

# Bytes of $\pi$

The newsletter of the BSU mathematics and computer science department

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Staff: Paul Fairbanks, Laura Gross, Shannon Lockard

## From the Editor

This is a busy time for our department. Last year we welcomed analyst Irina Seceleanu, completed a program review, hired computer scientist Chadi El Kari; mathematical statistician Kevin Rion and math education specialist Polina Sabinin, renovated our precalculus courses and launched our new calculus sequences. The School of Arts and Sciences is no more; we're now part of the College of Science and Mathematics. We have a new Dean – Dr. Arthur Goldstein – and Bridgewater State College has become Bridgewater State University. Soon we will separate into two departments, move into the brand new science building, revise our Freshman Skills courses, and launch an assortment of assessments.

Several faculty have had sabbatical leaves recently and more will be taking short leaves soon. We look forward to reporting on their activities! We're also hoping to start a "letters to the editor" column for responses to the articles we publish.

Thanks to everyone who has helped to make this newsletter possible,

Heidi Burgiel

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## Faculty Profiles

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Dr. **Annela Kelly** joined Bridgewater State University this fall as a visiting assistant professor. For the previous twelve years, she worked as assistant professor at Roger Williams University in Bristol, RI and as assistant and associate professor at University of Louisiana at Monroe in Monroe, LA.

She received her PhD from University of Missouri - Columbia in abstract harmonic analysis in 1996. Since then, she has published several papers in abstract harmonic analysis and more recently in combinatorial game theory. Her students have conducted undergraduate research projects in combinatorial game theory and cryptology. She has also co-authored two textbooks: "The Nature of Mathematics", for liberal arts mathematics, that emphasizes games and hands-on activities; and "College Algebra: The Problem Solving Approach". She has

given a number of presentations about her teaching and research at MAA and AMS national meetings.

Annela is originally from Estonia and visits her homeland almost every summer with her family. She, her husband Brian and her three children: Adam, Annika and Allena live in Barrington, RI. Besides traveling, her family enjoys bike riding on the bike path; various sports and games; and of course math and puzzles.

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Dr. **Polina Sabinin** joined BSU this fall as an Assistant Professor. She completed her doctorate work in Mathematics Education at Boston University in May of 2011 where she focused on the development of algebraic and proportional reasoning. She has taught in a number of 2- and 4-year colleges in Eastern Massachusetts, was the Associate Director of the Center for Mathematics Achievement at Lesley University, and edited a Pre-algebra text for Pearson Addison-Wesley. She has also served on the board of the Association of Teachers of Mathematics in Massachusetts (ATMIM). Currently, Dr. Sabinin is the Conference Chair and Past President of the Massachusetts Mathematics

Association of Teacher Educators (MassMATE) and running *Games Teachers Play* meetings for mathematics teachers in Eastern Massachusetts. She is co-authoring *Smart Cookies* (a game of visual logic) and *LogicGym* (a teacher's manual for an engaging visual game that introduces children to logic). When not at BSU, you can find her at canine agility competitions, doing animal therapy work with her dog at a federal medium security correctional facility, playing with her camera, exploring mathematical games, and traveling.

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## Feature Article

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### **The Benefits of Poor Teaching**, by Paul Fairbanks

At the USAF Academy in the 1970's, I was part of a group of math department faculty with the elusive goal of measuring teacher effectiveness. We felt that a teacher is effective if the student retains the information and remembers how to use it. So what we did was to include questions from calculus 1 in the final of calculus 2, 3, and 4, and some later courses, and then a similar thing with calculus 2 problems, etc..

For years, evaluation of Academy faculty was done with student evaluations and classroom observations, as at most universities. The math faculty was rank ordered from 1 to 35 based on these two variables. The result of our "test-back" project was astounding. It was almost the exact opposite of the rank ordering! For example, one officer who was reassigned because he was considered such a poor teacher came in as the second most effective teacher in test-back. Many who were considered excellent teachers did very poorly in test-back. Our study was dismissed as flawed, but was it really?

