

Quaternion

Department of Mathematics Newsletter

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The *Quaternion* is the newsletter of the Department of Mathematics, at the University of South Florida. This issue was put together by the Publicity Committee, consisting of Richard Darling, Gregory McColm, Boris Shekhtman, and Carol Williams.

We are very interested in receiving news, comments or questions from the readers of the *Quaternion*. If you wish to have a letter published, please do not exceed 200 words and send it to Carol Williams, Department of Mathematics, PHY 114, University of South Florida, 4202 East Fowler Avenue, Tampa, FL 33620-5700 (or e-mail at cw@math.usf.edu). For inclusion in the next issue, we must receive letters by October 31, 1997. The editors may edit letters before publication, but will consult with the authors before doing so. Letters will be published at the discretion of the editors.

CHAIRMAN'S COMMENTS

A Late-Night Cosmic Connection on the Hillsborough River

by Richard Stark

Weeks ago, on the nearly cloudless night of a full moon, with a choir of frogs singing their love songs, I began kayaking up the Hillsborough River. It was 10 p.m. and the surface of the water was absolutely calm--reflecting sky, stars, moon, and silver-edged clouds as clearly below as seen above. I glided effortlessly

over the liquid-gas interface. Only the shoreline provided evidence of the manifold. Without people, boats, or waves there were no distractions. Just before midnight, just north of University Park, I viewed the sky and its reflection simultaneously--without the tell-tale shoreline. The manifold was gone and only space remained. Then, paddling between the clouds and toward the stars, I was poised to begin a voyage of light years.

The exercise and resulting hyper-oxygenation of my neural tissues increased my energy. Thoughts developed rapidly and with unusual clarity. This, with the peace of the river and the dimensions of my solitude, lead to a vivid recollection of the following version of "self".

As an undergraduate, my astronomy professor, Wesley Kroghdahl, used to say, "Being primarily composed of atoms with atomic number > 1 , [e.g., carbon] we ourselves are actually globs of star dust. In fact 'life' itself is a strange property of star dust--especially the carbon that forms the spine of our protein building blocks."

Thus, my spiritual unity with the universe may actually have contained a bit of logic.

(continued on page 5)

NAGLE LECTURE SERIES

Spring was the second semester of the Nagle Lecture Series, which was established in honor of the late R. Kent Nagle, a faculty member deeply concerned with mathematical research, mathematics education, and mathematics in society. The Series invites distinguished scholars to come to speak to the general public about mathematical subjects. This past semester, the Series invited Robert Devaney and Persi Diaconis.

Robert Devaney is a leading expert on dynamical systems, a professor at Boston University, and a co-director of NSF's Dynamical Systems and Technology Project, which shows teachers how to bring ideas from modern mathematics into the high school classroom. In his talk on February 13, he led us through the maze of the Mandelbrot set, the most famous figure arising from the mathematical theory of chaos. Carefully explaining the recursion that defines the picture, Devaney showed us how to recognize the various shapes and figures reappearing on successively smaller and smaller scales. The set gradually became less chaotic as we learned to count features to see where we were: there is actually regularity hiding there. The audience enjoyed learning to identify the mathematics underlying each part of the picture, but our favorite part of the lecture no doubt was seeing an actual application of the way we always wanted to add fractions, for example, $1/2 + 1/3 = 2/5$. From the geometry, this addition tells us that in between the first periodic orbit of period

2, and the first periodic orbit of period 3 lies the second periodic orbit of period 5.

We rounded out the year with the lecture on March 20 by Professor Persi Diaconis, former magician and now professor of mathematics (and statistics) at Harvard University. He is also a MacArthur Fellow and a member of the National Academy of Science. He talked about the mathematics of card tricks. He tossed a deck of cards to a member of the audience, asked her to cut it, and then toss it to another person, who, with four of her neighbors, chose cards. He asked those people with red cards to stand up. He then told them which cards they had. The idea of the trick is that the deck is arranged so that each sequence of five successive cards has its unique sequence of red/black cards (there are 32 cards in the deck). He described a few other tricks, and how they are connected to the mathematics of Indian music and getting past combination locks. About 180 people attended.

