



Quaternion

Department of Mathematics Newsletter



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CHAIRMAN'S COMMENTS

In this election year, another area where Mathematics is relevant comes to mind; the area is voting systems. This is a part of mathematics called game theory, which deals with decision-making processes.

"Is Democracy Mathematically Unsound?". This was the question posed by an article of the same title in a 1985 issue of Science Digest. The article goes on to point out how the quasi-mathematical Nobel prizewinning work of Kenneth Arrow in the 50's, the so-called "impossibility theorem," shows that a perfect democracy is impossible.

We are probably all aware that a seemingly democratic voting system can yield surprising undemocratic results. Consider three equally distributed groups A, B, and C of eligible voters whose preferences on a non-amended motion (NM) or the motion as amended (AM) or against the motion entirely (N) are as follows:

	A	B	C
1st Preference	N	AM	NM
2nd Preference	AM	NM	N
3rd Preference	NM	N	AM

Clearly since the amendment is voted on first and A and B prefer the amended motion to the non-amended motion, the amended motion will be voted on second. Since A and C favor no motion over against the amended motion, the amended motion will paradoxically fail even though two-thirds of the voters favor the amended motion versus no motion.

Mathematical paradoxes also arise in the

process of apportionment of seats such as in the House of Representatives. One paradox, called the "Alabama paradox", apparently went unnoticed from 1850 until 1910 while a method due to Alexander Hamilton was used to apportion seats in the House. The method apportions seats by assigning to each state the number of representatives found by simply multiplying the state's population by the ratio of the total number of House seats to the total U.S. population and taking the integral part of the result. If the total number of seats then allocated was less than the designated number of seats in the House, the House was filled by allocating additional representatives to states with the largest discarded fractional parts.

The "Alabama paradox" which resulted is demonstrated in the following hypothetical five state union.

State	Population	26 House seats	27 House seats
A	9,061	9.061	9.410
B	7,179	7.179	7.455
C	5,259	5.259	5.461
D	3,319	3.319	3.447
E	1,182	1.182	1.227
Total	26,000	26	27

With 26 House seats, D would be allocated 4 seats since it has the largest fractional part (.319) and the sum must be 26. However with 27 House seats, states B and C are each allocated an additional seat while state D suffers double jeopardy by also losing a seat.

As reported in Science Digest, after 1910 "eminent mathematicians paraded before the House and offered sophisticated numerical formulas, incomprehensible to most of the politicians, for avoiding the Alabama paradox".

The result was a bill signed in 1941 by President Roosevelt.

For more information regarding the mathematical means of apportionment, the reader is urged to read about this application of mathematics in an article entitled "The Quota Method of Apportionment" by M. Balinski and H. P. Young in the American Mathematical Monthly, vol. 82. Yes, the sphere of mathematical applications extends even into politics.

DEPARTMENT NEWS

Dr. R. Darling attended the conference on Stochastic Processes at Gainesville on March 3 and gave an informal presentation on the Central Limit Theorem for Stochastic Difference Equations. A monograph on "Constructing Non-homeomorphic Stochastic Flows" by Dr. Darling was published in the Memoirs of the AMS, #376.

Dr. A. W. Goodman presented a talk entitled "The Complete Multivalence of Caalov-Distler Sums" at the annual meeting in January of the American Mathematical Society.

Dr. Goodman's article on "The Derivative with Respect to a Point" was published in volume 101 of the Proceedings of the American Mathematical Society, and he co-authored an article with I. J. Schoenberg on "A Proof of Grace's Theorem by Induction" that was published in volume 9 (1987) of the Honam Mathematics Journal.

Dr. J. Liang was an invited speaker at the AMS special meeting on Finite Field Theory and Applications in Knoxville on March 26.

The title of his address was "On Some Problems of Extended Fundamental Classes Over a Finite Field."

Dr. G. McColm gave a talk entitled "Introducing Partial Parametrization" at the UCLA Logic Conference on January 30.

