The Quaternion

The Newsletter of the Department of Mathematics, USF–Tampa

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Feature Article: Outreach Program helps Schoolchildren Catch Up

Several members of the Mathematics Department run a program to help disadvantaged schoolchildren catch up in their education, and help parents develop their tutoring skills. The *Urban Scholars Outreach Program* (USOP) runs classes on Saturday mornings on campus for students in nearby schools who need extra assistance.

The USOP is modelled after a much smaller Sunday morning program founded fifteen years ago by Professor A. N. V. Rao. The USOP itself was founded by Professors Rao and Chris Tsokos two years ago. In the last academic year, it served about 100 schoolchildren (it had 60 schoolchildren this Summer), and Professor Tsokos hopes to expand to 300 schoolchildren soon.

The schoolchildren come from economically and socially disadvanted backgrounds. Most are African American, although a few are White/Latino; the program is open to any child whose parents are willing to make the commitment. Evelyn Williams, a math secretary who is in real life the USOP Program Director, says that the children need to learn basic skills (how to study, how to do homework, etc.). Many of them have already had profoundly negative educational experiences, and they need constant encouragement that they can succeed — if they try. The teachers are very firm, but rely on positive reinforcement (rewarding success more than punishing

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The Joy of Math

A very personal view
by Boris Shekhtman

Boris Shekhtman is a Professor of Mathematics at USF. He has been a member of the department since 1986.

The beauty

If somebody would grant you just one wish, what would it be? Would you ask for money or health or peace on earth? Perhaps an interesting choice would be to become the luckiest man on the planet. As it was I became a mathematician and the wish was nearly fulfilled. By now you may feel that a crazy man is writing this. Perhaps. But this is good crazy.

A good friend and a famous mathematician Donald Newman once told me that as a young man he wanted to be a train conductor so as to have enough time to think about mathematics.

"Were you surprised to find out that you can do mathematics and be paid for it?" I asked.

He looked at me with that childlike excitement in his eyes and said: "I still am."

This is indeed one profession that affords you a unique luxury of being creative. Creative without restrictions and limitations. And being able to spend my life indulging in wild fantasies and the intellectual pursuit of those fantasies makes me believe in genies. If you listen to mathematicians talk (with the help of the universal translator of course) you will find routine discussions about the shape of a ball in a fifteen dimensional space and what happens to it when you

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failure). In addition, the program relies on parental support, to keep the schoolchildren on line between Saturdays.

Being only two years old, the success of the USOP is hard to evaluate, although most students in the program have shown marked improvement in their regular schoolwork (and many get onto their school honor rolls). (The original program, run by Professor Rao, has a considerable success record, but it also has a different audience.) The USOP appears to be more successful with younger schoolkids (no surprise): older children tend to be more pessimistic about their prospects, and to have more bad habits. The children tend to have materialistic goals (when I grow up, I want a house and a car and ...), so motivating them requires clear demonstrations that their goals can only be achieved by regular hard work. The courses are on reading and writing and, the big hurdle, mathematics: all elementary and secondary topics from arithmetic to calculus are taught.

The program has about 15 to 20 volunteers on average. While some faculty participate, along with some members of the outside community, the program relies heavily on advanced undergraduate and graduate students from the Colleges of Arts & Science, Education, and Engineering. In addition, Professor Tsokos is running a 1-credit course on pedagogy, which has participation in the program as part of the course assignment. Professor Tsokos observes that in the current academic job market, demonstrated teaching ability is required for the majority of available academic positions – and a record of educational service to the community impresses prospective academic employers. College student volunteers get a certificate of appreciation, and letters of reference. Students interested in getting additional teaching experience are welcome: again, as Professor Tsokos hopes to expand the program to meet the demand, more volunteers are needed.

Several organizations outside of USF help support the USOP. Holland & Knight, Florida's pre-eminent law firm, provides materials, while the Hillsborough Educational Foundation offers support to those students who participate. Additional assistance comes from the Kellogg Foundation.

For more information, consult the USOP's webpage at `http://www.cas.usf.edu/USOP`.

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intersect it with a cube in an infinite-dimensional space (a topic that is particularly close to my heart). You will wonder why would a mirror change left and right and not change up and down? How does the mirror know which direction is which? You will hear the discussions of objects that nobody have ever seen and nobody it can ever see and yet mathematics allows us to categorically insist on their existence or non-existence.