If students are spoon-fed information, they don't seem to retain it. When you have bright, motivated AF Academy cadets, they'll learn the material on their own and thereby retain it longer. Can this work at Bridgewater? We need to be careful not to make it too difficult or too easy, but there are a few tricks we can use:

- Have them read the text more as part of the homework, or “accidentally” assign a few problems in a section you haven't discussed.
- In-class group projects and problems lead to self-learning and better retention. Students really enjoy helping each other.
- Occasionally give open-book, open-note tests; in smaller classes, I've also allowed each student to ask me for up to two hints on a test. They are never so motivated to learn as when they are taking an exam.

If our goal is retention and understanding, somehow we need to fool students into learning on their own.

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## Faculty News

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### **My Recent Problems**, by Tom Moore

Since late Spring I have had a great deal of success creating and solving problems. With one exception they are all in number theory and most of those involve relationships among polygonal numbers. (The exception is a problem in ring theory.) As of this writing, sixteen problems have been accepted for publication and four others are currently being reviewed by the problem editors. These acceptances are scattered among the following journals: the Pi Mu Epsilon journal, the Pentagon journal, the College Mathematics journal, Mathematics Magazine, Math Horizons, School Science and Mathematics journal and Mathematical Spectrum. The first two journals are publications of national mathematics honors societies, the next three are from the Mathematical Association of America, the penultimate one is the official journal of the School Science and Mathematics Association (USA), and the last is a publication of the Applied Probability Trust (UK).

My methodology is the standard inductive one. Firstly, I ask a question which may, or may not, bear any fruit. Then I write a Maple program to gather relevant numerical data. Then I study the data for any patterns. If I discover one, then I formulate a conjecture and try to prove it. If successful, then I have a publishable problem, depending on the opinion of an editor and/or referee. The time lag from my submission to the editor's final decision is brief. The whole process is ultimately satisfying.

I should add that asking the right question to begin with is the most important creative step. I certainly have stumbled there, or had to reformulate the original question in the light of the data. Some investigations show no discernible patterns. Also, I have some

conjectures that I could not resolve. I would welcome some collaboration on these from my colleagues.

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### **MathSciNet**, by Annela Kelly, Laura Gross, and Sheau-Hwang Chang

The library has acquired MathSciNet. This database contains over 2 million items from the literature in the mathematical sciences, including citations, abstracts, reviews, and over one million direct links to articles – with over 100,000 new references and 40,000 reviews added annually. Click on Math Library Resources from the department web page, and try a search for your favorite mathematician, journal, article title, or key word!

During the trial period for MathSciNet at BSU (the month of October), many students completed an on-line quest for information using MathSciNet. This "scavenger hunt" was devised, implemented, and judged by math faculty Annela Kelly and librarian Sheau-Hwang Chang.

At a reception on Friday, 2 December, the library director, Michael Somers presented the prizes for the best answers to the winners in attendance, namely Meghan Sullivan (a lava lamp), Thomas Howard and Danielle Jolly (Red Sox baseball sets), and Thomas Carlin, Volodimir Duda, and Douglas Kirby (soap bubbles)! Other quest participants won mathematics memorabilia, puzzles, and calculators by raffle (generously donated by Phil Scalisi and Annela Kelly). These additional prizes went to Alex Roche, Hillary Linnehan, Ian Holdstock, James Marcotte, Joshua Bernard, Judi Morin, Tom Howard and Yagin Sun. Students and faculty alike have embraced MathSciNet as a valuable research tool, and planning for a training session is underway.

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### **STREAMS Meet-and Greet**, by Laura Gross

Two fall meet-and-greet events were organized by Student Retention and Enhancement Across Mathematics and the Sciences (STREAMS), a program to assist Bridgewater mathematics and science majors to persist and graduate within their majors, which is supported by a five-year National Science Foundation grant. One event hosted new math/CS majors; the other targeted transfer students.

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## **Student News**

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Edited by Laura Gross

**Math Club Game Night** took place on 19 September, 2011. Tom Moore introduced a variety of games including Knight Moves, and Mahmoud El-Hashash provided a puzzle.

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**The Power of Pythagoras**, written and presented by Abigail Glennon, Michael Hall, and Rebecca Tate of Wheaton College, was performed in the Heritage Room of Maxwell Library at 1:15 on December 2. The play focuses on the transition between math as a

utility and math as an art form by focusing on Pythagoras, the discoveries made within the Pythagorean society, and the Pythagorean view of mathematics.

