# The BIG SIGMAA News

**Business, Industry, and Government Special Interest Group
of the Mathematical Association of America**

## BIG Special Session at the 2019 MAA Southeastern Section Spring Meeting

by Caroline Maher-Boulis

A special session entitled "Mathematical Experiences and Projects in Business, Industry and Government (BIG)" was held at the 2019 MAA Southeastern Section Spring Meeting at Lee University in Cleveland, TN. Here is the session description:

> There are many problems in business, industry, and government that are best tackled by mathematicians. There has been a growth in the recent years in the number of undergraduate students who get involved in solving BIG problems or take part of a mathematical internship program. We eek presenters from all groups—faculty, undergraduate/graduate students and business partners — to share examples of their experiences. In addition to disseminating these experiences, this session will raise awareness for students who have not had the experience on what to expect in BIG as mathematicians.

What kind of problems do math majors work on in real life? What are the career options for math majors? These questions are asked universally by undergraduate mathematics majors (and by many of the faculty who teach them).

### The Session

The ten 15-minute talks in our session provided some very specific responses for these questions. We had a mix of mathematics graduates who are working in the BIG world, as well as current students and faculty who are teaching courses and/or directing projects in which undergraduates work on real-world problems. We heard about specific problems and specific roles in the BIG world.

For example, Joshua Crumblis has an undergraduate degree from Lee University (and he was pleased to come back "home" to give a talk). He currently works for Schneider Electric Company as a Materials Analyst; one current project is supply chain planning. He is also working on an MBA at Western Governors University.

Jason Quinley has an undergraduate mathematics degree from UGA and a master's degree in mathematics and computational linguistics from Indiana. He is the founder and chief consultant at Quintessence, a company promoting quantitative literacy for industry and government. Recent work includes voter database analysis, strategic demographic reporting, and GIS-canvassing integration for municipal and Congressional campaigns. He is also pursuing a PhD in linguistics at (Eberhard Karls) University of Tuebingen, applying game-theoretic modeling and data mining to problems of linguistic cooperation.

Allyse Lamon, who has an undergraduate math-

## The Puzzle Corner

At a neighborhood birthday party, there were $x$ children from Xavier Street, $y$ children from Young Street, and one parent. The average age of the Xavier Street children was $y$ and the average age of the Young Street children was $x$. The average age of everyone, including the 42-year-old parent, was $x + y$. How many people were at the party, including the parent? (*Solution on page 4*.)

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ematics degree from UT, talked about her work as an actuary. Upon graduation, she became a high school math teacher, but decided this was not the career for her; so she started studying for the actuarial exams. After she passed the first two exams, Cat Financial (part of the Caterpillar company) contacted her via LinkedIn and she went to work for them in Nashville. This talk drew the largest audience (about 35-40 students and faculty), because students already know enough about "actuary" to be interested in learning more.

Another presenter, James Sunkes, has also had a non-traditional route into the BIG world. He earned a PhD in mathematics from UT, intending to go the post-doc, tenure-track, academic path. When nothing opened up, he looked for appropriate non-academic positions and soon went to work for Dynetics, Inc., in Huntsville AL. His talk was titled "My transition into the defense industry". James also teaches some classes at UAH.

Kaitlyn Burk talked about her two projects in her PIC Math class as an undergraduate at Lee University. She is currently finishing her Master's degree at UAB, where she plans to continue to work toward her Ph.D. in applied mathematics.

Faculty Debra Gladden and Jason Schmurr of Lee University have taught the PIC Math class. They discussed the specific projects assigned to the students; they also talked about embedding the substance of the program
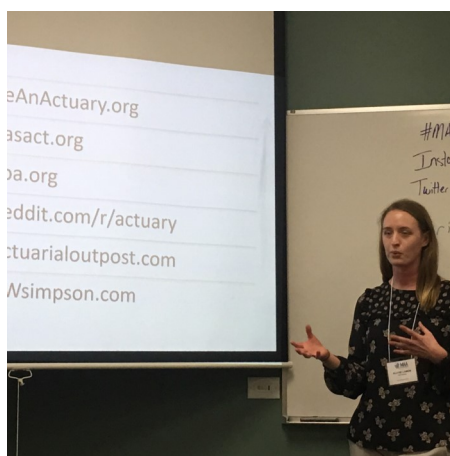


*Allyse Lamon talking about her actuarial experiences.*

into the curriculum after the PIC Math grant has expired.