In 1846 a French mathematician Leverrier sat down at the table and, using nothing more then his mind, discovered a new planet (Neptune) and its exact position. He had never seen the planet and never looked through the telescope. He used his intellect to be able to argue (proof by contradiction) that if the planet did not exist then the rest of the planets would not be acting the way they do. Of course shortly after, those less capable among us (they call themselves natural scientists) did observe the planet and in the process took all the fun out of it.

The increasingly materialistic world conditioned us to value only those things that we can buy, drive, touch, see, hear or have sex with. I enjoy those things as much as the next guy. Who doesn't? Yet it doesn't mean that I have to limit myself to them. There is another dimension, that which is usually associated with art, poetry and music. Only better. It is called 'Mathematics.'

The beast

With all this hoopla about math, why do so many people dislike and/or fear the subject? My feeling is that they don't know what mathematics is. Even worse, they think that mathematics is what it really is not. What most of us learn in schools and colleges

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is not the science of mathematics, but the language of mathematics. The process is so tedious, boring and time consuming that after a while we learn to think of it as the science of mathematics and thus find it to be unbearable.

As a young boy I was completely turned off by music. My music teachers forced me to spend hours playing scales. I hated it. Of course I could still appreciate music, but I never wanted to play it.

With language we are not so lucky. The knowledge is needed not only to create but also to appreciate the creation. It would be as if you wanted to learn the beauty of French poetry, but before you could understand it, you'd have to spend ten years learning and perfecting the intricacies of the French language. And if you don't know better you may believe that the study of French poetry is the study of the conjugation of verbs. How dull and uninteresting. What can people possibly see in it and how on earth can they call it 'Romantic?' Couldn't we instead use the English translation? Maybe, maybe not. Often the means of expressions are so intricately intertwined with the subject of the expression that something is inevitably lost in the translation.

We are born genetically predisposed to use and understand a language. It is hard to know how difficult it is for a child to learn to speak. The language is more then just the means of communication. In many ways it defines who we are. The linguists are still arguing about the influence of language on our perception of the world in general and ourselves in particular. The language is a marvel of creativity. Think about it. Every day we utter sentences that had never existed before. And yet a listener can understand it. In fact the very sentence I just used had probably been never used before. And yet you can read it. How neat is that? We all have this tool. And when we use it we don't even realized the complexity of it. Thank you, millions of years of evolution. (And Noam Chomsky).

It is much harder to learn to read and write. The idea is more or less the same and yet we are not genetically conditioned for it. So it takes us an enormous effort to perfect this new tool. (As you can probably judge from this article, I am not there yet.) I am more or less convinced that we are not predisposed to naturally accumulate the knowledge of mathematical language and that what makes it all so difficult, for this is a language of extreme formalism.

The beauty *and* the beast

Let's conduct an experiment. What would you guess is the percentage of the words in the English language that look like this: "**********n*?" Now, what percentage of the words, would you guess, look like "*********ing?" Well, if you are like most people you would have thought that the first percentage is smaller then the second. And like most people you would be wrong. Don't pick up a dictionary and count. Just think about it. Every word in the second set is contained in the first set. So the first set cannot be smaller then the second.

I wrote this to demonstrate two important points.

First: heuristics are often wrong. We arrive at the conclusion naturally without any effort, but it's a wrong conclusion. The less familiar the objects are the more likely it is that our instincts will lead us astray. In mathematics we deal with the nonexistent objects and the need for that beastly language of formalism is therefore paramount. (A. Tversky and his collaborators had done a brilliant account on the falsities of heuristics.)

Second: there is a way to come up with some conclusions without counting or observing. Simply rely on the logic.

And that is what fascinates me about mathematics the most. The elegant and unexpected logical argument that lead to the right conclusion without any empirical work. It doesn't mean that the argument naturally pops up. A mathematician often spends agonizing months and years to come up with that simple line of logic. But when he or she does, it becomes the work of art. Much like a painter may ponder over a particular brushstroke in private, before he or she exhibits the art. The final result does not bear the traces of hard work.

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It was known for a long time that π is a "transcendental number" (whatever that means). The proof of this is really difficult, and not many other transcendental numbers were known. So what happens if the question is not whether a given number is transcendental or not, but whether there exists a transcendental number? Cantor had a beautiful proof that transcendental numbers exist. He created an argument that said that the set of all numbers is larger (much larger) then the set of non-transcendental numbers. Thus there are transcendental numbers. Get it? If the number of fruits in your refrigerator is larger then the number of apples, then you can conclude that there is a fruit in there that is not an apple. This is an *existence theorem*. Well, actually Cantor's argument showed a lot more. It said that virtually all numbers are transcendental. So π is the rule while the numbers like 1 and 2 and 3 are the exceptions. And yet these are the numbers that everybody knows.