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**Collegiate Mathematics Competition:** On 18 November, BSU students took part in the 2011 Collegiate Mathematics Competition given by the Northeastern Section of the Mathematical Association of America at Connecticut College in New London, CT. Team members included: Danica Baker, Joshua Bernard, Ian Holdstock, Tom Howard, Alicia Lauzon, and James Marcotte. Annela Kelly organized, trained, and transported the competitors.

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### **Library Links:**

New titles: <http://tinyurl.com/mathnewtitles>

Math Research databases: <http://tinyurl.com/mathdatabases>

Math Club Events: <http://tinyurl.com/mathclubevent>

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## **Mathematical Humor**

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Edited by Paul Fairbanks

There are 10 types of people; those that know binary, and those that don't.

An infinite number of mathematicians walk into a bar. The first orders one beer, the second orders half a beer, the third orders a fourth of a beer, ... "That's it!" says the bartender as he slams TWO beers on the bar, "you guys know your limit."

We conclude with a quiz from the 'Italian stallion': What is the volume of a cylindrical pizza with radius  $Z$  and height  $A$ ?

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## **Did you know...**

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Edited by Shannon Lockard

Our department once had a number of course sequences that no longer exist. In some cases, the sequence itself is no longer offered, such as a calculus sequence for elementary education majors. Other sequences consist of a second course that is no longer offered. Have you ever noticed that MATH 401 is called Introduction to Analysis I, but that there is no Introduction to Analysis II? The second course in the sequence was offered at one time as MA 402, when the courses were called Advanced Calculus I and II. Computer Science majors were once required to take CS 205 and CS 305, Discrete Structures in Computer Science I and II. After this sequence became MATH 130 and MATH 330, Discrete Mathematics I and II, many of the topics covered in the second course were absorbed into other computer science courses in order to cut down on the number of courses CS majors were required to take. Although MATH 330 still appears in the catalog, it has not been offered in many years. Any guesses on what will be the next sequence to be cut?

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## Publications, Grants, & Awards

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**Heidi Burgiel** co-authored a chapter titled “Interactive Applets in Calculus and Engineering Courses” which has been accepted for publication in the book *Dynamical mathematical software and visualization in the learning of mathematics*.

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**Mahmoud El-Hashash** has published the paper “Bilinear GARCH Time Series Models” in the Proceedings of the 2011 International Conference on Scientific Computing (CSC 2011, July 18-21, 2011, Las Vegas, Nevada, USA) pp. 102-108.

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**Laura Gross** has published two papers in the SIAM Journal on Applied Mathematics, and has received a Faculty/Librarian Research Grant from CART for research to be done in the spring.

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**Ward Heilman** gave a STREAMS-sponsored presentation on November 8 with Dr. Teresa King (Psychology) on “New Approaches to Introducing the Major.” They led a conversation on how introductory courses (like MATH 180) can convey professional approaches to problems in the field.

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**Shannon Lockard** and **Irina Seceleanu** are mentoring undergraduates Monica Chalke and Laurie McEntee in researching the benefits of multiple choice versus open response assessment in calculus.

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**Shannon Lockard** gave a STREAMS-sponsored presentation on October 18 with Dr. Jenny Shanahan (Undergraduate Research) on “Why Inquiry?” They led a conversation on how using inquiry in lower level classes can enhance student learning.

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**Kazem Mahdavi’s** paper on Quantum Computation and Nanodevices was accepted for a fifty minute presentation at the 47th Annual Conference of Association for Computer Educator in Texas (ACET), Oct. 7-9, Dallas, TX. Professor Mahdavi has also published a review of the book *Drama of Mathematics*, by G. Hitchcock.

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**Irina Seceleanu** has published an article, given 4 talks, received a CART grant, and received an ATP grant to mentor an undergraduate research student over the summer.

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## Events

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The **Pi Mu Epsilon** math honor society induction will take place at BSU Sunday, 22 April, 2012 at 2:00 p.m. Marty Kemen of Wentworth Institute of Technology will give the **Abramson Colloquium**. She plans to show examples of contemporary artwork that (unintentionally) illustrate mathematical concepts. Marty enjoys working with prospective teachers.

Bridgewater State University will be hosting the **2012 Meeting of the Northeastern Section of the Mathematical Association of America** on November 16-17, 2012. The theme will be Mathematical problems: their creation, solution and publication.

