SUNY OSWEGO MATHEMATICS DEPARTMENT

Snygglet

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Letter From the Former Chair

Greetings from early 2016! A lot has happened since the previous edition of the Snygglet, in April 2013. In fact, we have been so busy that we haven't had time to put the news into a Snygglet newsletter. Until now.

First of all, the name "Snygglet" has become an anachronism, because Snygg Hall is no more. See the photo of Snygg under deconstruction, which took most of the 2013 - 2014 academic year. We are in the Shineman Center, along with all the science departments, the Computer Science Department, and the new Electrical and Computer Engineering Department.

Syngg Hall

With all those departments in one building, we are part of a bigger and tighter family of science related faculty and students — all to the good — but we miss the roominess of Snygg. Where in Snygg we had math faculty offices together, across the hall from classrooms, now the classrooms are on the first floor and our faculty offices, together with those of our colleagues in other departments, are on the second, third and fourth floors of Shineman. We have needed to be more imaginative in locating spaces where faculty and students can get together to talk math. See the articles on the Summer Lunch Club and the Math Club, which meet in the Math Student Commons Room.

A corresponding change over the past few years is in the majors of the students in our mathematics classes. A greater proportion are science students, including many who combine a mathematics major with a major in science or computer science or engineering. And far fewer are in education. In the listing of our graduates in this newsletter, note the decline of those in Adolescence Education, as grade 7 – 12 teaching is now called. And more of our students take statistics classes, with a few each year entering graduate programs in statistics, usually fully funded. We have become a feeder school for the University of Rochester's biostatistics program, with four of our graduates in the last four years moving to that program, all with assistantships.

We have solutions from the last set of problems, and three new ones to keep you occupied.

We have had a couple retirements: Jack Narayan in December 2013 and Lynn Carlson just in December 2015. See the article on Jack Narayan. We hope to have more about retiring faculty and new faculty with our next newsletter. And we have a new department chair. After five years in the position, Christopher Baltus happily turns over the reins to Scott Preston.

— Christopher Baltus

Math Career Outlook

Mathematics looks better and better as a path to a satisfying career.

From *The New York Times*, August 9, 2015

> **ROHNERT PARK, Calif.** — In a stark about-face from just a few years ago, school districts have gone from handing out pink slips to scrambling to hire teachers.
>
> Across the country, districts are struggling with shortages of teachers, particularly in math, science and special education — a result of the layoffs of the recession years combined with an improving economy in which fewer people are training to be teachers.

And from CareerCast.com

> If you love crunching numbers and managing spreadsheets, you're in luck. Jobs in mathematics rank among the nation's best for 2015. These positions are financially lucrative, offer abundant opportunities for advancement and, most surprisingly, often deviate from common perceptions about math.

The site emphasizes that one also needs to communicate well and work in a team. They selected the best jobs based on measures of "Environment, Income, Outlook, and Stress."

"To a large measure, the data used to evaluate each job comes from the Bureau of Labor Statistics (BLS), a part of the U.S. Department of Labor." Here are their top eight:

1. Actuary
2. Audiologist
3. Mathematician
4. Statistician
5. Biomedical Engineer
6. Data Scientist
7. Dental Hygienist
8. Software Engineer

Math Club Goes "Rubik"

The student run Math Club was especially active in 2014 - 2015 under President Kenny Roffo, Vice-President Jonathan McKibbin, Secretary Joanna McKinney, and Treasurer Harry Kandaras.

The club took over the Mathematics Student Commons Room, Shineman 373, on many afternoons. In the fall, Professor Justin Ryan ran a late afternoon seminar on Lie groups. On spring afternoons, club members held help sessions for calculus students.

The club ran the First Annual "Math Club Fun Night" on March 10. This early celebration of Pi Day included a variety of pies, from cherry to pumpkin to pizza, some lively rounds of "Set" — the clear champion was first year faculty member Bonita Graham, and Math Jeopardy, created and programmed by Ken Roffo and Jonathan McKibben.

