BIG SIGMAA News

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

BIG Math Network Connects Mathematical Scientists in Business, Industry, Government and Academia

Inside this issue:

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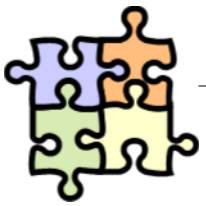
The BIG Math Network (bigmathnetwork.wordpress.com) is a collaborative effort among math societies, institutes, and industry partners to aggregate information about internships, training, mentoring, and jobs. As members of BIG SIGMAA are well aware, many undergraduate and graduate students trained in the mathematical sciences will enter the workforce in a rich array of business, industry and government (BIG) careers. Departments can have tremendous impact by raising awareness of the skills and experience required in today's job market. Each partner organization has its own initiatives related to careers; the network serves as a cooperating partner and hub.

The BIG Math Network website contains information for students and departments about careers. The blog has posts discussing training, internships, recruitment and jobs. The blog also advertises training opportunities and provides information for academic departments seeking to strengthen connections with business, industry and government. If you would like to submit a blogpost, please see the call on the site.

The network helps to organize events at society meetings. A career panel at the 2016 Joint Mathematics Meeting in Atlanta was cosponsored by the network, MAA, AMS, and SIAM and was standing room only. Look for a similar panel at JMM 2017 in San Diego. At JMM the network also collaborates with AMS and BIG SIGMAA on a BIG Careers booth, which was in the exhibit area and provided conference participants opportunities to interact with people working in BIG.

The BIG Math Network has provided workshops for department chairs, directors of graduate study, faculty and graduate students who would like to strengthen their department's connections with business, industry and government. Participants (a) discuss impactful initiatives, (b) exchange ideas about successful departmental programs, (c) identify departmental needs, (d) prioritize achievable action items, and (e) leave with an individualized institutional plan. A successful workshop was held at the TPSE Chair +1 meeting in March, 2017 and an upcoming workshop will be at the SIAM Annual Meeting in July, 2017. Contact us if you would like us to help you run a workshop for your department.



The Puzzle Corner (solution on page 4)

Find all positive real numbers x, y, and z such that

$$x + y^2 + z^3 = 3$$
$$y + z^2 + x^3 = 3$$
$$z + x^2 + y^3 = 3$$

from http://www.qbyte.org/puzzles/puzzle16.html

2017 Joint Mathematics Meetings

The 2017 Joint Mathematics Meetings were held in January in Atlanta. Over 6,000 people attending the meetings. Highlights included the series of colloquium lectures by Carlos Kenig, the Gibbs lecture by John Preskill, and the Porter lecture by Ingrid Daubechies. Susan Holmes's talk on *Statistical Proof and the Problem of Irreproducibility* was particularly timely.

The BIG SIGMAA contributed paper session was Friday morning. Six speakers gave talks, several dealing with the use of mathematical models to simulate real-world situations. One talk, by Robert Chaney and Chanda Hughes from Lee University, described an internship program for mathematics majors in which the interns work with local businesses on mathematical problems that arise in the industry. Another contributed paper session, on Saturday morning, was devoted to experiences with the PIC Math (Preparation for Industrial Careers in Mathematical Sciences) program; for more information on PIC Math, read Suzy Weekes's article about PIC Math in the Spring 2016 BIG SIGMAA Newsletter.

The BIG SIGMAA guest lecture was Friday evening. Dr. Eva Lee from Georgia Tech talked about *Optimization-Based Machine Learning Approach for Predicting Vaccine = Immunity*, another timely talk. A reception followed her talk.

The 2018 meetings will be held in San Diego from January 10 to 13. The Big SIGMAA contributed paper session will again be on Friday morning. Altogether there will be 35 contributed paper sessions at the meetings; the call for papers, listing the sessions, can be found on the MAA and the AMS websites. If you would like to present a paper to the BIG SIGMAA session or any of the other sessions, you need to submit an abstract by September 26, 2017. To submit an abstract, go to either the MAA or the AMS website, follow the links there to the JMM website, click on "Submit an abstract", and follow the instructions.

Two Fibs

You may recall some fibs in previous newsletters. A fib is a six- to eight-line poem in which the number of syllables in each line form the Fibonacci sequence 1-1-2-3-5-8-13-21. The name is due to Gregory Pincus, a Los Angeles writer, who kindled interest in figs after he composed one for his blog. Here are two mathematics-related fibs.

I
stand
before
my whiteboard
writing equations.
When people ask what I'm doing
I tell them I am doing mathematics today.
They shake their heads and walk away. I find this to be a good way to be left alone.

Pi
Day
In March
Celebrates
A central number
In our world. For any circle,
Around to across is pi, and not only that but
Pi over four is the alternating sum of the inverses of the odd numbers.