Dr. A. Mukherjea was invited to speak at the Oberwolfach (West Germany) Conference on Probability in January. In February, he was an invited speaker at the Indian Statistical Institute and presented a talk on "Convolution Products of Non-identical Distributions." In March at the AMS special session on Stochastic Processes at Knoxville, Dr. Mukherjea spoke on random matrices, based on a joint paper with Dr. R. Darling. Dr. Mukherjea also participated in the conference on Stochastic Processes at Gainesville in March.

Dr. E. Saff has been invited to the Steklov Institutes in Leningrad and Moscow in June. In addition to lecturing, Dr. Saff will attempt to arrange an exchange program with the Institute and USF.

Dr. F. Zerla wrote the Calculus Individual and Team Tests for the King High School Invitational Mathematics Tournament held at King High School on March 26th.

FACULTY PROFILE

Professor W. Richard Stark grew up in Lexington, Kentucky, across the road from the University of Kentucky. His mother and grandfather were professors; his father and several other relatives were engineers. As a high school student he studied chemistry at the University, but when he eventually enrolled at the University he found himself more drawn towards physics and mathematics, in which he took his B. A. in 1968. While still an undergraduate he married Judy Ingrao; they now have a son, Chris, aged 16.

Stark had studied the work of the logician S. Kleene while still an undergraduate at Kentucky. After graduating, he went to work under Kleene at Wisconsin, a major center for mathematical logic, model theory, and set theory. He was supported financially by a research fellowship and by his wife Judy. He obtained his Ph.D. in 1975 with a thesis on

independence proofs and forcing for infinitary logics. The years 1974-1977 were spent at the University of Texas at Austin, where Stark held a visiting position. During this time he worked on compactness proofs and other highly abstract problems in mathematical logic. While at Texas he also developed his avocation for Arctic exploration during a trip to Alaska.

In 1978 he was looking around for a permanent position, and first went to California State University at San Jose. As it turned out, California State didn't suit him, and the following year he moved to USF, where he is currently an Associate Professor. However a major benefit of his time in the San Francisco area was his interaction with researchers at Stanford, notably John McCarthy, who posed to him the problem of developing the algebraic structures and theories necessary for distributed computing. Since then, distributed computing has been the major theme of Stark's research.

His expertise in this area has led to consulting work for the U.S. Army Center for Electronic Command and Communication (1983-84, and 1987-present), and to a staff position at AT&T's Bell Laboratories from 1984 to 1987. He has made major contributions to the understanding of the behaviour and capabilities of large networks of parallel processors.

He has published about 15 refereed research articles in major research journals, about 30 unrefereed articles and reviews, and about 20 additional research papers which have not been published because they are D.O.D. classified "secret", or AT&T "proprietary". Besides distributed computing, his other areas of expertise are mathematical logic, model theory, LISP, artificial intelligence, signal processing, logical and algebraic aspects of computing, and representation of knowledge. John Wiley has contracted to publish Stark's book on LISP and the Lambda Calculus.

His service activities at USF include membership of the Joint Engineering - Natural Sciences Supercomputing Committee, associate directorship of the Institute for Constructive Mathematics, and chairmanship of the Natural Sciences Computing Planning Committee. He has also contributed substantially to the design of the University's program in Theoretical Computer Science.

For a Florida resident, his hobbies are quite unusual: skiing, mountain climbing, and Arctic exploration!

PI MU EPSILON NEWS

The Florida Epsilon Chapter of Pi Mu Epsilon Fraternity, under the leadership of its President, Richard Moscatello, and Faculty Correspondent, Dr. Fredric Zerla, continued its series of presentations with the theme, "The Year of the Student". The final talk of the Fall Semester, given on November 23, "Tessellations of the Escher Type", was by Kathryn Demas, a graduate student in Mathematics Education. The first talk of the Spring Semester, "The Theory of Round Robin Tournaments", was presented on January 25 by Charles L. Osborne, a senior mathematics major. On February 8, we introduced a new faculty member in the Department of Mathematics to our members. Professor Mourad E. H. Ismail celebrated the centenary of the birth of the great Indian number theorist in his talk, "Ramanujan's Life and Work". On February 22, William B. Wilder, a senior mathematics major, told of the new study, "Fractals". Our next two presentations were by distinguished visitors to the Department of Mathematics. On March 7, Professor Kamen Ivanov of the Bulgarian Academy of Science spoke on "Whitney's Numbers". On March 28, Professor Vilmos Totik of Szeged University in Hungary asked, "Why Are Bounded Harmonic Functions Constant And How Is This Connected To Brain Surgery?" On April 11, this year's series of presentations came to an end with the invited address by this year's Outstanding Scholar, senior mathematics major, Keith A. Terry.

