurance as ripe for technological change, explains Lisa Henderson, chief strategist of products and insurtech consulting at Milliman, Inc. They are hoping to achieve similar returns to those in fintech, which attracted \$150 billion in investments and is now a \$900 billion market. Insurtech investment is also growing. (See Figure 1: "Quarterly InsurTech Funding Volume — All Stages.")

Henderson projects that insurtech investment will grow in the next decade. "We're just at the beginning," she says.

Caribou Honig, an insurtech investor and the chairman and cofounder of InsureTech Connect, observes, "A year ago, there were a lot of seed-stage companies, and now this year (2017) I am seeing companies that are seed-stage and series A in venture capital speak." While insurtech was a subcategory of fintech, he explains, it is now a whole category unto itself, because the insurance industry alone is a large part of the economy and differs from the financial industry in companies, regulators, tactics and solutions.

Capital investors may have jump-started insurtech, but insurance and reinsurance companies are increasingly

Figure 1.



Quarterly InsurTech Funding Volume – All Stages

Starting largely in life and health insurance, property-casualty insurance began seeing greater investment in 2015 though funding rounds can vary considerably. P&C funding volume decreased 21 percent when comparing third quarter 2017 to the same period in 2016 year-over-year. Source: Quarterly InsurTech Briefing Q3 2017, published by WillisTowersWatson and CB Insights. Chart used with permission.

What is Insurtech?

Sources interviewed by *Actuarial Review* agree that insurtech is becoming a very broad term.

Like the ancient parable of the blind men and the elephant, the definition of insurtech is often molded by perspective. To investors, insurtech is a category of financial technology or fintech. When insurtech began making headlines a couple years ago, it initially referred to startup companies, technologies, applications and products from outside the insurance industry.

XL Catlin's Vinita Saxena sees insurtech as being centered on leveraging new technologies at its core. "It is also important to point to the broader insurtech ecosystem, which includes the startups, technology companies, insurance companies and venture capitalists, all working to transform the traditional insurance business model."

"The hallmark of being an insurtech company," is ultimately a question of how the company solves problems, says Caribou Honig of InsureTech Connect. "If their default answer is to solve problems in marketing, finance, operations and even compliance through software and hiring an engineer, it's a tech company." However, if a company's default answer is to solve problems by hiring a functional expert, such as marketing and finance consultants, then it's not a tech company.

As insurer-based technological initiatives and insurtech-insurer partnerships continue to grow, what is considered insurtech will be expanding and overlapping. "My philosophy," says Matteo Carbone of Connected Insurance Observatory, "is that any players in the insurance sector will be insurtech, meaning organizations where technology will prevail as a key enabler for achieving the strategic goals of the organization."

In the meantime, insurers have been pursuing initiatives that are not necessarily considered insurtech. Insurers, for example, have been pursuing IoT technologies that are now part of the insurtech umbrella. The technology that supports predictive modeling also falls under insurtech, and distinctions are necessary for understanding.

"Insurance has historically used technology and mathematical models to do predictions like probability of loss and projecting distribution of losses in the future," says Swiss Re's Pierluigi Fasano. Therefore, he does not consider predictive analytics using past data as an insurtech-only attribution.

Fasano advocates introducing "forward-looking models" that offer the ability to predict the future based on dynamic models measuring evolution of risk drivers rather than relying on data from long periods of the past. "It makes a jump in those areas where the velocity and depth of change makes it difficult to base pricing on long-standing models with three to five years of past data," he says.

Ultimately, "the face of pricing is going to change," observes Stephanie Gould Rabin of Holborn and the CAS Insurance On-Demand Working Party. "Pricing will become more dynamic and on time, requiring more robust predictive analytics, which will also be facilitated by insurtech."



investing in insurtech. Five years ago, Fraker observes, "there were not that many insurance companies that had their own venture capital arms, and now some insurance companies are considering their venture capital investments as their entire innovation strategy."

Honig explains that many "incumbents are leaning into this too, investing or partnering with startups." Insurers see insurtech as an opportunity to "play offense" by improving margin and market share, as well as

"defense" to improve cost structure by adopting technology, he adds.

Ten of the top 25 property-casualty insurers (ranked by direct written premium) have been investing in insurtech startups since 2015, according to CB Insights, a data aggregation service that provides strategic analysis for business decisions.

Those that have invested in the most startups (as of June 2017) are USAA (12), American Family (10), Assurant (8), Liberty Mutual (6) and Nationwide (4).¹

One of the earliest and largest investors from the property-casualty insurance industry is the insurer and reinsurer XL Catlin. Its venture capital

unit, XL Innovate, has invested in insurtech companies including Slice, Cape Analytics, Lemonade, Notion, Embroker, Pillar Technologies and New Energy Risk.

SwissRe's insurtech company investments include CarlQ, Ignitia, Tyche, Wellthy Therapeutics and Vouch.² Munich Re also contributed funding for Helium, Waygum, Lemonade, Tr**o**v, Simplesurance and Slice, according to CB Insights.³

Technological Growth

The growth of exponential technologies is also driving the rise of insurtech. "Smartphone penetration is 80 percent, cloud offerings are sufficiently mature to be able to provide real big benefits, and artificial intelligence is getting to the point where machines can interpret pictures of a loss event," Honig says.

" by improving age is also driving insufficient of a multiplicity of simultaneously converging influences. Expanding investment, technological tools and digital connectivity are just some of the drivers spurring the insurtech revolution.

Enabling customers to self-serve during the claims process and shifting the underlying technology stack in the cloud "is even more impactful in the long run," he observes. "It provides a cheaper and more flexible infrastructure for the entire insurance value chain."

The explosion of data from audio, video, digital, geospatial, IoT and other sources and the affordability of cloud storage is also driving insurtech, says Marty Ellingsworth, presi-

> dent of Salt Creek Analytics. It leads to AI algorithms "that can be used to classify and count and measure things using those new elements that you were not able to use before," he explains.

> Growing digital connectivity, Ellingsworth says, presents insurers with greater opportunities. "The reason why insurtech resonates with business and consumers is because they live in a mobile world," he explains. When insurers connect more with their customers, he notes, it opens a two-way street that benefits both insurers and their policyholders.

> "The real core of insurtech," Fraker notes, "is solving a customer pain point and gathering data while doing (so)" to expand product and service offerings or

to realize operational efficiency gains.

The successful players in insurtech "use the same data on different steps of the value chain," Carbone observes. For example, an insurer can use telematics for underwriting to gather useful data for claims management or for delivering services. "In this way, you are optimizing the return on investment (ROI) on the technology," he explains.

Customer Centricity

Digital technology behaviors are also changing the relationship between customers and their insurers, Carbone explains. "Human interactions are diminishing in frequency while digital interactions are exponentially growing."

Traditionally, customers and insurance companies have

¹ https://www.cbinsights.com/research/largest-pc-insurers-rank-startup-investments/ (obtained 10/16/2017).

² https://coverager.com/five-startups-selected-swiss-re-insurtech-accelerators-2nd-cohort/ (obtained 10/20/2017).

³ https://www.cbinsights.com/research/reinsurance-tech-startup-moves/ (obtained 10/20/2017).

An Insurtech Startup Sampler

Matteo Carbone of Connected Insurance Observatory developed a chart of insurtech companies, classifying them by both insurance value chain and customer experience.

The chart below shows the functions of insurtech companies through a simplified customer journey. They are as follows with the insurer's view of the process in parentheses:

- 1. Awareness of the insurance product (marketing/advertising).
- 2. Choice (marketing/underwriting).
- 3. Purchase ease (sales).
- 4. Use of products designed to improve interaction with customers for the claims process.

The horizontal bars below the categories feature insurtech companies that support the overall states. The first bar shows IoT-related insurtech companies. The second bar reflects P2P (peer-to-peer) insurtech companies.

Is the software eating the insurance? Awareness Choice Purchase Use ELEMENT financeAds Aggregators ValChoice Policy management 🖸 Knip 📘 Protect your bubble_com **dalan** @riskgenius Goji 🔽 To be CXA CLARK pypestream Clover facile.it NAVERA trov kroodle Services CMap TETT autoling EVER TE TANIVO Jetty OSCOr Neosurance Underwriters eagleeye VIRADO BookDoc tiassiste 24 amin KASKO Aairsurety BOUGHT BY MANY * VERACITY Claims pokitdok BeneStream × To help SCHUTZKLICK S connectome 🔀 🛕 Analyze Re hear say social (/ kWh analytics (a) pablow Internet of things CAMBRIDGE ICS 📢 otonomo iĝi () THE FLOOW (c_{0}) b Baseline ø roosta Gaitupo TrueMotion ybrain @ Carvi AMODO THING 🏂 INNOVATIONS CalAmp DIGITAL DRIVING PASS **P2P** UVAMC Triendsurance DYNAMIS Wecover inspool 000 besure insPeer AXIEME PeerSure teambrella Lemonade VERSICHERIX SO > 同聚保 Source: Connected Insurance Observatory. Used with permission.



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communicated on a transaction basis for sales, the claims process and renewal. However, insurers are realizing the growing expectation that customers want to hear from them digitally.

Encouraged by insurtech, insurers are steadily viewing marketing and customer service from new perspectives. To maximize customer experience — the overall result of interactions between insurers and their policyholders — more carriers are mapping out the customer journey.

Customer experience drives customer loyalty, Ellingsworth explains. The idea is to get to the current and future demographics to create customer lifetime value at each stage of a person's insurance needs and to anticipate future ones to retain customers over their lifetimes. This will "ruin the pipeline of prospects other carriers have been relying on for years," he adds.

Carbone explains that the customer journey starts with awareness and includes choice, purchase and policy management. (See "An Insurtech Startup Sampler."). At each stage, insurers are identifying "micro moments" to reach customers with the appropriate messaging. For example, insurers could send push notifications to customers during travel to offer destination-specific coverage.

Ultimately, Ellingsworth says, insurance will be more customer-centric rather than product-centric. "That is the whole point of insurtech," he says. By combining connectivity and the resulting expansion of data, he believes that insurers will be able to cover multiple perils across multiple products that best serve the needs of individual customers. Current examples of customer-centric insurance products are ondemand, usage-based and peer-to-peer coverage.

Breaking Barriers

The insurance industry's expected transformative change will rely greatly on the interplay between insurance companies and technology firms working to inspire change. For insurers, Henderson observes, there "is that push-pull of needing to be innovative and meeting market demands of being quick, fast and easy while still making sound risk decisions."