Mathematics is full of interesting unanswered questions of that nature. Most of my work had circled around the questions that ask whether infinite-dimensional objects with certain properties exist or not. Instead of trying to find or construct the object I try to proof that it exist by the means similar to those described above. Almost inevitably it leads to a conclusion that virtually every object has the required property, but I don't know a single one of the kind.

Well this was my attempt to translate some mathematics into English. Had anything been lost in the translation? Practically everything. I could not describe the objects in question. I also deprived you from enjoying the sheer beauty and elegance of the logical arguments. But I hope that I managed to preserve the flavor of the work and the enthusiasm that I experience in the course of my incredibly lucky scientific life. I also hope that all this gibberish lead you to an interesting philosophical question: Is our understanding of the world is only the understanding of the exceptions, the singularities in the universe?

But that is the whole different story.

Events Calendar

More information about the following events will appear at our website at `http://www.math.usf.edu` as the event approaches. So mark the event on your calendar, and plan on taking part.

Oct. 12, 2000: **R. Kent Nagle Lecture.** Noted mathematician, computer scientist, and author of popular science works **A. K. Dewdney** will be giving a lecture on **Do Aliens do Mathematics?** This talk is free, and intended for and open to the general public; parking is as usual $ 2 from the visitor's center. The lecture is at 7:30 in Cooper (CPR) Hall 103. Contact the Math Department for additional information, or check the website at `http://math.usf.edu/~nagle`.

Nov. 3, 2000: **Mathematics Field Day.** The Center for Mathematical Services will be hosting the fourth annual Mathematics Field Day at the University this Fall. Each high school in the Tampa Bay area is invited to send a team of four to five high school juniors to the USF campus for the day. The students will be treated to two mathematical lectures by mathematics faculty and a tour of the campus. They will also be involved in a mathematics team competition, testing their mathematics skills and knowledge against teams from other schools. The teachers that accompany the team will be treated to a luncheon in the Marshall Center. Contact the Center at (813) 974-4068 for information and to make reservations: reservations must be made with the Center by Oct. 20, 2000 to participate in the event.

Dec. 1, 2000: **MAA Suncoast Meeting.** The 25th annual Suncoast Regional Meeting of the Florida Section of the MAA will be held at St. Petersburg Junior College – Gibbs Campus. This event brings together teachers of mathematics from middle to graduate features an afternoon of mathematics talks, followed by dinner at the Marshall Center. For information on registration and/or giving talks, contact see the Suncoast web page at `http://www.math.usf.edu/suncoast`.

Walter Williams

Walter E. Williams, a longstanding member of the Department, died on February 14, 2000, of cancer.

Walter Williams received an A.A. from Ashland Junior College in Kentucky, and then went to Miami University of Ohio, where he received a B.A. and an M.A. in mathematics. As Frank Cleaver (another departed member of the faculty) told it, Williams was selling insurance in Tampa when USF opened in 1960, and he heard that USF needed teachers. He applied for a job, and was hired as an Instructor in 1961; he was promoted to Assistant Professor in 1964.

Williams helped form the mathematics departments (plural!) in those early years, including preparing the first mathematics brochure and, later, the brochure for the College of Natural Science. In 1971, he became "Assistant to the Chair" under Chairman Jogi Ratti, and later that same year he became "Assistant to the Dean" under Dean Ashford of the College of Natural Science; he served as Assistant Dean until he returned to the Department in 1982. And while assisting Dean Ashford and later Dean Ray, he earned a doctorate in Education from Nova University.

Williams co-authored three books. The first was *Pre-Calculus Algebra and Trigonometry*, co-authored with Frank Cleaver, and published in 1971 by Holt, Reinhart, and Winston. The second was *Fundamentals of Business Mathematics*, co-authored with fellow faculty member Jim Reed, and published in 1984 by W. C. Brown. The third, also co-authored with Reed, and published by W. C. Brown in 1984, was *Essentials in Business Mathematics*.

