The BIG SIGMAA News

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

Important notice:

The annual BIG SIGMAA business meeting at JMM has been moved from Thursday morning at 9:00 to Thursday morning at 8:00. Same day, different time. The location is the same as previously announced—Room 306 of the convention center.

BIG Events at JMM in Baltimore

In January the Joint Mathematics Meetings (the joint annual meeting of the American Mathematical Society and the Mathematical Association of America) returns to Baltimore, with additional sessions sponsored by the Association for Women in Mathematics, the National Association of Mathematicians, the Society for Industrial and Applied Mathematics, and the Association for Symbolic Logic. JMM claims to be the largest mathematical meeting in the world; over 6,400 mathematicians attended the meetings last January in San Diego. The 2019 meetings will be held January 16-19. There is an exciting lineup of invited speakers and, of course, there are lots of interesting sessions of shorter talks. Several of the invited talks might be of particular interest to BIG SIG-MAA members; see the inset.

Algebraic, Geometric, and Topological Methods in Optimization, Jesús A. De Loera (University of California, Davis)
Sailing Through Data: Discoveries and Mirages, Emmanuel Candes (Stanford University)
Immunology for Mathematicians, Alan S. Perelson (Los Alamos National Laboratory)
Dynamics of Systems with Low Complexity, Bryna Kra (Northwestern University)
Development of Mathematical Methods for Next Generation Stent Design, Suncica Canic (University of California Berkeley)
Verifying Quantum Computations at Scale: A Cryptographic Leash on Quantum Devices, Thomas Vidick (Caltech)
Big Data, Inequality, and Democracy, Cathy O'Neil (ORCAA)
The Inclusion Principle: the importance of community in mathematics, Deanna Haunsperger (Carleton College)

You can find the details on the JMM website.

Also of interest to BIG SIG-MAA members, of course, will be the BIG SIGMAA guest lecture on Friday afternoon at 4:30. This year the guest lecturer will be Paul Schuette from the Food and Drug Administration's Office of Biostatistics (part of the FDA's Center for Drug Evaluation and Research). The title of his talk is Data Science in Government: Opportunities for the Mathematically Gifted. See the separate article in this newsletter for more infor-

The Puzzle Corner

Imagine that you have three bowling pins, X, Y and Z. They are colored red, white and blue, though not necessarily in that order. One, but only one, of the following statements is true:

- X is red
- Y is not red
- Z is not blue

What is the color of each bowling pin? (*Solution on page 4.*)

BIG SIGMAA Guest Lecture

The BIG SIGMAA Guest Lecture at JMM in Baltimore this January will be given by Dr. Paul Schuette from the Food and Drug Administration. Dr. Schuette's talk will be titled Data Science in Government: Opportunities for the Mathematically Inclined. Since the abstract for his talk is not in the printed JMM program, it is included here, in the inset.

Dr. Schuette holds a BS degree in mathematics from Kansas State University and MA and PhD degrees in mathematics, with a specialty in probability, from the University of Wisconsin. Dr. Schuette has worked as an applied mathematician with a defense contractor, developing probabilistic models and implementing them via programs and simulations, and he has taught mathematics and statistics at Georgia College, Georgia Tech, and Meredith College. In 2008, Dr. Schuette joined the FDA's Office of Biostatistics in its Center for Drug Evaluation and Research (CDER). Since 2010, Dr. Schuette has served as the Scientific Computing Coordinator

Data Science is an emerging discipline that exists at the intersection of mathematics, statistics, and computer science. Data Science combines advances in large scale computing, data modelling and visualization, algorithmic methods, machine and statistical learning, and often uses large data sets to provide insight and predictions in the context of a given problem. Data scientist skills appear to be in demand in business, industry, academia and government. In this presentation, I will briefly discuss Breiman's two cultures of statistical modeling of data, De Veaux et al's curriculum recommendations for data sciences, and the findings of a recent National Academy of Sciences report on data science. Additionally, I will discuss two problems that have arisen in the context of clinical trials: data anomaly detection, and the birthdate problem. Finally, I will end with tips for locating and applying for federal jobs in data science related areas.

for the Office of Biostatistics. In this role, he has served on the Scientific Computing Board, the High Performance Computing Advisory Board, the Scientific Computing and Cybersecurity Task Force, the CDER Data Integrity Advisory Board, the Office of Biostatistics Data Review Committee, and the FDA Modeling and Simulation Working Group, and is the co-chair of the Statistical Models and Applications special interest group. Dr. Schuette is the principal investigator for a multiple center Cooperative Research and Development Agree-

ment with CluePoints to further develop and implement site level data anomaly and fraud detection software for clinical trials, and serves on working groups in the area of data anomaly detection.

Dr. Schuette give an interesting talk at a BIG contributed paper session at JMM a few years back. He described a method for estimating the probability of extremely rare events. His talk this year will surely be interesting, informative, and relevant.

Maria Gaetana Agnesi

This year marks the 300th anniversary of the birth of Maria Gaetana Agnesi, an Italian mathematician, philosopher, theologian, and humanitarian. She was the first woman to write a mathematics handbook and the first woman appointed as a mathematics professor at a university. She was a member of the faculty at the University of Bologna and is credited with writing the first book discussing both differential and integral calculus.

Maria Gaetana Agnesi was born in Milan, to a wealthy and literate family. Her father Pietro Agnesi, was a wealthy silk merchant. Maria was recognized early on as a child prodigy;

she could speak both Italian and French at five years of age. By her eleventh birthday, she had also learned Greek, Hebrew, Spanish, German, and Latin, and was referred to as the "Seven-Tongued Orator".