Technology companies and insurers currently approach problem-solving from different perspectives. Viewing insurance from the outside, tech firms perceive insurance as similar to other commodities, through the customer's eyes. "They are going to the white board and asking, 'What needs to happen to start from scratch with new infrastructure?" Honig explains. "[For] a lot of the startups, their thesis is cutting the cost structure. They don't have legacy systems," he says, so they are building their systems to operate in the cloud.

Fear of change is another factor, observes Stephanie Gould Rabin, head of corporate strategy and senior vice president of Holborn, a reinsurance brokerage firm. Insurtech "pulls at the heartstrings," she explains, because "it represents the possibility of a substantial change of how they do business and whether they will have a job." As a result, she says, "People will obfuscate, deny, criticize and do anything else it takes to ensure their job stays the same." Rabin is also co-chair of CAS's Insurance On-Demand Working Party, which covers

The insurance industry's expected transformative change will rely greatly on the interplay between insurance companies and technology firms working to inspire change. Since insurtech aims to address everything from underwriting operations and distribution to delivering insurance in new ways, experimentation and growth will vary.



insurtech's influence on product, consumer behavior and actuarial practices.

For insurance industry outsiders, change can appear to be painfully slow. "The insurance industry is something of an immovable object," Honig observes. "Even the internet did not change the game."

Vinita Saxena, senior vice president and senior enterprise risk officer of XL Catlin, acknowledges that the insurance industry has been slower to embrace technology than have some other sectors. She notes that there are plenty of inefficiencies and cost layers in the existing workflows and processes due to outdated and entrenched legacy systems.

While the outsider view on insurance can spur new ideas and innovation, insurtech companies also need to appreciate the nature of insurance, sources say. Fasano says that the insurance industry sees itself as being financially responsible for covering the lives of people. "Insurance exists to neutralize risks," says Fasano. "We manage money given by someone else to protect them."

Further, insurers are dealing with how to use data and technology appropriately. Fasano is cautious about AI-based assumptions and applications. "You can discover correlation that has nothing to do with causation and meaning," he says.

Growth Areas

Since insurtech aims to address everything from underwriting operations and distribution to delivering insurance in new ways, experimentation and growth will vary.

In the commercial insurance space, Saxena says, in-

surtech is currently centered on distribution, targeting smallsized and medium-sized businesses through digital brokerage and policy comparison platforms.

She also anticipates that commercial insurers will leverage sensors and IoT for loss prevention and proactive risk management. Examples include digital sensors at construction sites that help predict damage and help reduce risk due to fire and other destructive environmental conditions. "I also think we will see greater use of drone technology in underwriting and claims in commercial insurance," Saxena says.

In the short term, she expects growth "in areas that lower costs and include efficiencies in the insurance value chain, primarily around underwriting and distribution."

Saxena also sees continuing interest in insurtech solutions that address back office issues of poor data gathering and manual processes that hinder a better customer experience. "Artificial intelligence will have a role to play here, much like what we have seen in fintech, such as roboinvestment advising," she observes. There will be greater interest in plug-andplay solutions coming from insurtech companies that help transform the current legacy systems and lower operating costs, such as cloud-based solutions.

Fraker suggests a key to insurtech success. "Anytime you take a well-defined job to be done, a tech app that meets and exceeds the job, and business acumen, you are probably on to something that can go viral," he says. Some of the "most successful insurtechs" such as Pypestream and WeGoLook, "started in other industries without realizing that insurance was a potential market for them." "If we get technology that speeds up payment and changes how claims are settled," Rabin observes, "actuaries will need to adjust reserving methodologies."

One such example cited by sources is Snapsheet, which is serving 50 insurance companies, including USAA, The Hartford and Safeco. The company originally developed its app to help body shops estimate car repairs with pictures, explains C.J. Przybyl, the company's president. Seeing the potential benefits for insurance companies, body shop owners introduced him to insurers.

Snapsheet's mobile app and dispatch platform help insurance carriers settle claims faster, reducing the average cycle time to fewer than three days from first notice of loss. About 90 percent of claims are processed by photograph. "If we get technology that speeds up payment and changes how claims are settled," Rabin observes, "actuaries will need to adjust reserving methodologies."

Some insurtech companies are often called "disruptive" because they are rethinking ways to offer insurance. Two wellpublicized companies are Lemonade and Trōv. Lemonade is a new homeowners and renters insurer that uses behavioral economics. According to its webiste, it offers "instant everything" through AI, from completing applications to one-click premium payment and formless claim filing. Trōv offers on-demand coverage of scheduled personal items instead of blanket coverage. Trōv started in Europe, and its operation has been approved for at least 30 U.S. states so far.⁴

"By using the technological platforms and direct distribution model online ... they [Lemonade and Trov] have a lot more margin to play with," Fraker says. "You are not paying commission, for starters, and you're probably relying a whole lot more on artificial intelligence than human bodies and deep learning for risk selection — so you are not married to a distribution system that is very expensive and difficult to change," he adds.

Conclusion

As insurtech begins to take root in the insurance industry, experimentation to discover transformative and optimal solutions will continue. Because insurtech is sometimes described as "disruptive," it can attract skepticism.

Those who see insurtech as disruptive cite peer-to-peer homeowners coverage through Lemonade, usage-based automobile insurance via Metromile and on-demand personal property coverage through Tr**o**v. However, sources generally do not see insurtech disrupting the insurance business model. Fasano, who conducts due diligence on some of Swiss Re's insurtech investments, says he is "waiting to be surprised" by insurtech because virtually all of its applications are serving the traditional model.

Carbone notes that insurtech will not disrupt the insurance model nor will it replace traditional insurance products. While he believes insurtech will introduce insurance products personalized to individual customers, its most important contribution will be improving the insurance value chain. "It will bring the insurance model to the next elevation," adds Carbone. "It will bring superpower to the insurer that can use the technology."

Saxena observes that insurtech, "will take several years to play out in a meaningful way" in the insurance industry. But in the long term, she sees insurtech helping to find "new and

Because insurtech is sometimes described as "disruptive," it can attract skepticism.

underserved markets and products that better cater to a new generation of customers."

To Fasano, the "best disruption" of insurtech will be to "find ways to make insurance affordable and accessible to many more people than we have been able to do."

Annmarie Geddes Baribeau has been covering insurance and actuarial topics for more than 25 years. Her blog can be found at www.insurancecommunicators.com.

⁴ https://www.trov.com/blog/on-demand-insurance-has-been-approved-in-california

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professional INSIGHT

ON THE SHELF BY JULIE LEDERER

An Introduction to the Cosmos

Astrophysics for People in a Hurry By Neil deGrasse Tyson, W. W. Norton & Company, 2017, 224 pp, \$18.95.

n Astrophysics for People in a Hurry, Neil deGrasse Tyson, director of the Hayden Planetarium in New York City, explains what we know about the cosmos and what still eludes our understanding. You'd be hard-pressed to find a better tour guide through the universe than Dr. Tyson, who has made a name for himself as a scientist with a gift for making astrophysics accessible to the masses. The 12 chapters of this slim volume are adapted from essays that originally appeared in Natural History magazine between 1997 and 2007. Some of Dr. Tyson's best writings cover the universe's beginnings.

In the first 10-43 seconds — that's one ten-million-trillion-trillion-trillionths of a second — of the universe's existence, nearly 14 billion years ago, all matter and energy was confined in one hot, dense, tiny point. Almost immediately, the universe started to expand and cool. During the first one second, there was constant interplay between matter (in the form of subatomic particles) and energy (in the form of photons, or massless packets of energy that transmit light). It was so hot that photons were spontaneously converting their energy into matter-antimatter particle pairs, which immediately collided with each other, leading to their mutual annihilation and a return to the photon state. Soon, the temperature cooled enough that this type of spontaneous particle creation ceased; photons no longer had enough energy to transform into matter, so matter-antimatter pairs kept annihilating without being replaced.

Somehow, slightly more matter particles than antimatter particles had been created: one billion and one matter particles for each one billion particles of antimatter. This imbalance was good news for us; otherwise, each matterantimatter pair would have collided and left nothing but photons behind,



which Dr. Tyson calls "the ultimate letthere-be-light scenario." As it happened, there were extra matter particles without any anti-matter particles to collide with; these extra particles survived and went on to form the stars, planets and people.

By the time one second had passed, the universe was several light-years



across, the temperature had cooled to one billion Kelvin (about 1.8 billion degrees Fahrenheit), and the first protons and neutrons had formed. Over the next several minutes, protons fused with other protons and with neutrons to form atomic nuclei. For the next 380,000 vears, these nuclei coexisted with free electrons in a hot, glowing plasma. Photons of light were constantly reacting with and being scattered by the roaming free electrons, so light was trapped and the universe was a bright, opaque fog. One consequence is that even if we had telescopes that could see far enough away - that is, far enough back in time - to reach the first 380,000 years of the universe's existence, we wouldn't be able to see anything but light.

When the universe was around 380,000 years old, the temperature fell below 3,000 Kelvin. This drop in temperature slowed the speed of free electrons just enough for them to be captured by passing nuclei, forming the first atoms. Photons could now travel freely through space without colliding with free electrons, and the universe became transparent.

During the first one billion years, stars and galaxies formed as clouds of gas and dust drew together under the force of their own gravity. Heavy stars those with masses greater than 10 times that of our sun — have sufficient pressure and temperature in their cores to manufacture, via thermonuclear energy, dozens of different elements heavier than hydrogen, including the building blocks of planets. When heavy stars explode, those elements are released. About 4.6 billion years ago, our sun was formed from a gas cloud that contained some of these heavy elements. The elements coalesced to form an assortment of orbiting stuff, including rocky planets, gaseous planets, asteroids and comets.

Over the next several hundred million years, space debris in wayward orbits collided with the larger bodies in our solar system. The violent collisions kept the surfaces of the rocky planets molten and prevented the formation of complex molecules. Eventually, there was less space debris to collide with the planets, and the planets cooled. One of them was just the right distance from the sun for its surface water to remain liquid instead of evaporating or freezing. Life formed in these waters and eventually evolved into human beings with brains big enough and curious enough to ask how the universe got its start.