A number of club members went to the April 2015 meeting of the Seaway Section of the Mathematical Association of America, at Colgate University. In the Fall, the Math Club visited to the MAA Seaway Sectional Conference in Alfred, NY. Members of club gave presentations at each of these. (Kenny Roffo and Julia Martin in the Spring 2015; Amy Hanahan and Julia Martin in the Fall 2015)

The running theme of the year was Rubik's Cube. The dexterity and mastery of the cube of some of our students was amazing to watch! Ken Roffo added to his remarkable collection of cube. See the photo. And he did some solid mathematics, proving that the group of moves on the 3-by-3-by-3 cube is the group generated by five independent quarter turns of a face. In his Capstone paper, Jonathan McKibbin studied the transformation groups of some stranger cubes, such as the 2-by-1-by-1 "cube."

Ken Roffo's collection of Rubik's Cubes.

Lunch Club

In the summer of 2014, Professors Preston, Elmer, and Wilcox came together to create Lunch Club. In June and July, math faculty and students would gather once a week over lunch to discuss math articles. "Lunch Clubbers" rotated hosting duties; the host would assign an article and several thought-provoking questions, members would spend a week reading and pondering, and then the host would lead the Lunch Club discussion.

Professor Mark Elmer and Max Robertson.

In 2014, Lunch Club pondered topics as far-ranging as evaluating conservation techniques through graph theory, n-dimensional tic-tac-toe, knot theory, and penny games. The fun continued into the semester, with Professor Elmer giving a seminar in fall semester generalizing the penny game to unfair pennies and then Visiting Assistant Professor Ryan McCulloch gave a seminar in spring semester giving solutions to combinatorial problems associated with the generalized 3-penny game.

The 2015 version of Lunch Club read about card tricks and group theory, the upper half plane model of hyperbolic geometry, the history and physical properties of the cycloid function, the game sprouts, and polyominoes. New members are welcome! If you're interested in keeping up with our readings, contact Professor Wilcox to be added to the Lunch Club email list.

Here are a couple of problems associated with some of our readings:

1. Given two points A = (x1, y1) and B = (x2, y2) with yi > 0 for i = 1,2. Show that there is a circle through A and B with its center on the x-axis. This is a crucial step in proving that through any two "points" in the upper half plane model of hyperbolic geometry there is a unique "line" through the two points.

2. A polyomino is a polygon created by gluing sides of squares together; a domino is a polyomino because a domino is two squares glued together. In polyomino folding, there are five legal moves:

a. fold along a square's edge,

b. fold along the diagonal of a square,

c. fold along the line segment that connects midpoints of adjacent sides (i.e., folding a corner of the square so that the vertex is now overlapping the "center" of the square),

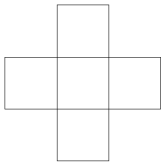
d. cut along the line segment that connects midpoints of adjacent sides (provided that the corner of the square can remain adjacent to another square and not float off into space), and

e. cut from a square's vertex to the midpoint of an adjacent side.

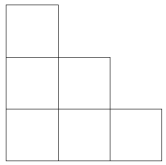
Use the legal moves to fold the given polyomino to create a smaller version of the polyomino where there are now two layers of paper.

(i) A 5-omino in the shape of an X.
(ii) A 6-omino in the shape of a staircase.
(iii) A 13-omino in the shape of a doughnut.

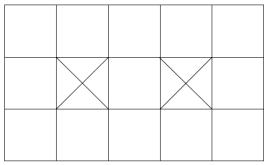
(HINTS: The 5-omino can be done with several iterations of types (a), (b), and (c) but only 0 moves of type (d) and 4 moves of type (e). The 7-omino can be done with several (a)s, (b)s, and (c)s but 0 moves of type (d) and 2 moves of type (e). The 13-omino "doughnut" is a bit more of a challenge (That's an understatement!) and you might need 8 moves of type (e) and 2 moves of type (d) – it's the only one of these three polyominoes that needs to be tackled with this type of move.)



An x-shaped 5-omino.

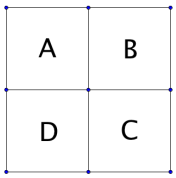


A staircase-shaped 6-omino.

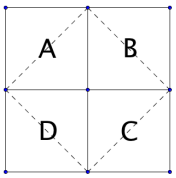


A 13-omino shaped like a donut with 2 holes!