Agnesi suffered a mysterious illness at the age of twelve that was attributed to her excessive studying and was prescribed vigorous dancing and horseback riding. This treatment did not work; she began to experience extreme convulsions, after which she was encouraged to pursue moderation. By age fourteen, she was studying ballistics and geometry. When she was fifteen, her father began to regularly

gather in his house a circle of the most learned men in Bologna, before whom she read and maintained a series of theses on the most abstruse philosophical questions. Records of these meetings are given in Charles de Brosses' *Lettres sur l'Italie and in the Propositiones Philosophicae*, which her father had published in 1738.

Her father remarried twice after Maria's mother died, and Maria Agnesi ended up the eldest of 21 children, including her half-siblings. The task of teaching her siblings and half-siblings was left up to Maria. This task kept her from her own goal of entering a

BIG Events at JMM in Baltimore (continued)

mation about Dr. Schuette and his talk. There will be a reception following the talk.

The BIG contributed paper session will be held on Friday morning, starting at 8:00. Eight speakers, from industry, government, and academia, will talk about their experiences in applying mathematics to BIG problems. In addition to the contributed paper session, other BIG-related events at JMM will include a panel discussion entitled Connecting High School and Post High School Mathematics on Thursday morning at 9:00 and the BIG Career Booth located in the exhibits hall. The booth is designed to provide BIG mathematicians with a centrally-located venue to network, provide information, and recruit other BIG mathematicians. For more information, or to reserve a time slot in the booth, go to the JMM website, or click here.

Finally, the BIG SIGMAA annual business meeting will be held on Thursday morning at 8:00 in Room 306 of the convention center. **Note that this is a change in time, though not date or location, from what was previously announced.** All BIG SIGMAA members are invited and are encouraged to attend.

We hope to see many BIG SIGMAA members at the meetings, especially members who live in the Baltimore/DC area.

Maria Gaetana Agnesi (continued)

convent, but she was able to avoid all interactions with society and devote herself entirely to the study of mathematics. After having read in 1739 the *Traité analitique des sections coniques* of the Marquis Guillaume de l'Hôpital, she was fully introduced into the field in 1740 by Ramiro Rampinelli, an Olivetan monk who was one of the most notable Italian mathematicians of that time. Maria studied both differential and integral calculus with him.

According to the Encyclopedia Britannica, Agnesi is "considered to be the first woman in the Western world to have achieved a reputation in mathematics." The most valuable result of her labours was the *Instituzioni analitiche ad uso della gioventù italiana*, (*Analytical Institutions for the Use of Italian Youth*) which was published in Milan in 1748 and "was regarded as the best introduction extant to the works of Euler." The goal of this work, according to Agnesi herself, was to give a systematic illustration of the different results and theorems of infinitesimal calculus. The model for her treatise was *Le calcul différentiel et intégral dans l'Analyse* by Charles René Reyneau. In her trea-

tise, she worked on integrating mathematical analysis with algebra. The first volume treats of the analysis of finite quantities and the second of the analysis of infinitesimals. A French translation of the second volume by P. T. d'Antelmy, with additions by Charles Bossut (1730–1814), was published in Paris in 1775; and *Analytical Institutions*, an English translation of the whole work by John Colson (1680–1760), the Lucasian Professor of Mathematics at Cambridge, "inspected" by John Hellins, was published in 1801 at the expense of Baron Maseres.

The *Instituzioni analitiche...*, among other things, discussed a curve introduced by Fermat, a special case of which is the curve $y = 1/(1 + x^2)$, the derivative of the arctangent function. A construction for the curve had been given by Guido Grandi in 1703, and in 1718, the year of Agnesi's birth, Grandi gave the curve the Latin name "versoria", which means "rope that turns a sail" because of its shape, and the Italian name "versiera". In her book, Agnesi quite correctly states that the curve was called "la versiera". However, when Colson translated Agnesi's book from Italian to English, he confused "la versiera" with "l'aversiera", which

means *witch* or *she-devil*. As a result, the curve has become known, at least in English-speaking countries, as the "Witch of Agnesi".

In 1750, on the illness of her father, Agnesi was appointed by Pope Benedict XIV to the chair of mathematics and natural philosophy and physics at Bologna, though it's not clear she ever served. She was the second woman, and the first female mathematician, ever to be granted professorship at a university. After the death of her father in 1752 she carried out a long-cherished goal of giving herself to the

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

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.

A Sudoku Fib

If
you
do a
sudoku
puzzle enough times
you will find there must always be
at least seventeen clues when you begin the puzzle
because of the theorem: With sixteen clues there is more than one correct solution.

Maria Gaetana Agnesi (continued)

study of theology and devoting herself to the poor, homeless, and sick, giving away the gifts she had received and begging for money to continue her work with the poor. In 1783, she founded and became the director of the Opera Pia Trivulzio, a home for Milan's elderly, where she lived as the nuns of the institution did. On 9 January 1799, Maria Agnesi died poor and was buried in a mass grave for the poor.

Puzzle Corner Solution

If the first statement were true, then X would be red. So Y could not be red, and hence the second statement would be true also. This contradicts the given requirement that only one of the statements is true. Therefore the first statement is false and X is not red. So X is either white or blue.

If the second statement were true, then Y could not be red. So Y would either be white or blue. This means the blue pin would be either X or Y. In either case, Z could not be blue, and hence the third statement would be true, again contradicting the requirement that only one of the statements is true. Therefore the second statement is false and Y is red.

It follows that the third statement is true and Z is not blue. It's not red either, since Y is red. So Z is white and therefore X is blue.