The annual Induction Banquet was held on April 22. The new members selected in Semester III are: Barbara S. Grimm, Keith A. Terry and Thomas Johnson Wangerman. Those selected in Semester I include Martha K. Cannon and Charles Lawrence Osborne. In Semester II, the following were invited: Brian E. Fielding, Paul Franklin Hodges, Suzanne Athlene Mills, Todd Davis Piersall, Maria L. Rametta, Gwiyeon Shim, Ellen Rachel Stickell and William B. Wilder. Dr. Leon Mandel, Dean of the College of Natural Science, addressed the inductees and their families with a talk on "Creativity: Science or Education".

VISITING FACULTY

Present in the Department as visiting faculty during Semester II were the following mathematicians: Professors Zhu-Rui Guo and Zhen Sha of Zhejiang University in Hangzhou, China; Professor Vilmos Totik of Szeged University in Hungary, and Professor Kamen Ivanov of the Bulgarian Academy of Science. Professors Guo and Sha are participants in the Chinese Exchange Program of the Department with Zhejiang University.

MAA NEWS

The twenty-first annual meeting of the Florida Section of the Mathematical Association of America was held at Rollins College in Winter Park on March 4 and 5. The program featured talks by several eminent mathematicians. Carl Pomerance of the University of Georgia spoke on "The Georgia Factoring Project". Leonard Gillman of the University of Texas, President of the Mathematical Association of America, discussed "An Obvious Induction". Howard Eves, Professor Emeritus of the University of Maine, now a member of the adjunct faculty of the University of Central Florida, told of his calendar of mathematical events in his talk, "What Happened on March 4 and March 5?" Participating from the Department of Mathematics were Dr. Kenneth Pothoven, Chairman, who attended the annual meeting of departmental chairmen. Dr. Fredric Zerla, President of the Florida Section, presided at the sectional meeting. Dr. Zerla also chaired the Sessions on Student Papers. Two students presented papers. Kathryn Demas, a graduate student in Mathematics Education, discussed "Tesselations of the Escher Type". Paula Jones, a senior Mathematics major, presented, "Mathematical Symmetry in Art and Nature". Both students were awarded a student membership in the MAA by the Association. The Program Vice President for this meeting, charged with constructing its elaborate agenda of events, was Ignacio Bello, who earned a Masters Degree in Mathematics from USF several years ago and now is often a member of its adjunct faculty. As a final note, a drawing was held for a 10-speed bicycle donated by Scott, Foresman and Company, Publishers. The winner was Dr. Pothoven.

The Twelfth Annual Suncoast Regional meeting of the Florida Section of the MAA was held at the Dale Mabry Campus of Hillsborough Community College on December 4. Dr. Pothoven participated in a panel discussion on "The RAISE Bill - Four Years Later!" Dr. Zerla helped to coordinate the meeting and presented a talk on "Who Really Invented the Pythagorean Theorem?" The meeting concluded with an informal dinner at CDB-Uptown/Downtown on the Franklin Street Mall.

INSTITUTE FOR CONSTRUCTIVE MATHEMATICS

The ICM recently completed a consulting project for Florida Power and Light Company. In the operation of two nuclear power stations, Florida Power and Light has an ongoing list of hundreds of plant modifications, some of which will assist in the efficiency or safety of the plant, and some of which are mandated by regulatory agencies. The mathematical problem passed to the Institute was to look at the existing algorithm for ranking the modifications in order of priority, and to suggest alternatives. The final report on the first stage of this project, which was submitted in February, contains a new algorithm developed by Professors Darling, Saff and Snader. Florida Power and Light Co. is so pleased with the new method (which produces radically different rankings to the old method) that it is already proceeding to implement the method.