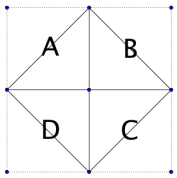
Here's how to do a 4-omino in the shape of a square:



A 4-omino configured like a square.



Fold along the diagonal of each square.



The new shape is a square!

For printable templates of the polyominoes, as well as some solutions and diagrams of the legal moves, turn to Professor Wilcox's webpage:
https://sites.google.com/a/oswego.edu/wilcox/

New Snyglett Problems

1. Three given segments may or may not serve as sides of a triangle, depending on their lengths.

Suppose a stick is broken in two places selected at random. What is the probability that the resulting three pieces form a triangle if

a. After the first break, the longer piece is broken at a randomly selected spot?

OR

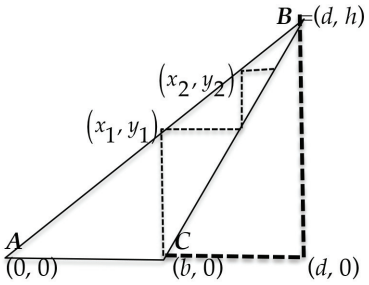
b. The two breaks are independently selected?

2. (Mark Elmer) Since a right triangle with legs a and b is half the rectangle with sides a and b, its area is ab/2.
For other triangles, if we limit ourselves to adding areas of right triangles, we can quickly find the area of a triangle when an altitude stays inside a triangle.

But can you derive the area formula when an altitude is outside the triangle?

You will need to add an infinite series of right triangle areas.

We have placed vertex A at the origin and C on the positive x-axis.

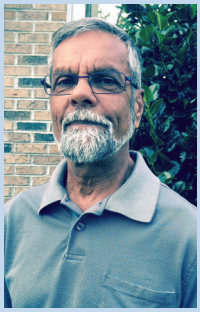


Show that, by adding areas of the infinite number of right triangles that form, we arrive at the correct area.

3. The Car Parking Problem. I (Baltus, not the creator of the problem) presented this problem to students in September 2014. At least one student, Chaskin Saroff, correctly solved it.

A parking lot consists of 16 spaces in a line. After 12 cars have, at random, occupied 12 places, Maxine arrives with a wide vehicle that requires two consecutive spaces. What is the probability that she will find the two consecutive spaces to park her vehicle?

Jack Narayan Retires



Jack Narayan retired in December 2013, after 43 years teaching at SUNY Oswego

Jack is from Guyana, where he began teaching in 1959. Do the arithmetic: that makes for more than a half-century span of teaching. Jack began in Oswego as an assistant professor in 1970, after completing his PhD at Lehigh. He quickly advanced through the academic ranks, achieving associate professor in 1976, full professor in 1984, and the singular honor of Distinguished Teaching Professor in 1988. He also was awarded, in 1981, the Chancellor's Award for Excellence in Teaching.

At the retirement dinner, in October 2013, Master of Ceremonies Mark Elmer identified some of the qualities to admire in Jack Narayan: "He is smart. He is funny. He works very hard, and he works well with others. He shares his knowledge and experience. He is a family man with a wonderful and talented family. Jack is a phenomenal teacher. He is also very, very fit. I smile when I think about finishing a 25-mile bike ride along with Jack, John Daly, Paul Dussere, and Sally Dussere. With about one half mile to go Jack demonstrated some yoga positions to me. He did this while still riding his bicycle!"

Attending the retirement dinner were Jack's sons Darren and Dwayne, and many retired colleagues; notes of congratulations and reminiscence came in from Jack's third son, Drew, and former chair Phil Downum, Jack's neighbor for thirty years.