Bridget Jones' path from math major to BIG career is instructive. After receiving her BS degree from UT in 2015, her job search was unsuccessful. She worked as a clerk at Dollar General for a while. After a year and a half, she was hired by Cognosante in Nashville: "It has proven to be a perfect fit for me … the important thing was that I didn't give up". She is a software developer at Cognosante, where her current role is to support the system that analysts use to process cases for people who have insurance through the Affordable Care Act.

Professor John Ramsay of Wooster is the founder and Director of Wooster's Applied Methods and Research Experience (AMRE) program, a summer program that just celebrated its 25th year. Students are employed to work as consultants in teams of three prob-

lems from local BIG employers. The program, funded by client fees, demonstrates that even at an early undergraduate level, mathematics students have marketable skills that can be leveraged into experiential education opportunities.

**Lessons to be learned**

This type of session has been presented at most recent national meetings; sometimes they target BS and MS degree holders, sometimes doctoral recipients. We believe they can easily be included as a part of any MAA section meeting.

In fact, any MAA member or BIG SIGMAA member can propose such a session in his/her Section – contact the Section officers.

To arrange speakers for our session, we contacted the chairs of Mathematics Departments close to the meeting site, asking for contacts with their graduates who are working in the BIG world. In our case, the University of Tennessee department was very helpful and we included several UT alums as presenters. We also contacted faculty who have been teaching PIC Math classes or who have organized student internships. We contacted BIG SIGMAA members in the Section. And, of course, some talks were volunteered in response to the conference announcement/call for papers.

Organizers: Caroline Maher-Boulis (Lee University), David Stone (Georgia Southern U), Jan Rychtar (UNC Greensboro), John Asplund (Dalton State College)

## Joint Mathematics Meetings 2019

The 2019 Joint Mathematics Meetings were held in January in Baltimore. Almost 6,000 mathematicians converged on the Maryland city to attend lectures, talk with colleagues, and meet up with old friends. BIG SIGMAA sponsored several events, including a contributed paper session at which seven speakers from business, government, and academia talked about BIG problems and opportunities for students to work on BIG problems as part of their studies. The was also a panel discussion on BIG job opportunities for mathematicians.

## BIG Jobs Guide

Members of the BIG SIGMAA may find a book recently published by SI-AM of interest. The book is called BIG Jobs Guide: Business, Industry, and Government Careers for Mathematical Scientists, Statisticians, and Operations Researchers. It's written by Rachel Levy, Richard Laugesen, and Fadil Santosa. Here's the description of the book from the SIAM website:

Jobs using mathematics, statistics, and operations research are projected to grow by almost 30% over the next decade. BIG Jobs Guide helps job seekers at every stage of their careers in these fields explore opportunities in business, industry, and government (BIG).

Written in a conversational and practical tone, BIG Jobs Guide offers insight on topics such as:

- What skills can I offer employers?
- How do I write a high-impact résumé?
- Where can I find a rewarding internship?
- What kinds of jobs are out there for me?

The Guide also offers insights to advisors and mentors on topics such as how departments can help students get BIG jobs and how faculty members and internship mentors can build institutional relationships.
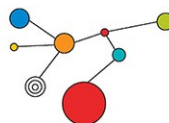
Audience

Whether you're an undergraduate or graduate student or a job seeker in mathematics, statistics, or operations research, this hands-on book will help you reach your goal—landing an internship, getting your first job or transitioning to a new one.

About the Authors

**Rachel Levy** advocates for mathematical modeling from kindergarten to industry and everyday life. She has served as Professor of Mathematics at Harvey Mudd College, SIAM Vice President for Education, and founded the BIG Math Network. She is the Deputy Executive Director of the

MAA.

**Richard Laugesen** created with colleagues at the University of Illinois an internship program serving over 25 students per year. He enjoys working toward a more diverse and inclusive community of mathematical scientists.

**Fadil Santosa** has been engaged in providing in BIG internship and job opportunities for over 20 years at the University of Minnesota through the Minnesota Center for Industrial Mathematics and through the Institute for Mathematics and its Applications.

For more information, check out SIAM's website, www.siam.org.

The BIG Math Network is sponsored by American Statistical Association (ASA), American Mathematical Society (AMS), INFORMS, Mathematical Association of America (MAA), and SIAM.

