L'Augarithms

vol. 25.03 Visit us at <augsburg.edu/math/> We're in color October 19, 2011

Mathematics Colloquium Fall Lineup

Colloquia are typically held Wednesdays 3:40—4:40 in Oren 113. Immensely appealing refreshments are served.

Sept.	7	The Annual Department Meet & Greet
	21	Robert Miner, Ph.D.
Oct.	4	Katy Micek, Augsburg College
→	19[1]	Mike Weimerskirch, Augsburg College
Nov.	2	Austin Wagner, Megan Sutherland
	16	Sarah McKagan, McKagan Enterprises, Seattle
Dec.	7	Steve Kennedy and Deanna Haunsperger

[1]This week's colloquium

Sturmian Words and *k*-Wythoff Nim

Mike Weimerskirch

Nim is an ancient game of strategy and variations of Nim are the source of a great deal of research in combinatorial game theory. One variation, *k*-Wythoff Nim has a winning strategy that can be described in several ways. Winning positions can be calculated through a (not very efficient) computer algorithm or by employing a variety of other mathematical techniques. This talk will discuss Beatty sequences, continued fractions, Sturmian words and morphisms and their roles in making you a *k*-Wythoff Nim grand master.

Unbounded to meet

Unbounded[2] is going to be holding a club-wide meeting on Tuesday, October 25 at 3 pm in Science 108. We're planning on having food and so far it's just a get-to-know each other event. If anything changes, either myself or one of the officers will let you know.

[2]Unbounded is a Chartered Student Organization at Augsburg that aims to get Augsburg College faculty, staff and students interested in math and to bring together math students. Unbounded also presents social opportunities for members as well as non-members interested in math, while also getting students, faculty, and staff more acquainted with one another outside the classroom or office.

Unbounded's advisor is Prof. Catherine Micek <micek@augsburg.edu>

Problem of the week...

Brian Peterman of Century College solved the POTW of vol 25.02. **Joe Dobrow** found that every solution of the palindromial problem from vol 25.02 was of the form $p(x) = a(x + 1)^n$, for a any constant, and n any positive integer. There were a couple of incorrect or incomplete solutions submitted (Write to me for details.).

Here is the new POTW:

My three grandchildren are coming to visit for Thanksgiving. My neighbor came over and wanted to know how old they are. I told her that the product of their ages is 72.

"That's not enough information for me to figure out how old they are," she complained.

I offered that the sum of their ages is my street address.

"But that's still not enough information."

After a moment's thought, I added that my eldest grandchild loves candied yams.

She then knew how old the grandchildren are, . . . but was afraid to ask their names.

How old are my grandchildren?

❖ Reprinted with permission from Bradley U's old 'POTW' page <http://hilltop.bradley.edu/%7Edelgado/potw/potw.html>

Puzzle of the week...

Brian Peterman solved the PZOTW fo vol 25.10. **A. K. Dimore**, **Tyler Van Zuilen**, **HeeChan Kang**, **Nate Fitzgerald**, and **Bob Campbell ('87)** had solutions to the 'fake coin' puzzle from v25.02.

Now, a new PZOTW:

Sixty-four soccer teams enter a statewide tournament. The teams are randomly paired in each round. The winning teams advances to the next round; losers are eliminated. How many matches must be played in order to crown the winner?

❖Submit POTW & POZTW solutions to kaminsky@augsburg.edu, or under Ken's door at SCI 137E, or in the puzzles and problems box just outside of Su's office.

L'Augarithms
The approximately bi-weekly newsletter
of the
Department of Mathematics
at Augsburg College
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The Nobel Prize in Chemistry 2011*

The Royal Swedish Academy of Sciences has decided to award the Nobel Prize in Chemistry for 2011 to **Dan Shechtman**, Technion – Israel Institute of Technology, Haifa, Israel "for the discovery of quasicrystals."