In addition to his memorable teaching, Jack built a distinguished list of publications, notable not just for its length but for its breadth. One can trace both Jack's interests and his collaborators in a selection from his publications, from 1970 to 2008:

1970 with Gilbert Stengle, his Lehigh thesis advisor: "Uniform asymptotic splitting of linear differential equations," in the Springer Lecture Notes volume *Analytic Theory of Differential Equations*.
1988 with John Considine, of Lemoyne College, "Assessment of the Impact of Fare Increases in a Transit System by Using Intervention Analysis," the Outstanding Paper of the Marketing Research Track, 1988 *Conference of the Southern Marketing Association*.
1989 with Craig Graci and Randy Odendahl, of the Oswego Department of Computer Science, "Bunny Numerics: A Number Theory Microworld," in the Springer publication *Computers and Mathematics.*
2002 with his son Darren Narayan, professor at Rochester Institute of Technology, "Fibonacci Determinants," in the *College Mathematics Journal*.
2008 "Across 50 Years of Teaching," the invited Randolph Lecture at the Fall meeting of the Seaway Section of the Mathematical Association of America.

Postscript: A few days after Fall semester 2013, Jack's final semester, Jack Narayan was named Chief Academic Officer of WebAssign. Retirement was short-lived!

Snygglet Problem Solutions (For problems from the 2013 issue)

1. My son's Masterlock combination (three distinct integers from 0 through 39) is an arithmetic sequence of 2-digit primes: *a, a+ d, a + 2d*.

How many such combinations are possible?

Solution: Two sequences. First, *a* cannot be a multiple of 2 or 3, since it is prime. *d* must be a multiple of 2 so that *a + d* is odd and *d* must be a multiple of 3 since otherwise exactly one of *a, a+ d, a + 2d* would be a multiple of 3. So *d* is 6 or 12. Then by trying all possibilities, we find just two: { 11, 17, 23} and {17, 23, 29}.

2. [From Jeremy Berquist, who posts the Problem of the Week. This was the first problem of the Spring semester.]

If three distinct integers are selected at random from { 0, 1, 2, . . . , *N*}, what is the probability the three numbers, in some order, form an arithmetic sequence:

{ *a, a+ d, a + 2d*}?

[You may first want a rule for odd *N* and a rule for even *N*. But Jeremy would like just one rule, involving the greatest integer function.]

Solution: [Jeremy Berquist]
Note that a three-number arithmetic sequence is determined by its first two or its last two numbers.

Case 1: *N* = *2m* is even. There are $\binom{2m+1}{3}$ ways to select three different numbers from the set { *0, 1, 2, . . . , N*}. Three numbers in arithmetic progression can be specified by selecting the first and third numbers, both odd or both even. For two evens, we select two numbers from { *0, 2, 4, . . . , 2m*}:

-- in $\binom{m+1}{2}$ ways.

For two odds, we select two numbers from { *1, 3, . . . , 2m - 1*}

-- in $\binom{m}{2}$ ways.

So the probability that the three numbers selected form an arithmetic sequence is

$$\frac{\binom{m+1}{2}+\binom{m}{2}}{\binom{2m+1}{3}}, \text{which simplifies to } \frac{3m}{(2m+1)(2m-1)}=\frac{3}{2}\frac{1}{N-\frac{1}{N}}.$$

Case 2: N = 2m – 1 is odd.

There are $\binom{2m}{3}$ ways to select three different numbers from the set { *0, 1, 2, . . . , N*}. Thinking as in Case 1, above, there are $2\binom{m}{2}$ ways to form an arithmetic sequence from { *0, 1, 2, . . . , N*}.

So the probability is $\frac{2\binom{m}{2}}{\binom{2m}{3}}=\frac{3(m-1)}{(2m-1)(2m-2)}=\frac{3}{2}\frac{1}{N}$.

In both cases the probability is $\frac{\frac{3}{2}\frac{N}{N^2-\frac{1}{2}+\left(\frac{-1}{2}\right)^{N+1}}}{}$.

3. [An oldie-but-goody.] A worm crawls at a steady speed of 1 inch per hour, starting from one end, along a 50 inch rubber band. To frustrate the poor worm, at each hour the band is suddenly lengthened by 1 inch.

Does the worm ever reach the other end?

Yes. Consider the fraction of the original band that the worm traverses each hour:

Adding them we get $1/50 + 1/51 + 1/52 + 1/53 + \cdots$.
This is a tail of the harmonic series, which is known to diverge to infinity. So eventually, the sum will pass 1, meaning that the worm has reached the end.