CENTER FOR MATHEMATICAL SERVICES

Since the Center for Mathematical Services has reported several of its activities in past issues of the "Quaternion", you may recall reading about one of their largest activities, the summer programs for gifted secondary school students. They run five such programs, three in Hillsborough County and two in Pinellas County. They are on the schedule again for this summer, in which incidentally, begins their 10th year. Four of the programs have a second year component now, which means secondary school students may spend up to five summers attending these programs

at USF. The programs cover not only Mathematics, but also Computer Programming and various topics selected from Engineering and the Physical and Life Sciences. The exact topics covered depend on the USF faculty members who are teaching, but all of the material is at the college level and definitely outside the range of the normal secondary school curriculum. Senior high school students, in addition to receiving high school credit for completing the program, may elect to receive college credit. Support for these programs comes from: the State of Florida Department of Education; the Center for Excellence in Mathematics, Science, Computers, and Technology at USF; and local school districts (Hillsborough, Pasco, Pinellas, and Polk). Since there is no residential program, participation from other nearby counties is limited. Students who wish to attend from these counties must arrange their own transportation. Other support comes from local businesses and industries, which provides funds for scholarships.

In the summer of 1987, 182 students representing 4 counties attended these five programs. Several of these students received recognition for their excellent performances, and three were awarded USF Freshman Scholarships.

The lecture series sponsored by the Center for Excellence in Mathematics, Science, Computers and Technology and the greater Tampa Chamber of Commerce was again conducted by CMS. As the end of the season nears, ten lecturers have given 116 talks to almost four thousand students. The topics of some of the lectures, while falling under the broad category of Mathematics in Today's World, include practical information on "Mathematics and Careers", "Uses of Algebra", and "Probability".

Anyone requiring further information about these or other programs of the Center should contact:

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University of South Florida
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ALUMNI CORNER

Robert W. Jernigan earned his B. A. and M.A. in mathematics, and a Ph.D. in statistics, all from the University of South Florida. His major professor for his Ph.D. was Dr. C. P. Tsokos. Following graduation, Dr. Jernigan took a position in the Department of Mathematics, Statistics, and Computer Science at the American University in Washington, D.C., where he is now a full professor. Since 1984, Dr. Jernigan has also been employed as a senior statistician at the Statistical Policy Branch of the Office of Standards and Regulations of the U. S. Environmental Protection Agency. Dr. Jernigan is a fellow of the Washington Academy of Sciences, and was the recipient of the 1985-86 Scientific Achievement Award for Mathematics and Computer Sciences from the academy. He is also a member of the American Statistical Association, the American Association for

the Advancement of Science, the Mathematical Association of America, Sigma Xi, and Phi Kappa Phi. He has published over a dozen articles in refereed journals. His research interests include statistical computing, time series analysis, mathematical modeling and mathematical ecology, spatial statistics, and stochastic processes. Dr. Jernigan resides in Rockville, Maryland with his wife Rose and daughters Nicolas and Laura.

RECENT COLLOQUIUM TALKS

Professor Philip Rabinowitz, Weizman Institute of Science, Israel, spoke on January 13th on "Product Integration Based on Hermite-Fejer Interpolation".

On January 28 and 29, Professor Bruce C. Berndt of the Department of Mathematics of

the University of Illinois gave two talks in observance of the Centenary Celebration of the great Indian mathematician Srinivasi Ramanujan. His talks were entitled "Gauss, Landau, Ramanujan, the Arithmetic-geometric Mean, . . . A Non-technical Discussion" and "Ramanujan's Modular Equations . . . A Technical Overview".

Professor Teng Zhen-huan of Peking University presented a talk on March 21st entitled "Particle and Vortex Methods for Partial Differential Equations".

Professor A. Sharma of the University of Alberta, spoke on "Some Recent Results on Enquiconvergence" on April 6th.

A talk entitled "Pade Approximants" was presented on April 11th by Professor Herbert Stahl of Technische Universitat, Berlin.

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