Dr. Tyson is a good writer with a

friendly tone. His explanations are clear, though they would sometimes benefit from diagrams; the book has no visuals, which probably speaks to its genesis as a series of essays. And certain concepts like "gravity assists" are referenced without further explanation. Nevertheless, while interested readers may want to supplement the book with other learning materials, Astrophysics for People in a Hurry is an accessible introduction to the workings of the cosmos. And it's repeatedly awe-inspiring. (It's one thing to read the words "By now, one second of time has passed [since the beginning]. The universe has grown to a few lightyears across." It's quite another to think about what that really means.)

Dr. Tyson says, "The universe is under no obligation to make sense to you." This is a humble perspective that appropriately reminds us of our insignificance and mental frailty when faced with the complexity of the cosmos. That being said, the universe will probably make a little more sense to those who read Dr. Tyson's book.

Julie Lederer, FCAS, MAAA, works for the Missouri Department of Insurance, Financial Institutions & Professional Registration.



ASTIN Continues to Evolve by Roger Hayne, CAS VICE PRESIDENT-INTERNATIONAL

t is fitting that Panama, a "bridge" between the Atlantic Ocean and Caribbean Sea on the east and the Pacific Ocean on the west, hosted the 2017 ASTIN Colloquium as the mission of ASTIN and the ASTIN Colloquium is to bridge the theoretical and practical non-life (property-casualty) actuarial sciences.

ASTIN, the section for Actuarial STudies In Non-life insurance, was organized in 1957 as the first Section of the International Actuarial Association (IAA). ASTIN is a membership organization formed to further research and education in non-life insurance. Historically, ASTIN has contributed to research and education by publishing the prestigious *ASTIN Bulletin* and holding annual colloquia.



Working Parties Drive Journal Content

Recently, the *ASTIN Bulletin* has expanded its focus beyond the theoretical aspects of non-life insurance to include research on the practical aspects of insurance, in particular through its working parties.

It is ASTIN members who propose and champion these working parties, which welcome everyone, including CAS members. The CAS supports ASTIN by publicizing these opportunities to its members.

Past working parties have published top-quality, highly practical reports, including one on reserving best practices around the world and another from AS-TIN's Working Party on Individual Claim Development with Machine Learning, which was released in November 2017.



Top and bottom left: ASTIN attendees work together on exercises. **Right:** Attendees listen to translation.



The author at the ASTIN/AFIR-ERM Colloquium last August.

ASTIN Colloquium Focuses on Practice

The Asociación Centroamericana de Actuarios (Central American Actuaries Association) organized the 2017 ASTIN Colloquium. In addition to providing more practical sessions, the Associación recognized a basic need for education in non-life actuarial science for those practicing in Latin America. Consequently, in addition to the usual plenary and parallel sessions, this colloquium introduced a series of workshops: fourhour sessions focused not only on basics such as reserving and pricing, but also on ERM, derivative pricing, reinsurance, Markov chain Monte Carlo methods, bonus-malus (experience rating), sol-

Join ASTIN!

ASTIN's goal is to be a bridge between academics and practicing actuaries with enhanced practical research and continuing education — a goal quite complementary to that of the CAS.

ASTIN members are active partners with the CAS in continuing education for members of both our organizations, particularly in Europe.

Annual dues are CAD50.00 and include the following membership benefits:

- Discounted registration at the ASTIN Colloquia.
- Free print copy and online access to the ASTIN Bulletin.
- Free access to all ASTIN webinars.
- Opportunity to champion an ASTIN Working Party.
- Possibility to disseminate your findings on the ASTIN network and beyond.
- · Conditional access to bursaries and financing.
- Opportunities to train colleagues in actuarially less actuarially developed regions.

ASTIN's current research and education efforts emphasize practicality and application, two things that often speak to us as members of the CAS.

If you count yourself amongst that group, consider joining the worldwide ASTIN community and actively participate in fostering meaningful actuarial research and developments.

Visit https://www.actuaries.org/merchandise/section/ to join and for more information.

vency/capital modeling, term structures and longevity.

These workshops marked a significant break from past colloquia that had a more academic flavor. For example, session moderators described applications of subject matter presented in parallel sessions. Although a first-time effort, practical applications will continue to be emphasized in future colloquia. As a result of these changes and the sessions' increased relevance, the workshops were very well received by attendees.

Outside of colloquia, ASTIN has also been presenting webinars related to non-life insurance. Topics have included the U.S. National Flood Insurance Program, professionalism, reserves and law, workers' compensation and prescription drugs. Given this subject matter, it would benefit both ASTIN and the CAS to team up on some of these offerings and continue developing these topics.

With the recent and ongoing changes, ASTIN is now much more focused on practical research and education, continuing to build the bridge between theory and practice in non-life actuarial science that its members have been seeking. The changes also reinforce ASTIN's commitment to improving the skills of its members.

Roger Hayne, FCAS, MAAA, Ph.D., is a consulting actuary for Milliman, Inc.

To Price New Risks, Go Back to the Basics by JAMES LYNCH

he book of Ecclesiastes tells us there is nothing new under the sun. But to some actuaries, insuring ride sharing, cyber exposures and marijuana dispensaries certainly seem outside the norm.

Attorney Eric Voigt, a partner at Mound Cotton Wollan & Greengrass LLP, a New York law firm known for its insurance and reinsurance practices, gave a detailed look at insurance-related case studies of emerging exposures in cyber liability, social media, medical marijuana and the sharing economy.

To price those and other emerging exposures, Karen Landrum, FCAS, consulting actuary at Merlinos & Associates, goes back to the basics.

Landrum outlined her approach during "Emerging Claim Issues and How to Price and Underwrite Them," the closing session at the CAS Annual Meeting in Anaheim in November 2017.

In his discussion, Voigt focused on key cases in emerging risks:

In cyber liability, which cost the global economy more than \$400 billion a year, Voigt's discussion included cases that:

- Discussed whether computer records that fell off a truck were a personal injury. (No, the records weren't published anywhere.)
- Examined whether a general liability policy covered a phishing scam in which a fraudulent email induced a person to transfer money in a phony transaction. (No, there was no unauthorized entry into a computer system.)
- Determined whether a restaurant chain had coverage that would reimburse a credit card issuer for

charges it had to void because the restaurateur's data had been hacked. (No, its coverage didn't include language that specifically covered such payments, and the policy's "privacy injury" coverage didn't cover the loss either.)

Voigt also examined the insurance industry's use of social media to investigate claims, often looking for evidence of insurance fraud. He noted that these kinds of "desktop investigations" are common but cited privacy laws that might apply. Insurers can also seek social media content during discovery, but the inquiries must be specific in what they seek and what they are likely to find.

Medical marijuana opens myriad questions for insurers, Voigt said. The federal-state conflict is a large issue here, too.

Workers' compensation insurers, for example, must struggle with whether a marijuana prescription should be covered. Voigt noted that some states have laws or court cases that instruct insurers and that, in all cases, medical marijuana is seen as alternative medicine. There is, however, a recent trend for insurers to pay for marijuana if a doctor recommends it and it is deemed "medically necessary."

He also discussed whether a homeowners policy covers weed that burned up in a house fire. (No, insurers don't cover illegal substances.) He also looked at marijuana use in the context of auto and general liability policies.

The sharing economy — including operating ride-sharing services or renting rooms via the internet — opens up unique insurance questions, Voigt said, because of the fundamental shift in the definition of ownership. The traditional personal auto and homeowners policies didn't anticipate the hybrid of commercial and personal use.

For ride-sharing, the sponsor (think Uber or Lyft) and the driver need to ensure they cover all the stages of an engagement: while the driver is waiting for rides with an app operating, while the driver is en route to a rider, and while the rider is being taken to a destination.

Home sharers also need tailored coverage, some of which is provided by the sponsor (think Airbnb). ISO recently crafted endorsements for homeowners policies to address new exposures.

Voigt's discussion outlined a number of important cases in a detailed slide deck that can be found at http://bit.ly/ CAS_AM17prog (key word: Voigt).

Landrum, meanwhile, said that pricing these emerging risks is a threestep process:

Step 1: Look at the CAS Principles of Ratemaking.

The principles act almost like a recipe, telling you what you need to think about when developing a rate.

The principles help from the outset, even when considering the type of entity issuing insurance — whether it is an admitted company, a surplus lines carrier, a risk retention group or a captive.

Take the tradeoff between homogeneity and heterogeneity. Admitted insurers have the ability to diversify their portfolio. Risk retention groups have homogeneous exposures. Captives insure a single entity, so there is no heterogeneity (unless the captive writes different lines of a single risk). Expenses differ by type of entity. Excess and surplus lines carriers have a different premium tax. Risk retention groups don't focus as much on profit. These obviously affect the final price.

Landrum said it is also important to know policy language: knowing what the policy excludes, what limits it covers and what actions trigger a claim. The final rate depends on all of these.

And the exposure base is important, she said. Most policies are rated on payroll — as is common in workers' compensation — but sometimes there is a desire for something different, like the number of employees.

Step 2: Create a framework for rate development.

The heart of the actuary's work is estimating expected loss, Landrum said, but some losses (short-tailed ones) are easier to estimate than others. The easier ones tend to be the ones that depend on the location of the risk — a part of the property coverage, usually.

Catastrophes and earthquakes, Landrum said, "Don't really care whether you're a cannabis-related business or McDonald's. They are going to hit you no matter what."

Ideally, of course, the actuary has historical information to price in a traditional way. Often that is not the case, so Landrum suggested these alternatives:

- Study industry filings of similar products. (Before the actuary develops the rate, she said, it is important to peel out the expense load from the rate, thus isolating the loss cost.)
- Perform mathematical simulations to estimate expected loss. (This helps the actuary understand how widely varied the rate could be.)
- Buy estimated loss costs from an

advisory service like ISO, NCCI or the American Association of Insurance Services.

Sometimes information is available from a foreign market, Landrum said, though that route should be approached cautiously. "[Foreign] laws are different," she noted. "Their behavior patterns are different."

Step 3: Consider what things make the risk unique.

Landrum gave up-to-date examples on various emerging risks.

Sharing Economy: How much should an Airbnb landlord or an Uber driver pay for coverage? The characteristics of the items insured have not changed (an Airbnb home is just a home; an Uber car is just a car), but the way they are being used has. The homeand reading publications that follow the new industries.

Data simulations will help the actuary understand how wide the range of outcomes could be, Landrum said. And she noted that these policies may have a seasonal element to consider.

Cyber Liability: The cyber market is competitive now, Landrum said, but there is no broad agreement on what a policy covers. When pricing, "policy language is critical," she said.