We plan on continuing the Nagle Lecture Series during the next academic year, and are out hunting for speakers. For information and/or unsolicited advice, contact the NLS committee (Ed Saff, chair, and Greg McColm, Arun Mukherjea, Ralph Oberste-Vorth, and Ken Pothoven) at the Mathematics Department.

DEPARTMENT NEWS

Nataša Jonoska presented joint work with S. Karl of the Biology Department, "Experiments in DNA Computing" at the Pacific Symposium on Biocomputing, which paid her way. She also watched the sunrise from the top of a volcano and had a marvelous bicycle ride from the top of the volcano to the shore. She talked about on "Solving graph problems with DNA" at the 1996 Conference on Combinatorics, Graph Theory and Computing at Boca Raton, on joint work with S. Karl and our own Masahiko Saito. She also gave an invited talk on "Semigroups associated with two-dimensional shifts" at the AMS Conference in Memphis.

Athanassios Kartsatos joined the editorial board of the Japanese journal "Advances in Mathematical Sciences and Applications".

Professor Greg McColm gave a talk on "Zero-One Laws for Homogeneous Models of Random Graphs" at the 1996 Conference on Combinatorics, Graph Theory and Computing at Boca Raton. He also took advantage of a sabbatical to organize his desk and visit colleagues at Haverford College and Pennsylvania State University, the University of Michigan at Ann Arbor, the University of Wales at Swansea, and RWTH at Aachen.

Mary Parrott spoke at the American Mathematical Society at Memphis on "An Age-Dependent Regularization to Martin's Problem" at a special session on Partial Differential Equations.

Ed Saff toured Spain to deliver invited lectures and collaborate with mathematicians at the University of Granada, the University of Sevilla, the University of Almeria, and Juan Carlos III University in Madrid. He spoke on orthogonal polynomials and the distribution of points on the sphere, speaking of which, he and his former student, Yanmu Zhou, wrote the cover article in the *Mathematical Intelligencer* on "****".

Masahiko Saito (see above) also gave some talks on work he did in collaboration with J. Scott Carter of the University of South Alabama and J.H. Reiger of the Universidade de Sao Paulo. He spoke about "A combinatorial description of knotted surfaces and their isotopies", at the Workshop in Combinatorial Problems in Knots and 3-manifolds at MSRI, Berkeley in January, then on "Knotted surfaces and 2-categories", at the Workshop on Higher Category Theory and Physics at Northwestern University in March, and about "A combinatorial description of knotted surfaces and their isotopies" at the American Mathematical Society meeting Special Session on Knot Theory and 3-manifolds at the University of Maryland.

Fred Zerla gave an invited address on "Fermat's Motivation" at the Florida Section Meeting in Tallahassee in February.

STUDENT NEWS

Since the last issue, the following degrees have been awarded:

B.A. in Mathematics
Linley May Cahill
Andreia Correia
Jennifer Lynne Herl
Minna Riitta Johanna Huttunen
Peter Bassmi Ibrahim
Myong Ok Kim
Ji Su Lee
Victor Anthony Loher,
Summa Cum Laude
Wendy Lenn Pognon
Richard Austin Raver
Ilfra Verna Raymond
Keith S. Richter
Peter Francis Ticola
Jason Matthew Wetherington

CENTER FOR MATHEMATICAL SERVICES

by Ken Pothoven

The Center for Mathematical Services continues to be involved in outreach and service activities to the service area of the University. Some recent activities of note are the following.

Beginning on June 12, for the 19th consecutive year, the Center began offering summer programs for gifted and high achieving secondary students. This year 175 students from Hernando, Hillsborough, Pasco, Pinellas, and Polk counties participated in the programs. There were three programs: the Mathematics and Science Program for junior high students, the Mathematics and Engineering Program for high school students, and the Biomedical and Life Science Program for high school students. Faculty and teaching assistants from the Departments of Biology, Chemistry, Mathematics, Physics, and Engineering served as instructors in the programs. Funding was provided through various grants with the counties, the Academy of Applied Science, the USF Institute for Biomolecular Science, and the Florida Department of Education.

During the Fall and Spring semesters, the Center hosted technology seminars for area secondary teachers and college teachers. The seminars this past year focused primarily on using calculators and calculator-based laboratories in the instruction of high school and introductory level mathematics courses. Further seminars are being planned for the Fall.