We also see that the sum through term $1/135$ exceeds, $\int_{50}^{136} 1/t\, dt = \ln 136 - \ln 50 > 1.0$, so the worm will reach the end of the band in less than 86 hours.

SUNY Oswego's Richard S. Shineman Center for Science, Engineering and Innovation, which opened in fall 2013,

New Chair, Professor Scott Preston and Kirsten Parsons, BA 2015

Michael Dempsey, Jackie Maguire, Dan Mannix

Math Club members (Left) Joanna Mckinney, Jon McKibben, Alex Jansing, Ken Roffo and Nina House.

(Right) 2015 graduate Chaskin Saroff.

Demolition of Snygg — 2014

LUNCH CLUB

(Left) Amy Hannahan and Professor Elizabeth Wilcox.

(Right) Julia Martin.

Erika Wilson, from Ontario, N.Y. — graduated in May 2015 with a major in applied mathematics and a minor in applied statistics.

Math Graduates: 2013 – 2015

May 2013 Graduates

Shannon Blazavich: Endicott, NY, Childhood Ed (Mathematics Concentrate)
Adam Clute: Johnstown, NY
Mathematics BA and Adolescence Ed (Mathematics)
Fenton Caster: Savannah, NY, Applied Mathematical Economics
Jessica Dickquist: Minetto, NY, Mathematics BA
Michael Dempsey: Bloomingburg, NY
Mathematics BA and Adolescence Ed (Mathematics)
Michael Edinger: Baldwinsville, NY
Applied Mathematics BS and Applied Statistics minor
Joseph Fear: Oswego, NY, Mathematics BA
Ashleigh Gerstner: Walcott, NY, Mathematics BA
Christi Gregory: Lyons Falls, NY, Adolescence Ed (Mathematics)
Nathan Hemmes: Poughquag, NY, Applied Mathematics BS
Kayla Hoffman: Central Square, NY, Adolescence Ed (Mathematics)
Bryan Jones: Ontario, NY, Childhood Ed (Mathematics Concentrate)
Kellie Kubala: Amherst, NY, Childhood Ed (Mathematics Concentrate)
Jeremy Lasda: Northport, NY
Mathematics BA and Adolescence Ed (Mathematics)
Jackie Maguire: Holland, NY
Mathematics BA and Adolescence Ed (Mathematics)
Daniel Mannix: Brewster, NY
Mathematics BA and Adolescence Ed (Mathematics)
Thomas Powell: Hicksville, NY, Applied Mathematical Economics
Luis E. Rodriguez: Colon, Guatamala, Mathematics BA
Stefan Scott: Mountainville, NY, Applied Mathematical Economics
M**atthew Stewart**: Oswego, NY, Childhood Ed (Mathematics Concentrate)
Rebecca Tango: Walden, NY, Mathematics BA
Maria Williams: Rochester, NY, Childhood Ed (Mathematics Concentrate)
Matthew Worden: Vestal, NY, Applied Mathematics BS

December 2013 Graduates

Katlyn Carnachan: Norwich, NY, Childhood Ed (Mathematics Concentrate)
Stephanie Ciesla: Oswego, NY, Childhood Ed (Mathematics Concentrate)
Melissa Degeronimo: Shoreham, NY, Childhood Ed (Mathematics Concentrate)
Kaitlyn Lefeve: Kirkville, NY
Applied Mathematics BS and Applied Statistics minor
Adam Lesh: Syracuse, NY Mathematics BA and Adolescence Ed (Mathematics)
Ethan Mitchell: West Hampton, NY
Mathematics BA and Adolescence Ed (Mathematics)
Rebecca Rappold: Rochester, NY, Childhood Ed (Mathematics Concentrate)
Rachel Rhynders: Syracuse, NY
Mathematics BA and Adolescence Ed (Mathematics)
Bryan Rose: Oneida, NY
Mathematics BA and Adolescence Ed (Mathematics)
Brittany Watkins: Constableville, NY, Childhood Ed (Mathematics Concentrate)