A remarkable mosaic of atoms

In quasicrystals, we find the fascinating mosaics of the Arabic world reproduced at the level of atoms: regular patterns that never repeat themselves. However, the configuration found in quasicrystals was considered impossible, and Dan Shechtman had to fight a fierce battle against established science. The Nobel Prize in Chemistry 2011 has fundamentally altered how chemists conceive of solid matter.

On the morning of 8 April 1982, an image counter to the laws of nature appeared in Dan Shechtman's electron microscope. In all solid matter, atoms were believed to be packed inside crystals in symmetrical patterns that were repeated periodically over and over again. For scientists, this repetition was required in order to obtain a crystal.

Shechtman's image, however, showed that the atoms in his crystal were packed in a pattern that could not be repeated. Such a pattern was considered just as impossible as creating a football using only six-cornered polygons, when a sphere needs both five- and six-cornered polygons. His discovery was extremely controversial. In the course of defending his findings, he was asked to leave his research group. However, his battle eventually forced scientists to reconsider their conception of the very nature of matter.

Aperiodic mosaics, such as those found in the medieval Islamic mosaics of the Alhambra Palace in Spain and the Darb-i Imam Shrine in Iran, have helped scientists understand what quasicrystals look like at the atomic level. In those mosaics, as in quasicrystals, the patterns are regular – they follow mathematical rules – but they never repeat themselves.

When scientists describe Shechtman's quasicrystals, they use a concept that comes from mathematics and art: the golden ratio. This number had already caught the interest of mathematicians in Ancient Greece, as it often appeared in geometry. In quasicrystals, for instance, the ratio of various distances between atoms is related to the golden mean.

Following Shechtman's discovery, scientists have produced other kinds of quasicrystals in the lab and discovered naturally occurring quasicrystals in mineral samples from a Russian river. A Swedish company has also found quasicrystals in a certain form of steel, where the crystals reinforce the material like armor. Scientists are currently experimenting with using quasicrystals in different products such as frying pans and diesel engines.

Dan Shechtman, Israeli citizen. Born 1941 in Tel Aviv, Israel. Ph.D. 1972 from Technion – Israel Institute of Technology, Haifa, Israel. Distinguished Professor, The Philip Tobias Chair, Technion – Israel Institute of Technology, Haifa, Israel.
Prize amount: SEK 10 million (≈ $1.464 million)

*Press release 2011-10-05 Kungliga Vetenskapsakademien.

Tidbits of the Week (TOTW)

Answers next week

Results from the Tidbits of vol 25.02's:

a) 37,607,912,018 = $\pi(10^{12})$, the number of primes less than or equal to one trillion. Now, how could you not know that?

b) Your chance is 1/195249054 ≈ 0 of winning the PowerBall jackpot.

This week's Tidbits:

a) Roman numerals are composed of the letters I, V, X, L, C, D, and M. What is the longest number between 1 and 2000 as expressed in Roman numerals.

b) You must cut two players from the Devils, your football squad. Being fair, you will do this at random. The number of players on the Devils is the same as the atomic number of rubidium. In how many ways can you choose two Devils players to cut?

Attention Math Majors & Minors

Registration for Spring 2012 is coming soon! If you're a math major, you should have declared that major and should have an advisor in the department. You'll be hearing from your advisor soon about scheduling an advising appointment. If you're a math minor and would like advising, talk to your instructor or to Jody Sorensen, the department chair.

There are some exciting upper level classes scheduled for the spring semester. Su will be teaching MAT 304 Graph Theory, a theoretical structures course focused on combinatorial graphs. Prereqs include MAT 271 Discrete. Jody is teaching MAT 363 Dynamical Systems, an elective that focuses on iterated functions and includes discussions of chaos and fractals. Prereqs include either MAT 246 or 271. And finally Tracy will teach MAT 395 Mathematical Economics, an applied projects course that is a requirement for the new Mathematical Economics major, but is also a good elective for mathematics majors. Prereqs include two MAT courses numbered 246 to 299.

Cartoon Corner

Cat-Cow Exercise