The Center is also planning a Mathematics Field Day in the Fall. Tentatively set for November 13, the Center hopes to invite 200 high ability high school juniors and seniors together with 30 to 40 high school mathematics teachers from counties contiguous to USF to the campus for a day to be treated to some special mathematics activities and presentations and a tour of the campus. Plans are currently being finalized with the area county mathematics supervisors.

Information about the activities of the Center can be obtained by calling 974-4068.

STUDENT CLUBS

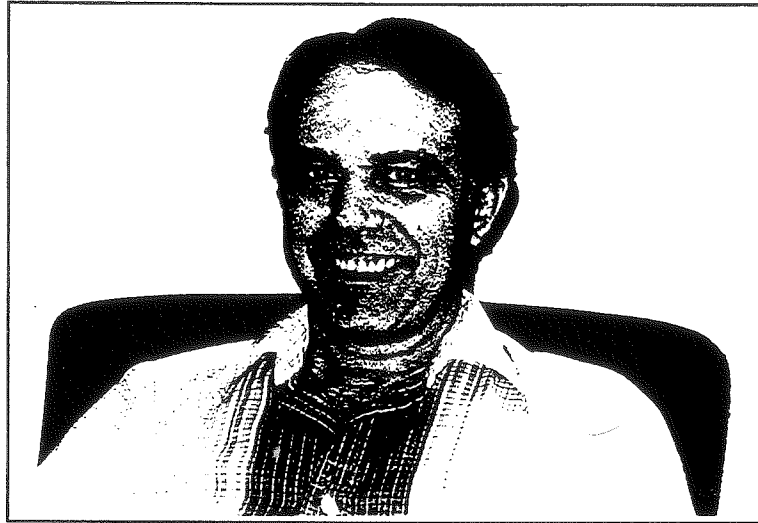
by Fredric Zerla

The USF Student Chapter of the MAA and Pi Mu Epsilon, the Mathematics Honor Society, met jointly this year under the direction of their respective presidents, Wakako Ihara and Nathanael Gay. The eleven regular meetings featured talks by students, new and veteran mathematics and allied faculty members, representatives from businesses that hire math majors, and from the USF Career Development Services. Members traveled to Florida State University to attend the Annual Meeting of the Florida Section of the MAA and to the Florida Power Building in St. Petersburg to attend a Conference on Practical Applications of Mathematics, at which representatives from several industries told of their responsibilities and the need for mathematics in what they do. The clubs hosted two Hillsborough County Math Bowls at the Marshall Center at which over two hundred high school students from the public junior and senior high schools participated in mathematics competitions. The year closed with the Pi Mu Epsilon Induction Banquet at which nine new members were inducted into the honor society.

ALUMNI NEWS

Since the last issue of the *Quaternion*, we have heard from two more alumni.

Greg Budzban (Ph.D. 1991) reports that he has been recently promoted to Associate Professor with tenure at Southern Illinois University. His most



recent publication, with I. Ruzsa, appeared in the January 1997 issue of *Journal of Theoretical Probability*.

Tim Terry (M.A. 1980) reports that he taught as an adjunct for 10 years (1985-1995) in the College of Engineering at the Sarasota campus of USF. He is currently chair of the Mathematics Department at Lemon Bay High School in Englewood, Florida.

FACULTY PROFILE

A Glimpse Into the Life of Marcus McWaters

I am sure that all of us have had a conversation with a stranger that went like this:

STRANGER: What do you do?
 YOU: I teach at USF.
 STRANGER: What do you teach?
 YOU: What is your worst subject?
 STRANGER: Math
 YOU: Bingo!

Thirty some years ago, Dr. Marcus McWaters could have been the stranger in this conversation. Marcus went to Louisiana State University in New Orleans (now UNO) majoring in Philosophy and Literature. His most hated subject was math. That is until he met Prof. James Watson Ellis, a good mathematician and a brilliant pedagogue. Ellis "tricked" him into Mathematics and to this day, Marcus is holding a grudge

against him. Begrudgingly or not, Marcus got his Ph.D. in Topology from the University of Florida and a position in the Math Department at USF.