May and August 2014

Matthew Brooks: Utica, NY, Applied Mathematical Economics
Kyle Buscaglia: Akron, NY, Mathematics BA
Sean Crowder: Greenwich, NY, Mathematics BA
Samuel Disalvo: Batavia, NY, Mathematics BA
Tara Fleming: Oswego, NY
Applied Mathematical Economics, Applied Statistics minor
Jacob Gallagher: Apalachin, NY, Applied Mathematic BS
Joseph J. Pike: Rochester, NYChildhood Ed (Mathematics Concentrate)
Ashley Collins: Binghamton, NY
Mathematics BA and Adolescence Ed (Mathematics)
Caitlin Dabkowski: East Northport, NY
Mathematics BA and Adolescence Ed (Mathematics)
Sara Herbrand: Rochester, NY, Childhood Ed (Mathematics Concentrate)
Chelsea Hunt: Brockport, NY
Mathematics BA and Adolescence Ed (Mathematics)
Michelle Mariano: Mathematics BA, Oswego, NY
James Mazzarano: Mathematics BA, Mohegan Lake, NY
Laura Murtha: Central Square, NY
Mathematics BA and Adolescence Ed (Mathematics)
Courtney Norell: Franklin Square, NY
Mathematics BA and Adolescence Ed (Mathematics)
Morgan O'Hara: Baldinsville, NY, Mathemtics BA
Nicholas Powers: Mexico, NY, Mathematics BA
Rebecca Rappold: Rochester, NY, Childhood Ed (Mathematics Concentrate)
Keegan Urtz: Oneida, NY, Mathematics BA
Brittany Watkins: Constableville, NY, Childhood Ed (Mathematics Concentrate)
Nicole Whittam: Webster, NY, Childhood Ed (Mathematics Concentrate)
Ben Valentino: Mexico NY, Applied Mathematics BS

Dec 2014 / May 2015 / August 2015

Amanda Austin: Massapequa Park, NY, BA
Daniel Batchelder: Salem, NY, Childhood Ed Math Concentrate
Jillian Bergemann: Baldwinsville, NY, Childhood Ed Math Concentrate
Kelly Brinkel: Hamburg, NY, Stat minor
Laura Critelli: Clay, NY, grad school in Oswego, BA plus ADO
Jacquelyne Fancett: Waterville, NY, Applied Mathematical Economics
Chelsea Fearon: Union Springs, NY, BA plus ADO
Matthew DeGilio: Syracuse, NY, BA plus ADO
Amanda Heberger: Liverpool, NY, Childhood Ed Math Concentrate
Alexander Jansing: Clinton, NY, BS
Ashley Johnston: Liverpool, NY, Childhood Ed Math Concentrate
Sanjeev Kumar: Syracuse, NY, BS
Miguel Lara: Oswego, NY, BA
Daichi Mae: Sopporo, Japan, BA
Michael Mahaney: Rochester, NY, Applied Math Econ, Applied Stat minor
John Mackie: Bellport, NY, Childhood Ed Math Concentrate
J**onathan McKibbin:** Patchogue, NY, BA
Ashley Michlovitch: Liverpool, NY, BA plus ADO, grad school in math ed
Benjamin Morrill: Webster, NY, Stat minor
Kailea Nelson: (Dec.) Ontario, NY, Childhood ed math concentrate
Thomas Perry: (Aug.) Syracuse, NY, BA plus ADO
Tracie Condi: Cayuta, NY, BS
David Randal: (Dec.) Ontario, NY, Childhood Ed Math Concentrate
Alexander Ross: Red Hook, NY, Stat minor
Chaskin Saroff: Queensbury, NY, BS
Christopher Schroth: Syracuse, NY, BA
Joshua Stuper: East Syracuse, NY, BA
Lauren Sutter: Newburgh, NY, Statistics minor
Timothy Van Hine: Apalachin, NY, Statistics Minor
Erika Wilson: Ontario, NY, BS, Applied Stat minor
Tyler Worzel: Glen Spey, NY, BS, Applied Stat minor
Andrew Urtz: (Dec.) Oneida, NY, BS
Timothy Van Hine: Apalachin, NY, Stat minor
Eyub Yegen: Turkey, Applied Math Econ and Applied Stat minor, to U of Toronto, Management

Dec 2015

Kirsten Parsons: Oswego, NY, BA
Jeremy Pietruch: Marcy, NY, BA and ADO

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