Atle Selberg (1917-2007)

2017 marks the 100th birthday of Atle Selberg, a Fields medalist who did important work in analytic number theory and automorphic forms. He was born on June 14, 1917 in Langesund, Norway. He was the youngest of nine children, four of whom (including Atle) became mathematicians. Selberg attended the University of Oslo, majoring in mathematics. He graduated with a Master's Degree in 1939. His graduate work was delayed by World War II. He fought in the Norwegian army and was held as a prisoner of war at least twice. He was appointed a research fellow at the University of Oslo in 1942 and received his Ph.D. in 1943. His thesis was *On the zeros of Riemann's zeta-function*.

On August 13, 1947 Selberg married the engineer Hedvig Liebermann in Stockholm. Atle and Hedvig Selberg had two children, Ingrid Maria and Lars Atle. Shortly after marrying, the Selbergs went to the United States, where Atle spent the academic year 1947-48 at the Institute for Advanced Study in Princeton. After this year, he was offered a second year at the Institute for Advanced Study but chose to see another American University. However, to do so he had to leave the country and get a new visa. He and his wife travelled to Montreal and, with some difficulty, got new visas and returned to Princeton. Paul Erdős had arrived at the Institute while Selberg was in Canada and they met as soon as he returned. It was at this time that Selberg and Erdős arrived at an elementary proof of the prime number theorem.

Selberg spent the following year as associate professor of mathematics at Syracuse University, returning to the Institute for Advanced Study at Princeton in 1949 as a permanent member, where he remained until his death. Selberg's wife Hedvig was a researcher at the Institute for Advanced Study in the 1950s working in von Neumann's group and later at Princeton's Plasma Physics Laboratory.

Selberg was awarded the Fields Medal in 1950 for his work on generalizations of the sieve methods of Viggo Brun, and for his major work on the zeros of the Riemann zeta function where he proved that a positive proportion of its zeros satisfy the Riemann hypothesis. The citation also mentions his elementary proof of the prime number theorem (with Erdős), with a generalization to prime numbers in an arbitrary arithmetic progression.

Probably Selberg's best and most important work is his trace formula for $SL_2(\mathbf{R})$, which was done several years after the work for which he was awarded the Fields Medal. Selberg used his trace formula to prove that the "Selberg zeta function" of a Riemann surface satisfies an analogue of the Riemann hypothesis.

Selberg received many distinctions for his work in addition to the Fields Medal. In 1986 he shared the Wolf Foundation Prize in Mathematics with Samuel Eilenberg. When the Abel Prize was established in 2002 he was given an honorary award. And in addition to these awards, Selberg was elected to the Norwegian Academy of Sciences, the Royal Danish Academy of Sciences and the American Academy of Arts and Sciences. In 1987 he was named Commander with Star of the Royal Norwegian Order of St Olav.

When Selberg reached the age of seventy, in 1987, he retired from the Institute for Advanced Study at Princeton. Throughout his time at Princeton he had remained a Norwegian citizen but in the 1990s he became a US citizen. His wife, Hedvig, died in July 1995. On February 14, 2003 he married Betty Frances ("Mickey") Compton. Atle Selberg died on August 6, 2007 at his home in Princeton following a heart attack. (*adapted from the MacTutor History of Mathematics archive*)

To mark the centennial of his birth, here are two quotes from Atle Selberg:

The thing is, it's very dangerous to have a fixed idea. A person with a fixed idea will always find some way of convincing himself in the end that he is right.

A felicitous but unproved conjecture may be of much more consequence for mathematics than the proof of many a respectable theorem.

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Business • Industry • Government

Special Interest Group of the MAA

from the MAA Website:

BIG SIGMAA serves as a unifying link between business, industry, and government mathematicians, academic mathematicians, and mathematics students. The SIGMAA provides resources and a forum for MAA members who share an interest in mathematics used in business, industry, and government, aids in professional development, helps build partnerships between industry and academics, and increases awareness of opportunities for mathematicians in business, industry, and government.

Puzzle Corner Solution

Subtracting the second equation from the first yields

$$x(1-x^2)+y(y-1)+z^2(z-1)=0,$$

and subtracting the third from the second yields

$$y(1-y^2)+z(z-1)+x^2(x-1)=0.$$

Multiplying the second of these equations by z, subtracting from the first, and rearranging, we have

$$x(x-1)(1+x+xz)=y(y-1)(1+z+yz).$$

Similarly, $y(y-1)(1+y+yx)=z(z-1)(1+x+zx)$. Since x, y, and z are positive, it follows that $1+x+xz$, $1+z+yz$, and $1+y+yx$ are positive. Therefore either $x-1$, $y-1$, and $z-1$ are all negative, are all positive, or are all equal to zero. Thus either x, y, and z are all less than 1, are all greater than 1, or are all equal to 1. The first two cases contradict the initial equations while the third case is clearly a solution to the initial set of equations. Thus the only positive real solution to the initial set of equations is $x=y=z=1$.