**Local Arrangements Committee:** Dr. Rebecca Metcalf (chair), BSU; Dr. Polina Sabinin, BSU; Dr. Glenn Pavlicek, BSU; Dr. Kevin Rion, BSU

**Program Committee:** Prof. Tom Moore (chair), BSU; Dr. Shannon Lockard, BSU; Dr. Matt Salomone, BSU; Dr. Ralph Bravaco, Stonehill College; Prof. Margaret Stevenson, Massasoit CC

Tax deductible contributions to the Abramson Colloquium Fund may be made through the Bridgewater State College Foundation. Checks may be made payable to the Bridgewater State College Foundation with "Abramson Colloquium" noted on the memo line. Please call the advancement office at 508-531-2609 with any questions.

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## Problems

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**Solution to Last Newsletter's Car Talk Puzzler**, solved by John Maslanka

...He's riding home, when he comes to the same intersection. He thinks, "What are the chances I'd ever see that again?" He knows it's a different temperature because it's not warm and sunny like it was when he went to work, and now it's cold, drizzly, and rainy. He sees the temperature in Fahrenheit, and the temperature in centigrade.

**TOM:** Let me guess! They're the same digits reversed, again.

**RAY:** What are the chances? Only in a puzzler could this happen! The question is, what was the temperature in the morning when he went to work, and what was the temperature when he went home?

The Java program presented below found two likely pairs of temperatures: 61F and 16C, and 82F and 28C.

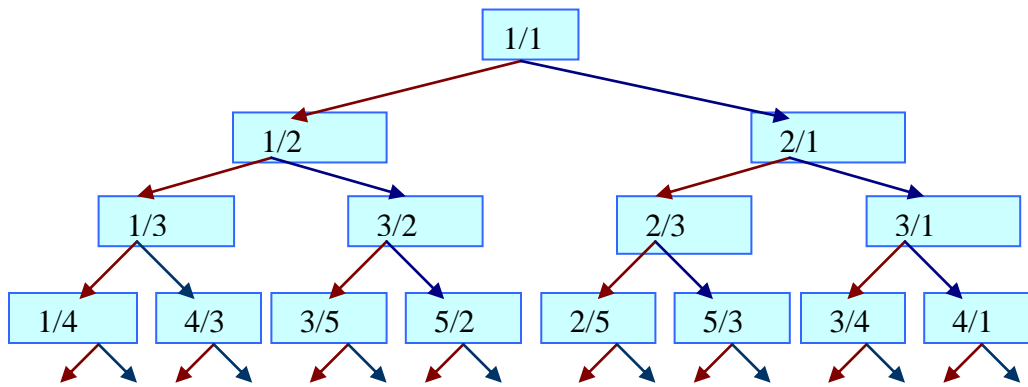
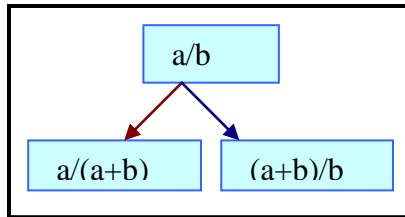
```
public class TempConv {
    public static void main (String [] arg) {
        int F; double C;
        for (F = 32; F < 100; F++) {
            C = (double)(F - 32) * 5/9 + 0.5;
            System.out.println ( F+ " " + (int)C);
        }
    }
}
```

Since Stevie went to work late in the day, I assume that the second pair represents the temperature during his trip to work and the first the temperature on his trip home. A temperature of 82F in the middle of a warm spring day in May is reasonable, and for the temperature to descend to 61F on a spring evening is also reasonable. However, I feel

that it was unreasonable for Stevie to leave his motorcycle in the garage until so late in the season.

**Fraction Trees**, submitted by Annela Kelly

The tree of fractions pictured below is generated using the simple rule:



- (a) Four levels of the tree are shown above. On what level will the fraction 18/5 occur?
- (b) Could you find every positive rational number (i.e. every positive fraction) in the tree eventually? Can you prove your answer is correct?
- (c) How many times does each fraction occur in the tree? Can you prove your answer is correct?

**Call for Submissions**

If you'd like to respond to an article in this newsletter, or if you have some news you'd like to share, please email Heidi Burgiel ([hbürgiel@bridgew.edu](mailto:hbürgiel@bridgew.edu)). We look forward to hearing from you!