Over the years, Williams served USF by his work on many councils and committees, including the Golf Course Committee, the Athletic Council, the Work Study Council, the Basic Studies Council, and the Insurance Committee. As Assistant Dean, he served on (and indeed helped formulate) such groups as the Academic Standards Committee (now called the Academic Regulations Committee), the Council on Advising, and the University Undergraduate Council. He worked on the Foreign Student Council and chaired the Faculty Committee on Student Admissions.

Williams was a mainstay of the teaching staff of the Department until he retired in 1992. He would handle three mass lectures each term, and would do them well. Although he did not do mathematical research, the work he did with his very competent handling of three mass lecture classes each term allowed others to concentrate on mathematical research. The Department owed him a debt of gratitude for the care he gave its students and the support he gave to the research effort of the Department. We still miss him and cannot replace him.

Williams is survived by his wife, Liz, and two daughters, Debbie and Vickie.

MAA Meetings at USF

About 80 people attended the **XXIVth meeting of the Suncoast Region of the Florida Section of the MAA** met on Friday, December 3, here at USF. There were nineteen speakers who gave talks on a variety of subjects, from distance learning, to using a Rubik's cube as a teaching device in abstract algebra courses, to using calculators in the classroom, to wavelets, knots, and magic squares. The speakers include eight students, a secondary teacher, an independent researcher, and college and university professors, including three from USF. The main speaker was Steven Karl, of the USF Department of Biology, who gave a talk on some of examples of the role that mathematics plays in biological research. The next meeting will be this Fall on Dec. 1: see the Calendar above.

About 200 people attended the **Annual Meeting of the Florida Section of the MAA**, which met jointly with the Floriday Two-Year College Mathematics Association (FTYCMA) at USF on March 3, 4. There were workshops on environmental mathematics, the computer algebra system MAPLE, and distance learning, as well as the nearly forty talks on on methods of classroom teaching, technology in the classroom, mathematical research and applications to real-world problems, and other mathematical subjects. In addition to the regular talks, there

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was a Student Oriented Special Session for college students interested in mathematics and mathematics education, and a Special Articulation Session to address one or more of the following issues: "Who is teaching mathematics at the various levels and are they qualified?" and "How can adjuncts be used most effectively?" and "How are Computer Algebra Systems impacting on the way that we teach mathematics?" The primary speakers were **Colin Adams**, Mark Hopkins Professor of Mathematics at Williams College in Williamstown, Massachusetts, who spoke about "Real Estate in Hyperbolic Space: Investment Opportunities for the Next Millennium" (in the character of Mel Slubgate, a sleazy real estate agent), and **Fred Richman**, Professor of Mathematics at Florida Atlantic University in Boca Raton, who spoke about "What is Constructive Mathematics?" (in constructive mathematics, one proves that objects — numbers, diagrams, etc. — exist by constructing them).

Nagle Lecture Series

The Spring, 2000 Nagle Lecture was delivered by **Jerrold Marsden**, Professor of Control and Dynamical Systems at CalTech and Professor Emeritus at UC Berkeley. He spoke about "Dynamical Systems and Space Mission Design," specifically about the problem of sending a low-thrust (hence, low-cost) mission to the moons of Jupiter. This talk concentrated on of the great problems of astrodynamics: the three-body problem. How do three celestial objects, like the Sun, Earth, and Moon, move under gravity? And how can we construct an itinerary for a spacecraft navigating through these celestial objects?

We will be having another Nagle Lecture this Fall: **A. K. Dewdney** will be speaking on *Do Aliens Do Math?* on October 12. See the Events Calendar above for details.

Faculty News

We have three new faculty this year. **Mohammed Elhamdadi** received his Ph.D. from the University of Nice - Sophia Antipolis in 1996, and works in algebraic K-theory and algebraic topology. **Anton Kaul** received his Ph.D. from Oregon State University, and works in geometric group theory and low-dimensional topology. **Scott Rimbey** received his Ph.D. from UCLA in 1984, and works in computational fluid dynamics, especially on transonic flow calculations.

We also have three visitors this Fall. **Vincent Camara** received his Ph.D. from USF in 1996, and he works in Bayesian and empirical base analysis. **Arcadii Grinshpan**, who is directing our *Mathematics Umbrella Group*, received his Ph.D. from St. Petersburg University (Russia)/Donetsk University in 1973, and he works in Complex Analysis, Mathematical Modeling, Numerical Analysis, and Differential Equations. **Guillermo López** received his D.S. from the Steklov Institute in 1988, and he works in Approximation Theory.