The line has low frequency but high severity, so the data available has limitations. Also some insurers partner with loss mitigation services; these reduce losses, but their costs should be considered in the rate.

Data can be difficult to come by, Landrum said. The actuary can analyze information from known breaches, and

Insurers can also seek social media content during discovery, but the inquiries must be specific in what they seek and what they are likely to find.

owner has become a landlord; the driver now operates a taxi.

The risk clearly changes, she said, making it important to audit how the policy is used and making the underwriter's job that much more important.

The actuary should also pay attention to any insurance the creator of the system (for example, the Airbnb and Uber) provides.

The policy being priced will likely combine characteristics of standard commercial and personal policies, so understanding those will help develop the price. And it is possible to glean industry data by attending conferences publicly available information can be a useful benchmark.

"This is a perfect opportunity to simulate" losses, Landrum said.

It is critical to consult experts when pricing cyber, she said.

Additional considerations include:

- Exposures vary greatly by the size of insureds and by industry.
- Some industries (e.g., hospitals) keep more information about exposures and losses than others.
- A firm can be hacked by a party that holds no malice. But there can still be losses, particularly in reputational damage.

professional INSIGHT

Marijuana-Related Businesses:

Though more than half the states have legalized some dispensing of marijuana, it remains a Schedule I drug to the federal government.

"Almost all traditional policies exclude coverage for anything to do with Schedule I drugs," Landrum said. "Anybody that operates in this space is technically violating federal law, even if it is legal in that state." That makes data hard to come by.

The actuary can liken dispensaries to pharmacies to help benchmark, she said. Grow houses are similar to greenhouses.

There are seed-to-sale tracking systems, Landrum said, which help in understanding the product liability exposure, but it is important to adjust those rates.

Furthermore, each state regulates

cannabis its own way. The regulations can "gravely" change the exposure, Landrum said.

"If you go to a dispensary in Colorado you are going to have a completely different experience than if you go in Washington [state] or California," she said. Rates should reflect that.

The strict federal ban has other repercussions. Marijuana-related businesses are effectively prohibited from using banks. All their sales are conducted in cash.

Typically the dispensary has an ATM near the front of the store. Customers use the machine and pay with cash. At the end of the day, the owner returns the cash to the ATM.

This system has insurance implications. For instance, all that cash floating around could invite theft. Also, sales can be an exposure base for rating, but if all sales are cash, there is potential for sales to be underreported — meaning the insurer risks underpricing.

Even the most basic underwriting tool — the background check — can be difficult. The best weed cultivators have been breaking the law for decades.

"For years this has been a blackmarket business," Landrum said. "You can't just call a former employer and find out how long this person has been in the business."

Landrum's presentation can be found at http://bit.ly/CAS_AM17prog (key word: Landrum).

James P. Lynch, FCAS, is chief actuary and director of research for the Insurance Information Institute. He serves on the CAS Board of Directors.

Studying Climate: The Next Steps by JIM LYNCH

wo years ago the Actuaries Climate Index was launched to demonstrate how extreme weather events are on the rise in the United States and Canada. Now the developers of the index

want to see if more extreme weather means more costly insurance losses by creating an Actuaries Climate *Risk* Index. It is scheduled for launch in 2018.

CAS Fellow Doug Collins explained how the risk index would work at the session "The Actuaries Climate (and Climate Risk) Indices: Uses for Modeling," held during the CAS Annual Meeting in Anaheim, California. He gave an overview of the current index and a guided tour of the host site for the index, actuariesclimateindex.org.

Development of the indices is a

joint venture of the CAS, the American Academy of Actuaries, the Canadian Institute of Actuaries and the Society of Actuaries. The indices are intended to show objectively the changes in climate extremes and the associated financial and human impact. The indices are there as a means for the actuarial profession to add objective information to the public policy debate over climate change.

However, Collins said, "We do not try to address the causes of climate change . . . The emphasis is on keeping it an objective measure of the past."

The original index, the Actuaries Climate Index, has been fairly successful. Its website has recorded more than 22,000 visits from 134 countries. Its data has been downloaded more than 1,600 times. Six hundred people have signed up to receive updates.

The index has reported the frequency of severe events quarterly since November 2016. It divides the United States and Canada into 12 subregions.

The index looks at extremes in six different climatic elements:

- high temperatures.
- low temperatures.
- precipitation.
- drought.
- wind.
- sea level.

The index operates somewhat like the consumer price index, Collins said. There is a measurement in each region for each climatic element, plus a composite of each of the elements. And there is a set of readings for the U.S. and Canada combined.

All of the readings are calibrated to the 30-year period from 1961 to 1990. The 1961-90 baseline was selected because climate scientists prefer to look at eras in 30-year increments, Collins said, and earlier data was too sporadic and not reliable enough.

The average reading across that span is defined to be 1.00. A reading above 1.00 means there were more extreme events than were typical in that era; a reading under 1.00 indicates there were fewer extreme events.

In announcing results, press releases about the index emphasize the five-year moving average of results, which smooths out fluctuations in the reading.

The October 2017 press release announced results for the 2016-17 winter. That reading, 1.14, set a record. Results were driven by more warm days, fewer cold ones, more heavy precipitation and higher sea levels, Collins said.

Collins then outlined the steps in developing the Actuaries Climate Risk Index, which would show how extreme events are correlated with economic and human losses. The risk index will bring in data from Spatial Hazard Events and Losses Database for the United States (SHELDUS), a project out of the University of South Carolina that has countylevel information on economic losses from extreme events.

Analysts looked for significant relationships between extreme events as defined by their index and economic losses from SHELDUS. Some findings were intuitive. Extreme heat was correlated with deaths from heat. Flooding was correlated with heavy rain. Wildfire was correlated with heat. From all that work, an index from 1 to 10 was created, with 5 as the average from a reference period.

Preliminary work, which ended with readings in 2014, showed that the heat component was the biggest driver of the index, Collins said. And heat, he said, is what had been driving the index higher than its normal baseline. In the United States, it is important to note that the later periods tended to be above average in extreme-weather-related losses, but not by much. Canadian measurements, on the other hand, stuck close to the long-term average.

The next step for the new risk index is a peer review by The Research Committee of the U.K.'s Institute and Faculty of Actuaries. When it passes peer review, the index will be updated and launched, likely in 2018.

Modeling the Casualty Exposures in Epidemics BY JAMES LYNCH

casualty actuary might be forgiven for thinking that illness and disease are what those "other" actuaries worry about. Though risk of illness is usually considered the province of the life-health actuary, a session at the 2017 CAS Annual Meeting in Anaheim, California, showed how epidemics can affect property-casualty risks. The session also described how to approach modeling those exposures.

Speakers intoned that, if done right, the modeling could drive new insurance products. These developments could narrow the insurance gap — the chasm between what is insured and what could be insured.

Milliman actuary Cody Webb, FCAS, began by demonstrating how big the insurance gap is, particularly in developing nations. He explained that the spectrum of losses ranges from minuscule (loss of a single strand of hair) to catastrophic (sudden, instant death) and can affect a single person or every entity in the universe across eons. But the insurable losses share some traits, Webb said, including:

- a large number of similar exposures.
- a definite loss, driven by some sort of accident.
- the ability to create an affordable premium to reimburse after such a loss.
- the ability to accurately quantify the amount of loss sustained. This is the most important shared trait. In showing a chart of property-ca-

sualty insurance as a percentage of GDP — with the wealthier countries better insured than others — Webb noted that insurance companies need to "quantify and develop products that meet all criteria of insurability." (See chart on page 50.)

Cathine Lam, ACAS, an actuarial associate at Metabiota, continued the session with examples demonstrating how epidemics and pandemics involve property-casualty exposures. She pointed to what happened to a Dallas, Texas, hospital during the 2014 Ebola outbreak and described how the Zika virus befell Miami in 2016.

Ebola in Dallas

The deadly outbreak (28,000 cases/11,000 deaths worldwide) originated

professional INSIGHT

Penetration of the non-life insurance industry, 2015.

Direct gross premiums as a percentage of GDP.

Country	Penetration non-life insurance industry				
OECD countries					
United States	6.7				
Korea	5.1				
Switzerland	4.1				
Ireland	4.0				
Slovenia	3.6				
Germany	3.4				
Denmark	3.3				
France	3.2				
Canada	3.2				
Austria	3.1				
Luxembourg	2.8				
Netherlands	2.7				
United Kingdom	2.7				
Spain	2.7				
New Zealand	2.6				
Norway	2.4				
Belgium	2.4				
Estonia	2.3				
lceland	2.3				
Australia	2.2				
Israel	2.2				
Finland	2.1				
Portugal	2.0				
Czech Republic	2.0				
Italy	1.9				
Sweden	1.9				
Japan	1.8				
Latvia	1.7				
Chile	1.5				
Poland	1.4				
Turkey	1.4				
Slovak Republic	1.3				
Hungary	1.2				
Mexico	1.1				
Greece	1.0				

Country	Penetration non-life insurance industry			
Selected African, Asian and European countries				
South Africa	2.7			
Singapore	1.9			
Malaysia	1.7			
Hong Kong, China	1.5			
Lithuania	1.1			
Russia	1.1			
Sri Lanka	0.6			
Indonesia	0.5			

Selected Latin American countries				
Puerto Rico	10.3			
Argentina	2.4			
Ecuador	1.8			
Costa Rica	1.7			
El Salvador	1.7			
Uruguay	1.6			
Colombia	1.4			
Nicaragua	1.3			
Honduras	1.2			
Brazil	1.2			
Paraguay	1.2			
Peru	1.0			
Guatemala	1.0			

Source: OECD Global Insurance Statistics. Used with permission.

in West Africa. One man who contracted the disease only displayed symptoms after he traveled to Texas. He went to a hospital and died two weeks later. In the meantime, he infected two individuals.

The property-casualty exposures include the following:

- Business interruption. When potential patients learned of possible Ebola exposure, the number of emergency room visits was cut in half. Additionally, the number of patients per day fell by 22 percent and net revenues declined by 25 percent (\$12 million). After the U.S. Centers for Disease Control (CDC) said the hospital was Ebola-free, revenues returned to normal.
- **Malpractice.** The victim's family sued the hospital. A nurse also sued, alleging that the staff had inadequate training to deal with Ebola victims and that she had suffered a loss of privacy, becoming known as "the Ebola nurse."

And the exposures extended beyond the hospital. A bridal shop that the nurse had visited became known as "the Ebola shop." It closed.

