

# What Can I Do with a Math Degree?

The National Security Agency (<http://www.nsa.gov>)

“NSA Mathematicians spend their days focusing on some of today’s most distinctive challenges and problems. They apply Number Theory, Group Theory, Finite Field Theory, Linear Algebra, Probability Theory, Mathematical Statistics, Combinatorics, and more. We encourage our Mathematicians to participate in interdisciplinary assignments and train with professionals in such fields as Computer Science and Signals Analysis.”

## Problem of the Month

You set out from a boathouse and row one mile upstream. At that point, you pass a bottle floating with the current of the river. You continue upstream for another ten minutes, then turn around and row all the way back. Just as you reach the boathouse, you pass the bottle again. How fast is the current? (Mids who submit a correct solution to the editor via email will be entered in a random drawing for Math Department swag.)

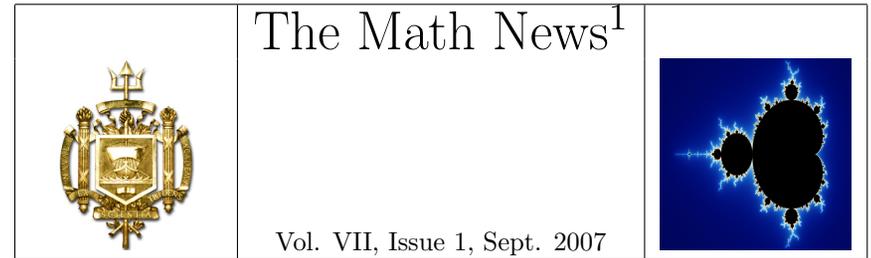
## Mark Your Calendar

Midshipman-Faculty Colloquium

- Date & Time: Monday Sept. 24, 2007 from 7:15-8:15pm
- Location: Chauvenet 100
- Speaker: Prof. David Saunders (Univ. of Delaware)
- Title: *Symbolic mathematical computation, is it right to be exact?*

## Contact the Editor

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## Actuarial Mathematics

by LCDR Marc Lucas, USN ([mdlucas@usna.edu](mailto:mdlucas@usna.edu))

How much is the warranty for the MP3 I just bought worth to me? How much should I save for retirement? How? Should I take my career advancement loan? What should I do with it? Should I buy a house or rent at my first duty station? What should I do at my next duty station? How much should I save for “a rainy day”? What is my “risk tolerance”? What is an optimum portfolio for my risk tolerance? How “credible” is certain information? What is the expected present value of a U.S. naval career?



These are actuarial questions. What they have in common is an element of the unknown—an element of “risk”. Actuaries spend their careers quantifying risk. This usually results in a “price” for the risk that can be a profit margin, the cost of health or life insurance, a personal retirement plan, an interest rate for a loan, a plan of asset and liability management for a new business venture, or a guarantee on the return of an annuity (a regular payment in exchange for a lump sum of money such as a pension or lottery winning) in exchange for a “cap” on the return relative to some index such as the stock market.

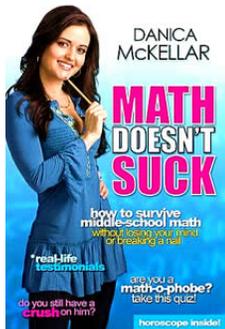
Some of the answers are surprising—the monetary compensation for a successful naval service career (30 years in active service and making Captain, USN or Colonel, USMC) is about \$5,200,000 in 2007 dollars for men not including medical and dental...just what Uncle Sam will deposit into

<sup>1</sup>On the cover: The USNA seal (left) and the Mandelbrot set (right).

your bank account as active duty pay, allowance for housing (Norfolk), and military pension, not including sea pay, nuc pay, or any other special pay or bonus. It's about \$5,400,000 for women because women tend to live a little longer.

In Spring 2008, LCDR Marc Lucas of the Math Department is expected to teach an actuarial modeling course (SM421).<sup>2</sup> A recalled reservist and USNA Class of 1991 honors math graduate, LCDR Lucas is also an Associate of the Society of Actuaries. As a civilian, LCDR Lucas priced several-million-dollars-large group health contracts and allocated \$650,000,000 in overhead for CareFirst BlueCross BlueShield. For Old Mutual Financial Network, he priced about \$4,000,000,000 (yes with a "B") in equity-indexed annuities. "It is an amazing field. You stop looking at the here and now and instead evaluate potential futures. Most questions get more complex, but the answers are important. For example, the value of a home isn't just the market price—it is what a house is worth relative to the substitute of renting and the actuarial present value of projected future cash flows if you rent it. To do that, you need to start with an investment horizon and many other reasonable assumptions." Even more interesting in this "age of information", so much data is available that actuarial science is being applied to many "non-traditional" fields. "You might apply it to an intelligence estimate, or to a neuron-population-based bio-sensor for weapons of mass destruction."

## Math in the News



Danica McKellar is best known as the actress who played Winnie Cooper on the popular late 80's TV show *The Wonder Years*. Not so well-known is that she was a highly successful math major at UCLA. In fact, she co-authored a research article entitled *Percolation and Gibbs states multiplicity for ferromagnetic Ashkin-Teller models on  $\mathbb{Z}^2$* , which appeared in the Journal of Physics. A vocal advocate for math education, McKellar recently (2007) published a math book aimed at middle school girls entitled *Math Doesn't Suck*. For more information about her book, including recent media coverage, visit <http://www.mathdoesntsuck.com>.

## Faculty Profile: Asst. Prof. Sommer Gentry



Assistant Professor Sommer Gentry is from Thousand Oaks, California, which is a beautiful town just northwest of Malibu. Since her plan to become a famous dancer on Broadway didn't work out, she turned to mathematics instead. She saw studying applied mathematics and operations research as a great scheme to avoid specializing in any one field, since her true interests range from politics and psychology to engineering and space exploration. The best thing about mathematical modeling is that the same abstractions can generate insight into problems in vastly different fields: she's worked on international nuclear non-proliferation treaties, credit card fee and interest rate structures, touch-based human/robot collaboration, and allocating scarce organs for transplantation.

Most recently, she's been working with her husband, Dorry Segev, a transplant surgeon, on optimizing kidney paired donation. Members of a kidney patient's family are often willing to be live kidney donors, but at least a third of such offers must be rejected because of incompatibility. In a kidney paired donation, two patients and their donors exchange kidneys in simultaneous operations. This allows compatible donations when the donor of the first family gives to the patient of the second, and vice versa. To maximize the number of patients who can receive a kidney paired donation, Professor Gentry uses combinatorial optimization on graphs. Getting the media to notice math can be challenging, but TIME magazine and Reader's Digest ran articles about her research, and the Discovery Channel's *Surgery Saved My Life* show featured Segev and Gentry along with some actual paired donation participants.

But Gentry hasn't given up her dancing dreams entirely. She still likes to dance, but now she's passionate about swing dancing with her husband. They compete nationally (and sometimes even win) in Lindy Hop, which is a dance style straight out of the 1940's. They perform as featured dancers with groups like the Baltimore Symphony Orchestra. Gentry likes aerial acrobatic moves best—including one where she launches straight over her husband's head! If you'd like to learn to swing dance, Professor Gentry recommends the free lessons offered by the SwingMids organization, founded by Midshipman Orion Hall.

<sup>2</sup>See <http://www.usna.edu/acdean/courses/newcourses082.html> for a description.