Good things come from Mathematics: from that point on, mathematics influenced his life in more ways than anyone could have predicted, for he fell in love with Debbie, a student in his class, who later became his wife and mother to their two daughters, Sharon and Renee. Now, Debbie is the director of the Broadway Theatre Project and the assistant choreographer for the widely acclaimed musical "Chicago", starring Ann Rienking and Bebe Newirth (whose dad is also a topologist). The show just won five Tony Awards. When Dr. McWaters is not rubbing shoulders with celebrities, he is rubbing them with us.

In the midst of his own career, Marcus became interested in computers and has become a consultant to private companies and every one of us in the math department on the uses of PCs. Three years ago, Marcus became the Associate Chair in the department.

Despite his thirty years' service to the University, and the administrative position, he is still universally loved by everyone. His easy-going personality, friendliness, and sense of humor allows him to get along with just about anyone. His greatest turn-off in life is arrogant people. Turn-ons are skiing (water and snow) racquetball, and ... his wife.

COURSE REVISIONS

Much of the undergraduate program is under review. The major changes are: A new course, MGF 3301, Bridge to Abstract Analysis, was launched. It has Calculus I as a prerequisite and it, in turn, is a prerequisite to Linear Algebra. Multivariate Calculus (MAA 4211) has been canceled and Intermediate Analysis, formerly MAA 4212, has been renumbered MAA 4211. Further changes may be announced next year.

PROBLEM

There was an error in the solution to the coin problem published in an earlier issue. The correct solution is as follows. Here is the problem: "You are given six kupons (i.e., 6 coins), five of them are identical in weight, but one has a different weight because it is counterfeit. A scale (not a balance) with a digital readout is available for your use. Find a way to locate the counterfeit coin with only three predetermined weighings."

Suppose the coins are I, II, III, IV, V, VI, and the good coins are of weight w while the bad one is of weight W . Weigh I, II, III, IV together, to get A , and weigh III, IV, V, and VI together to get B . If $A = B$, then $A = B = 3w + W$, so the bad coin is III or IV, and we can weigh I, II, III, and V and see which it is. If $A \neq B$, then weigh I, III, V, to get C . If C is $3/4$ of A or B (say of A) then $C = 3w$, $A = 4w$, and the

bad coin is VI (if C is $3/4$ of B , then the bad coin is II). If C is not $3/4$ of either A or B , then $C = 2w + W$, so $A + B - C = 5w$, and we can see which of A or B is a multiple of w (suppose it was A) and so figure out which coin is bad (as A is a multiple of W , the bad coin is V or VI, and as $C = 2w + W$, the bad coin must be V).

The second problem was incorrectly stated, so here it is again. A special card deck consists of

$2^0 = 1$ card with 1 on one face and 2 on the other,

$2^1 = 2$ cards with 2 on one face and 3 on the other,

$2^2 = 4$ cards with 3 on one face and 4 on the other,

$2^3 = 8$ cards with 4 on one face and 5 on the other,

...
 2^{k-1} cards with k on one face and $k+1$ on the other,

A randomly-selected card is placed so that each face is visible to exactly one of two gamblers. Given only the number seen, they bet \$1 on the value of the number seen by their opponent. If there is a unique winner, he/she takes all. How should a player bet? There are two cases: you know what k is, or you don't know what k is.

CHAIRMAN'S COMMENTS

(Continued from Page 1)

[Remarks by Professor Williams... Carl Sagan (later) called this the Cosmic Connection. You are correct, stars can build a whole periodic chart from Hydrogen, but it is not done exactly as you suggest. In small stars, like the Sun, Hydrogen fuses to Helium and Helium fuses to Carbon. Then fusion stops because the Sun's mass is too small to generate any more heat required for further fusion. In the larger stars, the fusion continues until iron is formed. The binding energy of iron is an extremum over the atomic weights and so neither fusion nor fission of iron will produce energy. When stars begin to fuse iron, they implode forming a neutron star or possibly black hole. The formation of neutrons releases a shock front of neutrinos which meets the star's outer layers that are still on their way in to join the implosion. This immediately blasts the outer layers out again creating the supernova. Elements heavier than iron are fused in the supernova explosion. Astrophysicists are studying SN1987 now to try to follow the nuclear reactions that are occurring to test their theories. Of course 'magical property' is not proper scientific terminology.

Response by Professor Stark... Ah Ha! so this is why my kayak is made from a carbon composite rather than iron.]



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