Zika in Miami

The 2016 Zika outbreak was the widest ever, Lam said. The virus is generally not dangerous to adults, but a pregnant woman can pass it to her fetus, causing severe birth defects.

The first case in Miami occurred in the Wynwood neighborhood, where the CDC had issued a six-week travel advisory. The advisory was later lifted, but at its height, airline travel to the Miami area fell by 17 percent. Revenues from hotel taxes dropped about five percent and the majority of all businesses reported a decrease in revenue of at least 20 percent.

Keeping these examples in mind, it takes little imagination to construct an insurance product that would respond to an epidemic. Pricing that product, though, would be a challenge. Epidema time before becoming fully symptomatic. They then either recover or die. The length of time at each stage varies by disease.

An additional consideration in the model is the impact that travel has on

The disease being modeled has to originate somewhere. From that point of origin, the amount that the disease spreads depends on the originating state's ability to combat it. This is reflected in what Lam calls a "Preparedness Index."

ics are fortunately rare, Lam noted, so there will never be much historical data from which to project. The alternative was to build a model. Such a model, Lam said, would require a solid scientific foundation. It would be a multidisciplinary exercise, involving knowledge of how diseases spread and how economies are affected, among other things. The result would provide a granular look at how the spread of a disease would affect property-casualty exposures.

At a high level, the procedure she described resembles catastrophe modeling, translated to the world of disease. As with a catastrophe model, one models the exposure, creates a catalog of events, and then uses the information to inform pricing and capital decisions.

The disease spread model, Lam said, would be a large scale computational model that shows how a disease would move across the world. The model would show how people progress from susceptible (within the exposure area) to exposed.

Some of the exposed become infected. Then they are asymptomatic for increasing the potential for the disease to spread. Lam discussed how government policy and efficacy was used to incorporate this into the model.

The disease being modeled has to originate somewhere. From that point of origin, the amount that the disease spreads depends on the originating state's ability to combat it. This is reflected in what Lam calls a "Preparedness Index," a metric that describes the level of access to vaccines, drugs and physicians. It also accounts for how capably a government can respond to epidemics, from informing people about the outbreak to establishing quarantine areas, and more.

Ultimately, the goal is to establish an event catalog— a collection of scientifically plausible, hypothetical events. Higher probability events are more frequent in the catalog. Analysis of the catalog will produce exceedance probabilities (the probability that losses will exceed a given loss amount). To revisit the catastrophe modeling comparison, the disease spread model exceedance probabilities similarly play a large part in informing property-casualty insurers' capital and pricing decisions.

Lam gave examples of how such modeling could be used. During a 2015 outbreak of Middle East Respiratory Syndrome (MERS) in South Korea, a policy offered up to \$4,500 for medical costs if a person traveling to the area contracted MERS (and \$91,000 if they died within 20 days of diagnosis).

But the insurance had a fairly narrow scope; it only insured people traveling to the region. It did nothing for people in the infected region.

Hope for a solution comes from the African Risk Capacity, an agency established by the African Union to help member countries prepare and respond to extreme events, of which epidemics is one. Modeling could help them prioritize the risks they face and respond efficiently, mitigating property-casualty exposure along the way.

Lam envisioned a number of other insurance products, including:

- Travel insurance with an epidemicdriven trigger (e.g., the number of cases in a country exceeding a predetermined threshold, or issuance of a government travel alert).
- Business interruption insurance for hospitals. In addition to covering lost revenue, a policy could extend to cover absenteeism, which rises during an epidemic. She cited a survey stating that if an avian flu struck, 42 percent of nurses said they might show up or might not. Fifteen percent said they would not show up, even if they would lose their jobs.

Absenteeism is a "major concern during an outbreak," Lam said. "When there is inadequate care for the patient, it just makes the outbreak worse."

EXPLORATIONS By STEPHEN MILDENHALL

The Re-Arrangement Algorithm

"Can he have everything louder than everything else?" — Ian Gillan, Deep Purple, Made In Japan

> ast month's column introduced three situations where Value at Risk (VaR) fails to be subadditive and respect diversification:

- 1. When the dependence structure is of a special, highly asymmetric form.
- 2. When the marginals have a very skewed distribution.
- 3. When the marginals are very heavytailed.

It showed that given two nontrivial marginal distributions X_1 and X_2 and a confidence level α it is always possible to find a particular form of dependence where subadditivity fails. This is surprising. It shows that dependence trumps characteristics of the marginal distributions. The column described the worst dependence structure. It takes the largest 1- α proportion of the observations from X_1 and X_2 and forms their crossed combination: the largest from X_1 with the smallest from X_{2} , the second largest with second smallest and so forth. There are no restrictions on the smallest α proportion of values since they are irrelevant to the VaR computation.

Now consider the same problem with d>2 marginals. Specifically, what is the range of possible values of VaR_a of $A=X_1+\dots+X_d$ when only the distributions of the marginals X_j are known, and not their joint multivariate distribution? Practitioners often address this problem.

It is common in capital modeling,

operational risk modeling and some kinds of catastrophe risk modeling that the univariate distributions X, are understood quite well, but there is considerable uncertainty about their joint distribution. Joint distributions are very hard to quantify as d becomes large. There are $d(d-1) \approx d^2$ bivariate relationships, and d^2 quickly overwhelms 10 years of loss data. The problem goes beyond estimating association parameters, such as linear correlation or Kendall's tau, because the marginal distributions can be combined using different copulas to vield the same association measures. As a result, practitioners want to determine the range of $VaR_{\alpha}(A)$ as the multivariate distribution of $(X_1, ..., X_d)$ varies over all possible multivariate dependencies.

Standard practice often selects a base dependency structure, perhaps using coarse correlation coefficients such as multiples of 0.25, and a normal or tcopula, and uses it to derive a baseline $VaR_{a}(A)$. It then stress tests the result by increasing or decreasing the coefficients. The resulting VaRs can be compared to those computed assuming the marginals are either independent or perfectly correlated using the comonotonic copula. The comonotonic copula ranks all the marginals from largest to smallest and combines in order, so VaR computed using the comonotonic copula is additive. However, as shown in the last issue, the comonotonic copula does not give the worst possible outcome for d=2 marginals, nor does it for d>2. How much worse than additive can the VaR be for a given

set of marginals?

Let $X_j = (x_{1j}, x_{2j}, ..., x_{Mj})^t$, j=1,2,...,d be column vectors of equally likely losses and let $X=(x_{ij})$ be the $M \times d$ matrix with columns given by X_j . In cat model-speak, the x_{ij} are samples from the yearly loss tables for d different peril-region combinations. VaR_{α} (X_j) can be computed by sorting X_j from largest to smallest and selecting the $(1-\alpha)M$ th observation.

How should the observations from X_j be combined so that the VaR of the sum is as large as possible? We want to rearrange each column of X so that the $(1-\alpha)M$ th largest observation of the row-sum A is as large as possible.

First observe it is only necessary to combine the $(1-\alpha)M$ largest observations of each marginal. Any candidate combination that does not satisfy this condition can be made better, i.e., have a larger $(1-\alpha)M$ largest observations, by swapping combinations using observations outside the "top $(1-\alpha)M$ " with unused top $(1-\alpha)M$ entries. From here on assume that *X* has been truncated to only include the $N=(1-\alpha)M$ largest observations of each marginal.

When there are only two marginals, it is plausible that the crossed arrangement is best: it does not "waste" any large observations by pairing them with other large values and hence maximizes the minimum sum. It is the perfectly negatively dependent arrangement of two marginal loss distributions. However, if there are d>2 marginals, we can't combine largest with smallest in the same way. Having paired largest and smallest, what do we do for the third marginal? We can't "make everything louder than everything else."

The logic used in last issue's column suggests a two-part approach. First, any very large outlier observations should be combined with the smallest observations from all the other marginals. These values will be above the resulting VaR. Second, the middle-sized observations should be grouped together so that their sums are as close in value as possible. The least such value will be the VaR. These groupings minimize the variance of the sum. The Re-Arrangement Algorithm finds a near-optimal worst-VaR dependence structure that uses this approach.

The Re-Arrangement Algorithm was introduced in Puccetti and Ruschendorf (2012) and subsequently improved in Embrechts, Puccetti and Ruschendorf (2013). The setup is as follows. Inputs are samples arranged in a matrix $X=(x_{ij})$ with *i*=1,...,*M* rows corresponding to the simulations and *j*=1,...,*d* columns corresponding to the different marginals. These samples could be produced by a capital, catastrophe or operational risk model, for example. We want to find the arrangement of the individual losses in each column producing the highest VaR of the sum of losses for $0 < \alpha < 1$. Start by sorting each marginal in descending order and select just the top $N = (1 - \alpha)M$ observations. For simplicity assume N is an integer. Only these top N values need special treatment; all the smaller values can be combined arbitrarily. Select a level of accuracy $\epsilon > 0$ for the algorithm.

Re-Arrangement Algorithm

- Randomly permute each column of *X*, the *N*×*d* matrix of top 1-α observations.
- 2. Loop:
 - Create a new matrix *Y* as follows. For column *j*=1,...,*d*.
 - Create a temporary matrix V_j by deleting the *j*th column of *X*.

- Create a column vector v whose *i*th element equals the sum of the elements in the *i*th row of V_r.
- Set the *j*th column of *Y* equal to the *j*th column of *X* arranged to have the opposite order to *v*, i.e., the largest element in the *j*th column of *X* is placed in the row of *Y* corresponding to the smallest element in *v*, the second largest with second smallest, etc.
- Compute *y*, the *N*×1 vector with *i*th element equal to the sum of the elements in the *i*th row of *Y* and let *y*^{*}=min(*y*) be the smallest element of *y* and compute *x*^{*} from *X* similarly.
- If $y^* x^* \ge \epsilon$ then set X = Y and repeat the loop.
- If *y*^{*}-*x*^{*}<*ε* then break from the loop.
- The arrangement *Y* is an approximation to the worst VaR_a arrangement of *X*.

Given that *X* consists of the worst $1 - \alpha$ proportion of each marginal, the required estimated VaR_{α} will be the least row sum of *Y*, that is *y*^{*}. In implementation *x*^{*} is carried forward from the previous iteration and not recomputed. The statistics *x*^{*} and *y*^{*} can be replaced with the variance of the row sums of *X* and *Y* and yield essentially the same results.

Embrechts, Puccetti, and Ruschendorf (2013) report that while there is no analytic proof the algorithm always works, it performs very well based on examples and tests where the answer can be computed analytically.