## George Gabriel Stokes

The year 2019 marks the bicentennial of the birth of the Irish and British mathematician and physicist George Stokes. Sir George Gabriel Stokes was born on August 13, 1819, in County Sligo, Ireland. He was the youngest son of the Reverend Gabriel Stokes, a clergyman in the Church of Ireland who served as rector of Skreen, in County Sligo. Stokes home life was strongly influenced by his father's evangelical Protestantism. After attending schools in Skreen, Dublin, and Bristol, Stokes matriculated in 1837 at Pembroke College, Cambridge. Four years later he graduated as senior

wrangler, the title given each year to the top undergraduate mathematics student. The significance of attaining the position of senior wrangler is apparent, not only by looking at others who achieved that title (e.g., John Hershel, Arthur Cayley, J. E. Littlewood, Donald Coxeter, and Jacob Bronowski), but also by looking at those who did not achieve the title: James Clerk Maxell, J. J. Thomson, and Lord Kelvin were second wranglers, G. H. Hardy was fourth wrangler, Bertrand Russell was seventh, and John Maynard Keynes was twelfth. Stokes spent all of his career

at the University of Cambridge, where he was the Lucasian Professor of Mathematics from 1849 until his death in 1903. He was a fellow of Pembroke College for most of that time.

On July 4, 1857, he married Mary Susanna Robinson, daughter of the astronomer the Reverend Thomas Romney Robinson, at St Patrick's Cathedral, Armagh, Ireland. In accordance with Pembroke College statutes at the time, he had to resign his fellowship at the college on account of his marriage, but twelve years later, under new stat-

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http://sigmaa.maa.org/big/BIG_SIGMAA_Home.html

## A Spring Fib

When
a
warm day
is followed
by a day that's cold,
blustery, and stormy, one thinks
that the chaotic nature of weather forecasting
is less chaotic than the problem of deciding what to wear to work tomorrow.

## George Gabriel Stokes

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utes, he was re-elected to the fellowship.

As a physicist, Stokes made seminal contributions to fluid dynamics, including the Navier-Stokes equation, and to physical optics, with notable works on polarization and fluorescence. In mathematics, he contributed to the theory of asymptotic expansions. Stokes' Theorem in vector calculus is named after him, although the theorem was actually proved by Lord Kelvin.

Stokes also served as president of the Royal Society from 1885 to 1890 and represented Cambridge University in the British House of Commons from 1887 to 1892, as one of the two members for the Cambridge University constituency, sitting as a Tory. He was the first person to hold the Lucasian professorship, the presidency of the Royal Society, and a seat in the House of Commons at the same time. Isaac Newton also held all three positions, but not at the same time.

Stokes was made a baronet by Queen Victoria in 1889. In 1893 he received the Royal Society's Copley Medal, the most prestigious scientific prize in the world at that time, "for his researches and discoveries in physical science".

On June 1, 1899, the 50th anniversary of Stokes's appointment as Lucasian Professor was celebrated at Cambridge in a ceremony, attended by numerous delegates from European and American universities. A commemorative gold medal was presented to Stokes by the chancellor of the university and marble busts of Stokes by the popular sculptor Hamo Thornycroft were formally offered to Pembroke College and to the university by Lord Kelvin.

On August 12, 1902, the day before his 83rd birthday, Stokes was elected as Master of Pembroke College. He did not hold that position for long, for he died at Cambridge on February 1 of the following year. He was buried in the Mill Road Cemetery, Cambridge.

## Puzzle Corner Solution

There were a total of $x + y + 1$ people at the party. The total age of the Xavier Street children was $xy$ and the total age of the Young Street children was also $xy$. Thus the total age of everyone at the party, including the parent, was $2xy + 42$. Therefore the average age of the $x + y + 1$ people at the party was $(2xy + 42)/(x + y + 1)$, and hence $(2xy + 42)/(x + y + 1) = x + y$. From this we have $2xy + 42 = (x + y)(x + y + 1)$ and therefore $x^2 + y^2 + x + y = 42$.

It's easy enough to use brute force to find all the positive integer values of $x$ and $y$ that satisfy this equation. Alternatively, complete the square in both $x$ and $y$ by adding ¼ + ¼ to both sides, and then multiplying by 4 and factoring, obtaining $(2x + 1)^2 + (2y + 1)^2 = 170$.

It's not hard to see that 170 can be written as the sum of two perfect squares in only two ways, $170 = 1 + 169$ and $170 = 49 + 121$. Since $x \geq 1$ and $y \geq 1$, it follows that $2x + 1$ and $2y + 1$ are 7 and 11 (in some order), and hence $x$ and $y$ are 3 and 5 (in some order). Therefore there were $3 + 5 + 1 = 9$ people at the party.