Professor Emeritus **Al Goodman** has written a book *A Victim of the Vietnam War, the Story of Virginia Hanly*, which has just come out.

Professor **Ed Saff** has co-edited a book *Computational Methods and Function Theory*. He also co-organized a workshop on *Minimal Energy Problems* at the University of Hong Kong last November. And he is an editor of a new journal, *Foundations of Computational Mathematics*, whose first edition is scheduled to come out in January (he is already the editor of *Constructive Approximation*, which was listed as 8th out of 145 math journals worldwide by Scientific Citations).

Professor **Vilmos Totik** was awarded the Lester R. Ford Award for his article *A Tale of Two Integrals*, which was published in the American Mathematical Monthyly in 1999 (Vol. 106, pp. No. 3, pp. 227-240). The award is given by the MAA for expository papers printed in the Monthly.

And Professors *Shanti Gomatam*, *Mourad Ismail*, and *Masahico Siato* were awarded nearly $ 200,000 in grants from the National Science Foundation.

Student News

We congratulate the students who recieved the Bachelor's degree in Mathematics this past year.

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In Fall, 1999: Rachelle Margaret Brunton, Jamie Lynn Gerber, Rosanna Maria Saraceno, and Trina Nicole Talley.

In Spring, 2000: William Alex Dorosin (cum laude), Tho Hu Huynh, Cynthia Lee Lozano, Thuc Doan Nguyen, and Dan Ruelos Paraoan.

Student Clubs

ΠME and the Student Chapter of the MAA again worked together to provide mathematics students a varied and interesting program.

The year began with Kathleen Meirau's address as President of USF ΠME in which she discussed "Pascal's Triangle." Katie joined Michael Lopez, Kevin Wagner and Melissa Holmes as the Math Clubs' Team in the USF Quiz Bowl. The Team won Silver as they came in second with Michael the highest scoring individual in the entire tournament and Katie and Kevin placing in the top ten. After two meetings at which we talked about plans and munched pizza, we addressed student concerns about life after USF. We asked Patricia Pekovsky, Dirctor of Graduate Admissions, to discuss the steps involved with applying to graduate school at this and other universities. We followed this with a presentation by Jackie Tumelty of the Career Center on "Careers in Mathematics: Job Search Strategies."

The Spring Semester opened with Cynthia Gomez Martin's address as President of the USF Student Chapter of the Mathematical Association of MAmerica. Cynthia told about her summer research work on "Stellar Evolution: A Study of Draco Dwarf Spheroidal Galaxy" with data from the Hubble Space Telescope Wide Field Planetary Camera. As we try to provide a forum for students to present their work, we asked Jost Thias to discuss his Master's Thesis, "Newton's Method in Cubic Polynomials." Undergraduate Kaveh Ghaedi told of his own work with "Magic, Latin and other Matricies in Light of the Eignenvalues." We are always pleased to welcome former students to campus to tell of their experiences. Bonnie Bussman Peters graduated 15 years ago and returned to tell of her journey from teacher to actuary.

The last talk of the year is always the address of the Outstanding Scholar of ΠME. This year, the winner was Kevin Wagner, who told of his own ideas about the construction of the $2/n$ table in the Rhind Papyrus of Ancient Egypt. ΠME hosted the December and April Hillsborough County Mathematics Bowls in the Special Events Center. Each contest drew over 300 students and teachers from public high schools in the county. The year closed with the annual ΠME Induction Banquet, at which 19 students were welcomed to membership. Dr. Rod Deans of the Pysics Department told of his activities in the USF BioEngineering Institute and invited our members to participate.

Opportunities

Support for Graduate Students. The Department of Mathematics offers several forms of financial support to qualified graduate students

We offer teaching assistantships, which start at $ 11,000 (and include a waiver of about 90 % of the tuition), and go higher for students in the Ph.D. program. A teaching assistant is required to sign up for 9 credit hours each semester and stay in good academic standing.

The teaching assistantships or fellowships can be increased up to $ 15,000 by the funds provided from the Tharpe foundation. Each year we have an opportunity to award a few of our exceptional students with these additional funds.

Assistant Professorships. The Department of Mathematics will be conducting a search this academic year to fill several tenure-track lines at the assistant professor level. We will be seeking mathematicians with a demonstrated excellence in research and teaching. We will be hiring people to begin work in Fall, 2001. Details, such as the fields that we will be hiring in, will be announced as they are available on the Departmental website and elsewhere.

See the last page for providing feedback and/or contacting us.