Here is an example. Compute the worst $VaR_{0.99}$ of the sum of lognormal distributions with mean 10 and coefficient of variations 1, 2 and 3. To solve,

take a stratified sample of *N*=40 observations at and above the 99th percentile for the matrix *X*. Table 1 shows the input and output of the Re-Arrangement Algorithm.

Table 1 illustrates that the worstcase VaR may be substantially higher than when the marginals are perfectly correlated, here 45 percent higher at 352.8 versus 242.5. The form of the output columns shows the two-part structure. There is a series of values up to 356 involving moderate-sized losses from each marginal with approximately the same total. The larger values are then dominated by a single large value from one marginal combined with smaller values from the other two.

Performing the same calculation with *N*=1000 samples from the largest 1 percent of each marginal produces an estimated worst VaR of 360.5. Figure 1 shows plots of the marginals with the worst VaR dependence structure, highlighting the same concepts shown in Table 1. The diagonal plots show histograms of each marginal. Working with even larger values of *N* does not change the result significantly. Figure 2 reveals the strange dependence between the marginals by plotting in three dimensions.

Just as for the case d=2, there are several important points to note about the Re-Arrangement Algorithm output and the failure of subadditivity it induces.

- The algorithm works for any nontrivial marginal distributions — it is universal.
- The output is tailored to a specific value of α and does not work for other values of α. It will actually produce relatively thinner tails for higher values of α than the co-

actuarial EXPERTISE

X ₀	X ₁	X ₂	Sum	S ₀	S ₁	S ₃	Max VaR
49.0	85.6	107.9	242.5	87.1	124.6	141.1	352.8
49.4	86.6	109.5	245.6	70.8	113.6	169.3	353.7
49.9	87.7	111.2	248.8	98.8	127.9	127.4	354.1
50.3	88.9	112.9	252.1	79.9	118.8	155.5	354.1
50.7	90.0	114.7	255.5	83.1	107.1	164.3	354.5
51.2	91.3	116.6	259.1	92.1	139.7	122.8	354.6
51.6	92.6	118.6	262.8	67.7	135.4	151.5	354.7
52.1	93.9	120.6	266.6	108.8	116.1	129.8	354.7
52.6	95.3	122.8	270.7	62.8	105.1	186.9	354.8
53.2	96.7	125.0	274.9	63.9	170.6	120.6	355.0
53.7	98.3	127.4	279.3	69.2	111.3	174.6	355.1
54.3	99.9	129.8	284.0	72.7	144.5	138.1	355.3
54.9	101.5	132.4	288.8	59.9	101.5	194.1	355.5
55.5	103.3	135.2	293.9	127.5	103.3	125.0	355.8
56.1	105.1	138.1	299.3	60.8	162.6	132.4	355.9
56.8	107.1	141.1	305.0	66.3	109.1	180.5	355.9
57.5	109.1	144.4	311.1	61.8	149.8	144.4	356.0
58.3	111.3	147.9	317.5	65.0	155.8	135.2	356.0
59.1	113.6	151.5	324.3	74.8	121.6	159.7	356.1
59.9	116.1	155.5	331.5	77.1	131.5	147.9	356.5

Table 1: Starting X is shown in the first three columns $x_{0}x_{y}x_{2}$. The column Sum shows the row sums $x_{0}+x_{1}+x_{2}$ corresponding to a comonotonic ordering. These four columns are all sorted in ascending order. The right-hand three columns, $s_{0}s_{y}s_{2}$ are the output, with row sum given in the Max VaR column. The worst-case VaR_{0.99} is the minimum of the last column, 352.8. It is 45 percent greater than the additive VaR of 242.5. Only a sample from the largest 1 percent values of each marginal are shown since smaller values are not relevant to the calculation.

X ₀	X ₁	X ₂	Sum	S ₀	S ₁	S ₃	Max VaR
60.8	118.8	159.7	339.3	59.1	179.9	118.6	357.5
61.8	121.6	164.3	347.7	58.3	99.9	202.0	360.1
62.8	124.6	169.3	356.7	57.5	191.1	116.6	365.3
63.9	127.9	174.6	366.4	56.8	98.3	210.9	366.0
65.0	131.5	180.5	377.0	56.1	96.7	221.0	373.9
66.3	135.4	186.9	388.7	55.5	205.1	114.7	375.4
67.7	139.7	194.1	401.5	54.9	95.3	232.7	382.9
69.2	144.5	202.0	415.7	54.3	223.3	112.9	390.5
70.8	149.8	210.9	431.6	53.7	93.9	246.3	393.9
72.7	155.8	221.0	449.5	53.2	92.6	262.5	408.2
74.8	162.6	232.7	470.1	52.6	248.7	111.2	412.5
77.1	170.6	246.3	494.0	52.1	91.3	282.3	425.7
79.9	179.9	262.5	522.3	51.2	288.1	109.5	448.8
83.1	191.1	282.3	556.5	51.6	90.0	307.2	448.9
87.1	205.1	307.2	599.4	50.7	88.9	340.0	479.6
92.1	223.3	340.0	655.5	50.3	87.7	386.6	524.6
98.8	248.7	386.6	734.1	49.9	366.9	107.9	524.7
108.8	288.1	461.1	858.0	49.4	86.6	461.1	597.2
127.5	366.9	615.7	1110.1	49.0	85.6	615.7	750.3

monotonic copula. In Table 1 the comonotonic sum is greater than the maximum VaR sum for the top 40 percent of observations, above 366.4.

- The implied dependence structure only specifies how the larger values of each marginal are related; for values below VaR_a, any dependence structure can be used.
- The dependence structure does not have right tail dependence.

The Re-Arrangement Algorithm is easy to program and can be applied in cases with hundreds of thousands of simulations and hundreds or more marginals. It gives a definitive answer to the question "Just how bad could things get?" and, perhaps, provides a better base against which to measure the diversification effect than either independence or the comonotonic copula. It is a valuable additional feature for any risk aggregation software. While the multivariate structure it reveals is odd and specific to α , it can't be dismissed as wholly improbable. It pinpoints a worst case driven by a combination of moderately severe, but not absolutely extreme, tail event outcomes. Anyone who remembers watching their investment portfolio during the financial crisis has seen that behavior before!

Next issue's column will discuss the two remaining ways subadditivity fails: extreme skewness and the bizarre world of extremely thick tails.

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Figure 1: Pairwise bivariate scatter plots of the worst VaR arrangement of losses using N=1000 points. The same patterns observed in Table 1 are clear. Log scales.



Figure 2: Multivariate distribution of the worst VaR arrangement of losses using N=1000 points. Log scales.

RANDOM SAMPLER By NANCY BRAITHWAITE

Change, Innovation and Diversity

The following is an excerpt from Nancy Braithwaite's Presidential Address given at the CAS Annual Meeting in Anaheim, California on November 6, 2017.

don't like change. I admit it. Many of us are not comfortable with change; it's natural. Yet, I've spent my year thinking about change; it's unavoidable. And, I'm going to spend my last presidential moments with you talking about change. But, maybe I can also give you a comforting thought ... "The more things change, the more they stay the same."

This cliché came to mind throughout my year as president - and in a prominent way as I worked with the board on refreshing our strategic plan ... The scope of actuarial practice has been a significant topic of conversation for our board. Casualty actuaries have specialized knowledge, but our scope of practice can be quite broad. And this is true even before we consider nontraditional roles of actuaries. The types of risks we are prepared to evaluate range from personal auto insurance to cyberrisk. We operate in insurance and risk management, and our skills are relevant and being used in many other areas.

CAS members are continuously exposed to new data and new techniques for analyzing those data; we are exposed to new product ideas and new societal risks. We are constantly expanding the body of actuarial knowledge. The same is true as we apply the tools and training we have to "nontraditional" areas of practice like claims, marketing and even banking.

... Innovation is one of two core values that are new to our strategic plan.

Casualty actuaries have been innovators from day one. Our Society was founded over 100 years ago by those actuaries who met the challenge of data collection and ratemaking for the new insurance coverage known as workers' compensation. In the traditional roles of ratemaking and reserving, we are constantly innovating as new products are developed, and even before that, as data anomalies created interesting puzzles for us to solve.

... Two of the many changes we are facing today is the availability of massive amounts of data and the use of sophisticated techniques to get information out of that data. While many actuaries were and still are asking, "What do we do about these data scientists? Will they be taking our jobs?" The CAS has been creating a vehicle, through [the CAS Institute] iCAS, to bring professionalism and community to data scientists. iCAS also aims to bridge the communication gap, so that actuaries and data scientists can work effectively side-by-side and be more productive than either profession would be alone.

As I think of iCAS, and its first credential, the Certified Specialist in Predictive Analytics, my mind goes back to data anomalies. Whenever I think of data, I think about potential for incorrect data. For example, it is reported that over 20 percent of credit reports have incorrect data. Yet we use that data to make financial decisions. As available data increases and models become more complex, we have a professional responsibility to ask the right questions. Just because it appears that the data says something, do we believe it? Is it possible there's something wrong with the data? Is it possible something has changed that affects the outcome of the model? Is it possible that something in the data has become a proxy for socially unacceptable rating factors? Professionalism and integrity are still among our core values.

... In the CAS's traditional area of basic education, we continue to explore changes that keep the CAS the gold standard in P&C actuarial education. If you are a candidate or work with one, you've surely heard about the new integrated questions we've added to our exams. ... We'll be introducing TBE, technologybased examinations, which will allow the examination environment to be more like an actual work environment, questions and solutions can address situations an actuary would encounter at work.

We've also added into the syllabus some of the statistical theory that underlies predictive modeling. We know that all actuaries will need some understanding of the predictive modeling techniques that have become available with big data. This understanding complements the deeper learning that comes with an iCAS certification.

All of these initiatives nicely illustrate the "formerly-implicit-now-explicit" CAS core value of innovation.

The second new core value in our strategic plan is diversity.

As much as I hate change, I love diversity. Diversity has made my life richer. We talk about continuous learning — what better way to learn than to be exposed to people who've had different experiences and see the world differently?

... Have you ever thought about how many different kinds of actuaries there are or how much potential for success our industry, as well as changes in our daily lives that will affect our industry. After all, our organizations seek to provide financial stability to those who own cars, and houses, as well as to those with complex business problems. Cultural changes in desire to own homes

Diversity can prepare us for change. We operate in a complex world. No one of us can be in tune with all of the things that are changing around us. The more diverse perspectives and ideas we are exposed to, the more prepared we can become for changes in our industry, as well as changes in our daily lives that will affect our industry.

and job satisfaction there is? I mentioned some of the diversity as I talked about our scope of practice. It's really amazing the varied work available to us! And there's a place for all kinds of people in our profession — an opportunity for each type to find a niche where they can be successful.

Some of us like people and want to work on a team. Others are highly technical and prefer detailed analysis. Still others like the predictability and routine of an annual personal lines pricing review. Some of us even love the challenge of pricing a complex, new cyberrisk policy! ...

Of course, diversity offers more than just personal satisfaction. Our employers, our industry, our society — they all benefit as well. Diversity can prepare us for change. We operate in a complex world. No one of us can be in tune with all of the things that are changing around us. The more diverse perspectives and ideas we are exposed to, the more prepared we can become for changes in and cars, as we have seen with millennials, might come as a surprise. These changes, if unforeseen, might be a threat to our ability to adapt our products and services to the needs of our customers. It took our industry some time to catch up with the sharing economy when ridesharing services first developed. As more and more workers are self-employed or contract workers, what does that mean for workers' compensation insurance?

How can we contribute to product development without understanding the varied needs of our population? How can we contribute to profitability if we don't know how our products will be used? As our employment opportunities become more global, diversity becomes even more important. Understanding the cultures we work in is essential to adapting our methods and becoming successful.

Diversity and innovation work hand in hand to help us adapt to change. Teams that are diverse have the opportunity to share and build on the creativity of their members. Our products can incorporate new features that a homogeneous team might not imagine.

So, let's think again about change. Has anything changed since you started your career?

Even if you started in the profession two years ago, I'll bet you've experienced *some* change. ... The way I do my job today has nothing in common with the way I worked on day one, in fact it has little in common with what I did five years ago. If I told you half the things that have changed over my career, you'd think I was about 200 years old!

With the variety of actuarial work and the rate of change in the world around us, could you ever be bored as an actuary?

... To prepare to speak with you today, I, as many others before me, read through the addresses of previous CAS Presidents. ... Do you know what the themes were?

- Education (keeping our system the gold standard).
- Globalization.
- Technology advances.
- Nontraditional roles (advancing actuarial science in these areas).
- Professional and ethical standards (maintaining these).
- Change (this is a recurring theme that is always happening at an everincreasing rate. Sound familiar?)

We've got this. We've done it before. There are continuing challenges. There always will be. ...

But the CAS, with its strong tradition of volunteerism and its committed leadership, will continue through innovation and diversity, and our other enduring values, to meet those challenges.

RANDOM SAMPLER BY AL BEER

A Commencement

The following is Al Beer's Address to New Members given at the CAS Annual Meeting in Anaheim, California, on November 6, 2017.

hank you, Nancy [Braithwaite], for allowing me the privilege of addressing the new members. As I was preparing for this moment, I reflected on the fact that this is, in many ways, a commencement speech. Yet unlike high school and college graduations, which generally celebrated institutions you were leaving, this is truly the "beginning" of your career as a member of the Casualty Actuarial Society. And it was in that vein that I reflected on the derivation of the term "commencement speech" which, as I am sure you know, is derived from the Latin which means, loosely translated, "Some old guy rambles on for 10 minutes about things you will forget before you even leave the room."

Ladies and gentlemen, it is to that high standard that I aspire this morning.

It has become fashionable to ask the question, "What valuable, sage advice would you give to a younger you?" Well, preparing my remarks today, I thought about what advice I would give a young Al Beer in May 1980, sitting in the audience as one of 12 new Fellows being admitted to the CAS.

And I came up with three pieces of advice that I would absolutely impress upon him:

Number 1 — There's going to be a stock offering for a company called Apple ... BUY IT! (Well, you said it should be valuable advice!)

Number 2 — Now, listen carefully. You can't comprehend what I am about to tell you, but trust me, it will save you hours of agony and heartache. PLEASE be sure to regularly back up your hard drive! (You have no idea how valuable that little nugget will be.)

But seriously, my third piece of advice to him would be the most valuable of all. And it would be the same advice I would give to you right now.

Number 3 — Be proud of yourself.

By that I mean, every day you should be able to take inventory of what you have done in your life and how you achieved it. It would be silly of me to preach to you about hard work and dedication. You wouldn't be in this room today if you hadn't already mastered these traits. However, to truly be proud of yourself, I believe you rigidly follow a few basic principles, the most important of which follows next.

Honesty and Integrity

You should continually judge yourself based on every action you take. Whether it be on the personal or professional level, honesty and integrity will always be the most important attributes you can possess. I may be a bit naïve, but I believe that dishonesty is just a bad habit that some people acquire. Little white lies all too easily become huge lies and soon a career is permeated with dishonesty. I remember a great piece of advice I received from one of my favorite business mentors: "Not everyone who cheats in business cheats in golf, but I guarantee you, if someone cheats in golf, they will cheat in business!" His point being that if someone is so driven that they feel they must cut corners on the insignificant things in life, they will certainly have no problem cutting corners on what really matters. I know very well how hard it is to say, "It was my fault", or "It was my decision" or "I'm sorry." But you will be amazed at how important a role those phrases will play in your life and your career. So, work very hard every day to maintain your reputation for honesty and integrity. You will never have a more valuable possession.

Humility

It might surprise you, but an important element of being "proud of yourself" is humility. All of the most impressive people in my life have shown a strong sense of humility.

Your celebration today is just one of many successes you will experience in your lifetime. And you have every right to feel an enormous sense of pride in your accomplishment. But always balance that with the realization that one of the most important qualities of leadership is humility. People often confuse being humble with being meek. The best expression I have heard is from Jim Collins' book, Good to Great: "Humility is pride without arrogance." The greatest managers and leaders I have been blessed to work with are not afraid to ask, "What do you think?" or "How am I doing?"

My appreciation for the importance of humility began long ago. The greatest teacher I ever had was my high school Latin teacher. (Now you have to be VERY GOOD to stimulate students in Latin.) What made him exceptional was that,

in addition to discussing the conjugation of verbs, he also brought the glory that was Rome into the classroom. One lecture in particular stands out in my mind. With misty eyes, he described the Roman triumphus, a civil ceremony and religious rite of ancient Rome, held to publicly celebrate and sanctify the success of a military commander who had led Roman forces to victory. On the day of his triumph, the general wore a crown of laurel and a gold-embroidered toga. During this ceremonial adulation by the *populus*, he rode in a four-horse golden chariot through the streets of Rome alone, except for a single servant who had one and only one responsibility - to continually whisper in the ear of "Worldly glory is fleeting." The Romans knew the power and importance of humility.

Now, I never needed a servant to whisper in my ear to keep me humble. God gave us three children to do that. A quick example: I was getting a noon flight out of LaGuardia one day and, over breakfast, my son, Kevin, asked for a ride to school. Now, I warn all of you that every once in a while you will be overcome by a demonic urge to channel your parents. Well, that was the moment it happened to me. For whatever reason, I began to hear myself spout the old anecdote, "When Abraham Lincoln was your age, he would walk to school every day, uphill, both ways, in the snow!" At which point Kevin said: "And when he was your age, Dad, he was president of the United States!" Now that's how I am kept humble!

Don't waste your time defining "success"

You have heard it a thousand times, but

I never needed a servant to whisper in my ear to keep me humble. God gave us three children to do that.

I truly believe it: "Success is defined by the quality of the journey, not the destination!" My father worked for the New York City Transit Authority for 45 years. During that time, he never earned more than \$30,000 a year. But I look at him as one of the most successful people I have ever known. He and my mother put two kids through college, helping their daughter have a very rewarding nursing career and somehow helping their mischievous son become an actuary. And when I was growing up, on Saturdays he would invest 15 cents in a token (he would ride free) and spend the morning with me traveling around the subways of New York teaching me all about the nuances of the IRT, IND and BMT subway lines. You have probably heard stories of wealthy executives taking their families on a vacation to a villa in Tuscany for a week. Sounds impressive. But I challenge them to create one-tenth of the memories and bonding experiences that I had as a kid, riding with my father for 15 cents under the streets of New York. Now, that is a successful person!

That's why I always smile when asked about "the secret to climbing the ladder of success." Success to me is certainly not a ladder. If anything, it's a jungle gym, three-dimensional monkey bars, a Rubik's cube of framed pipes and empty space. Why does every move you make have to be carefully planned and classified as "a successful one"? Though I was brought up in an Irish Catholic family, one of my favorite expressions is an old Yiddish proverb: "Man plans, God laughs." Let me share with you some of my journey.

I was a 22-year-old with a graduate

degree in mathematics who couldn't find a teaching job, loading baggage onto planes at Kennedy Airport. A good friend from high school was working at Insurance Services Office and reminded me that, since I was engaged, I probably should think about getting a better job. He talked someone into interviewing me and, as they say, the rest is history. Except it wasn't. I spent the next four years taking exams and learning a lot about the business. Then one day I received a call from the president of The College of Insurance. He said they needed someone to develop a property-casualty actuarial department and thought I would be a good teacher. That night, my pregnant wife Mary calmly listened to all my reservations, including giving up a job paying \$22,000 a year for one paying \$19,000. She finally clinched the deal when she said, "I don't want you moping around at 40, complaining that you should have taken the chance to do what you have always wanted to do." And so, in the most circuitous route possible, I became a teacher. Those "ladder of success" devotees would say it was a "poor career move." To me it was just jumping at an angle to another bar on the gym. Soon, for obvious reasons, I decided to try to supplement my income, and I began a small consulting practice. God laughed and six years later I had the opportunity to leave the academic department that I had built and become a partner in Tillinghast, the actuarial consulting firm. Four years after that, I was offered the role of chief actuary at one of my clients' reinsurance companies. I nervously shared with Mary my trepidation about leaving consulting.

viewpoint

She calmly talked me through it, and I eventually decided to jump to a bar that was hanging in a completely new direction. But let's take a humility break! After the decision, with the family gathered around the dinner, I explained that I was entering the reinsurance business. My dear son, Tommy, asked, "What is reinsurance?" In my most professorial tone, I explained, "Reinsurance is the insurance of insurance companies." At which point Tommy smirked, "Ouch! Boring squared!"

The next 10 years were kind to me, finding me assuming a variety of corporate and underwriting roles, culminating with me deciding to retire as president

Never, ever, stop learning

My children and my students are very familiar with a graduation card that I am fond of giving. It reads, "How does it feel knowing that everything you just spent four years memorizing can be looked up on Google in five minutes?" This jibe is based upon a gross misunderstanding of what college is meant to provide. I have bored my children and students to death, continually preaching that the secret to educational and professional success is "learning to learn." If you think a college education consists of learning that the Battle of Hastings occurred in 1066, you are sadly mistaken. Hopefully, you have developed an ability

Drones, cyberrisk, terrorism, climate change — these are just a few examples of risk management topics that actuaries are better prepared to tackle than any other profession.

of Munich Re America. But I only tell you that to emphasize that the next leap across the gym was, in my opinion, the most successful! I am now on the faculty of St. John's University, waking up every morning nervously anticipating the challenge of keeping up with bright 20-year-old actuarial students!

Still think of success as a ladder?

To me the secret was to enjoy what I did, who I worked for and who I worked with. Every one of my employment decisions was based on those three factors. I am not so naïve as to think everyone will always have the perfect job. But there is no reason to punish yourself (and your loved ones) by staying in an aggravating situation. So enjoy what you do! Don't settle. You can never be good at something you hate.

Which leads to my last point:

to carefully synthesize information from a variety of sources and reach sound conclusions. When my daughter, Katie, was an undergraduate, she was majoring in psychology and unsure of what she wanted to do with her life. I encouraged her to go to law school. She responded that she knew nothing about being a lawyer. I told her that wasn't the point. Law school would teach her to think in an incredibly analytical way, regardless of whether or not she made it her career. To this day, she says it was the best advice I gave her.

Your Associateship and Fellowship designations are testaments to the fact that you have mastered certain fundamentals of actuarial education. Now the real actuarial work begins in applying that education to the real world. One quick example: There are a handful of

people in this audience who took exams during the '70s and recall reading a paper by Luther Tarbell. The paper examines the appropriateness of applying auto physical damage insurance to the peril of the erosion of the paint on a car by the kicking of a horse pulling a horsedrawn vehicle. You can rightly ask how that can help you deal with the evolving phenomenon of autonomous vehicles today. But the point is that your education (and mine) was never intended to train you to merely replicate the past. Your challenge is to adapt a handful of fundamental principles in order to apply them to the new and exciting challenges that will arise during your career. We, as a society, desperately need your enthusiasm and creativity to help deal with issues that never existed before. Drones, cyberrisk, terrorism, climate change - these are just a few examples of risk management topics that actuaries are better prepared to tackle than any other profession. And to do that you need to constantly improve your skill set by continual learning, whether it be by formal continuing education programs or working on projects with others who can give you the significant benefit of their experience. In particular, every one of you should consider getting involved in some CAS committee work. This is a great organization made greater by the contributions of its volunteers and you will be amazed at the value you receive from working with your peers. So, to be great at what you do, never stop learning ... never!

So, I want to conclude by offering you congratulations and good luck. For what you have accomplished, the CAS is immensely proud of you. Now spend the rest of your life making yourself proud!

COLLABORATIVE

At the Casualty Actuarial Society, we believe that collaboration is the key to success. We are proud to foster a community of risk professionals collaborating towards a common goal — solving today's risk-oriented challenges. Learn more about how we are working together – and partnering with others – to create solutions for the property and casualty insurance industry at casact.org/collaboration.



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IN MY OPINION BY GROVER EDIE

"Stuff"

ecently, my wife and I inherited a lot of "stuff" from our parents: boxes of pictures, family documents and some heirlooms. One of the best items is an 1865 newspaper announcing the death of Abraham Lincoln. The paper is extremely fragile: I feel like I am holding history when I pick it up.

But there are also a lot of things of doubtful value, and some things we have no idea as to why our parents kept them. Sorting through all this stuff is an arduous project. You may have experienced a similar situation.

I recently came across an old newspaper I had kept from the September 29, 1999, edition of The Wall Street Journal. I was working at General Motors when it was published. On the cover page it read: "Lasting Impact: How an Internal Memo Written 26 Years Ago is Costing GM Dearly." In 1973 a "low-level engineer" wrote a memo estimating the cost to GM of the deaths due to post-collision fuel-tank fires from vehicle accidents. Setting the monetary damages at \$200,000 per such death, he went on to calculate the added cost per car to be \$2.40. General Motors had tried to keep the memo from being presented as evidence in post-collision fuel-tank lawsuits, but was unsuccessful; its admission in court just added more fuel to many plaintiffs' cases. (Pun intended.)

Timely disposal is also important, as Arthur Andersen found out. In 2002 the firm was convicted of witness tampering in connection to its disposal of Enron-related documents. It wasn't so much that they destroyed the documents in question, but that the "reminder notice" and subsequent And what about the stuff you left behind when changing jobs within the same company? Was it only useful documentation? Did it include drafts

Timely disposal is also important, as Arthur Andersen found out. In 2002 the firm was convicted of witness tampering in connection to its disposal of Enron-related documents.

shredding occurred as executives began to worry that an investigation by the Securities and Exchange Commission might be imminent. The conviction was eventually overturned by the United States Supreme Court, but the situation might have been avoided had a different, more ongoing document retention and disposal practice been in place. (You can find more about the Arthur Andersen case at http://www.economist. com/node/4033756.)

You may have your own favorite example of a memo that came back to haunt the writer.

How many times had I left a company leaving behind such a mixture of stuff for someone else to clean up? I offer my apologies to whomever had to sort through it, and my sympathies to anyone who has been left with stuff to sort through from someone else. and multiple versions besides the final report? Did someone have to go through a lot of useless items to find the truly valuable documentation and analyses? How did they know which version of the model was Electronic files can be deleted in a single step, but going through them is often tedious as they must be opened before determining their content, unless you have a naming convention or other form of version control. Even if a memo is worthy of being

the one used in the report for the filing?

retained, all the drafts before the final memo can be discovered in the event of a lawsuit. Attorneys can grill you for hours as to why the wording in version 6 was different than the wording in ver-

> sion 7, which was different from the final. Trust me on this point. I once spent a full day in a room of attorneys trying to explain exactly the difference between a succession of wording differences in the drafts that lead

up to the final version. It is not a fond memory. With multiple drafts, attorneys pick the wording they like best, charging that the other versions were "sanitized," go into this file. About every month or two (or three or four), on a Friday when things are winding down, I go through this drawer and sort it. Most of it goes

All the drafts before the final memo can be discovered in the event of a lawsuit. Attorneys can grill you for hours as to why the wording in version 6 was different than the wording in version 7, which was different from the final.

that your analysis was inconclusive, you were indecisive, or worse. Keeping only the final version prevents that from happening.

When writing a report or memo, I try to think about what is included that has no value or is of questionable value. Less wording means less to distract the

reader, makes the salient points more visible, and limits the damages caused by superfluous wording. (See the "In My Opinion" column titled "And Your Point Is?" in the November-December 2017 Actuarial Review.)

> Less stuff to go through also means that you find what you want quicker, whether it is in a memo, paper files or electronic files.

For many years, I have kept a "Friday drawer." It is a drawer of things I am not sure if I should toss. Rather than place them in another file, they into the trash, but some items are saved. It saves me a lot of time trying to decide whether to keep something and relieves me of the anxiety that I may throw away something valuable.

For electronic files, I usually create a folder within the project folder called "old stuff." Prior editions of the report, old versions of the worksheets or models, go into that file. I keep the "old stuff" because occasionally someone comes back with "I like the way you worded it two versions ago" or "I think the way you reflected the trend was better in the earlier version of the worksheet." When the project is done, I can erase the "old stuff" in a single swipe, keeping only the most recent data, spreadsheets and reports.

The last task of any project should be to clean up. Eliminate the drafts, both paper and electronic.

With all the attention-catching items that surround us, we can eliminate a lot of the clutter, or "stuff," that distracts us from what we really want and need to find.

IT'S A PUZZLEMENT BY JON EVANS

Buoyancy

ou are a scientist on a research ship positioned over the Mariana Trench, which is 11 kilometers deep. Four super-strong solid spheres are securely tied to the deck. You plan to untie them and gently push them off the ship.

- Sphere A has density 10 percent lower than the density of water at the bottom of the Trench.
- Sphere B has density 10 percent higher than the density of water at sea level.
- Sphere C has density 10 percent higher than the density

of air at altitude 100 kilometers (official boundary of space).

• Sphere D has density 10 percent lower than the density of air at sea level.

Without looking up any specific empirical physical

measurements, based on general principles of physics, roughly and qualitatively speaking, at what altitude above or depth below sea level will each of the spheres end up? Can you look up some actual empirical measurements and estimate quantitatively these altitudes and depths? Intuitively, does this suggest it should be easier to control the altitudes of airships or the depths of submarines, or are they both equally difficult to control? How consistent is this intuition with the history of airship and submarine technologies?

More Refined Pricing

It turns out that Tony's pricing formula P(m,n) is not more refined at all and must be exactly \$300 for all values of m and n. This is because the averaging constraint P(m,n) = (P(m+1,n) + P(m-1,n) + P(m,n+1) + P(m,n-1))/4 is the defining condition for a function on the lattice Z^2 to be harmonic. Harmonic functions that are bounded, either in maximum or minimum, must be constant. This is a version of Liouville's theorem, although the more familiar versions apply to continuous harmonic functions or continuous analytic func-



tions. Furthermore, this can be generalized to Z^d where d is any non-negative integer. So, even with more than two rating factors, Tony's formula would still charge a flat \$300 in all cases.

Unfortunately, a proof of Liouville's theorem for all positive harmonic functions on Z^d appears to be intrinsically rather complicated. This was an unexpected surprise. I first saw reputable references in mathematical literature that this version of the theorem was true.

I expected some relatively simple proof to exist, since several other versions of the theorem do have fairly simple proofs, but to no avail. I continued my search.

To see the simplest approach to the proof outline that I know of and reasonably trust, visit the new *Actuarial Review* website and look for "It's a Puzzlement."

Absolutely no one submitted solutions to this puzzle.

Know the answer? Send your solution to ar@casact.org.





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For Position 78291, a New Jersey client has asked Ezra Penland to find a senior property and casualty actuarial analyst. Requires 5+ years of property and casualty actuarial experience. \$90K-\$110K compensation package. Some workers compensation experience preferred. Predictive modeling, data analytics, pricing, reporting, premium studies and other assignments.

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