Quaternion

Department of Mathematics Newsletter

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CHAIRMAN'S COMMENTS

"USF lures more scholastic stars" was the title of a recent (September 28) article in the St. Petersburg Times. The article went on to describe an "emerging trend" at the University of South Florida - that of top students choosing USF over rival state schools in Florida, the east, and the southeast.

Several observations were cited to show the improvement in the profile of USF students. Among these were: (a) the average SAT scores for incoming freshmen at USF have increased more than 8% since 1980 (to an anticipated average of 1027 for fall 1987) versus an average increase of less than 2% nationwide; (b) Barron's college guides now rate USF as a school with a "very competitive" admission policy along with schools like the University of Florida, the University of North Carolina at Chapel Hill, and the University of Texas at Austin; and (c) in the fall of 1986, USF had 70 students receiving National Merit Scholarships versus only two students in 1981, the first year that USF participated in the program. In an editorial on the following day complimentary to USF's progress and referring to (a) and (b) above, the Times said, "These are unmistakable signs that USF is moving ahead in the realm where it counts most -the quality of its students and the quality of the education they are offered".

The Department of Mathematics is in tune with these trends. Over the past several years it has developed two programs for top students who wish to major in mathematics. They are the departmental Honors Program in Mathematics and the Accelerated BA/MA Program in Mathematics. The Accelerated BA/MA Program in particular is designed for students such as National Merit scholars who wish to jump ahead in their academic work in mathematics by pursuing graduate level work as undergraduates. Both of these programs have been described in previous issues of the newsletter. More information can be obtained by writing to the Department.

PI MU EPSILON NEWS

The Florida Epsilon Chapter of Pi Mu Epsilon Fraternity has declared this year the Year Of The Student. At least every other presentation should be by a student. In the Fall Semester, we also are continuing a long standing tradition of the Chapter in introducing new faculty members of the Department of Mathematics to the students by inviting them to present talks on their activities. On August 31, Richard Moscatello began the year by telling, in his Presidential Address, of his summer research on "Methods for Solving a Small Advertising Campaign Game." On September 14, Professor Boris Shekhtman, the first to speak of the three faculty members who joined the department last year, discussed, "Adventures in An Infinite Dimensional Space." On September 28, Doug Woolley, student member and, in his senior year in high school, winner of the State PRIDE Competition in Mathematics, told of his hobby in a talk on "Number Communication in the Bible." On October 12, Professor Richard W. Darling, also new to the department, spoke on "Random Transformations." Other talks were on October 26 by Paula Jones, a senior mathematics major, on "Mathematical Symmetry in Art and Nature," and on November 9 by a new faculty member, Professor Gregory McColm, who discussed a topic from mathematical logic, "What, if Anything, is a Theorem?"

ALUMNI CORNER

In 1975, Anastase Nakassis was the second Ph.D. student to graduate from the department. His Ph.D. defense was chaired by MIT probabilist Richard Dudley. Besides a Ph.D. at USF, Anastase earned a doctorate in mathematics from the University of Paris, a Master's degree in computer science from Johns Hopkins University, and a Master's degree in Economics from American University. He is presently a GS-14 mathematician at the National Bureau of Standards in Gaithersburg. He has also worked as a mathematician at the U. S. Geological Survey. Despite his work at NBS, he has found time to author over twenty-five research papers in probability and algebra in such journals as the Journal of Multivariate Analysis and the Journal of Mathematical Analysis and Applications. Anastase is known to be an excellent chess player and a first class cook. He and his wife and three children live in Gaithersburg.

CENTER FOR MATHEMATICAL SERVICES TRAINEESHIPS AVAILABLE IN APPLIED MATHEMATICS

Bright mathematics undergraduates having a familiarity with the IBM PC and interest in marketing concepts and business decision-making are invited to apply for part-time (not more than 20 hrs/wk) traineeships with General Telephone Data Services.
If you have a GPA of at least 3.0 and are interested in participating in this traineeship program, contact E. B. Saff, PHY 363, ext. 4068.

DEPARTMENT NEWS

PROFESSOR R. DARLING was a visitor at the Laboratoire de Probabilites, University of Paris VI in May and gave a seminar on his joint work with Professor Mukherjea. In July, he was a visitor at the Mathematical Sciences Institute at Cornell University and while there participated in the AMS Summer Research Conference on Geometry of Random Motion. On September 24, he gave a colloquium at the University of Central Florida on Random Transformations, and October 9, gave a colloquium at the USF Chemical Engineering Department on Coalescing Stochastic Flows.

PROFESSOR A. GOODMAN attended the winter meeting of the American Mathematics Society in January. On October 15, he presented a paper on Chromatic Graphs at the Distinguished Professors Luncheon at the University Center.

PROFESSOR J. LIANG was an invited participant at the International Conference in Algebraic Number Theory on August 9 at the Mathematical Institute of Oberwolfach, Germany. He gave a lecture on Representation of Algebraic Integers. Professor Liang also received an award for outstanding undergraduate teaching at the USF Honors Convocation.

PROFESSOR A. MUKHERJEA was an invited participant at an American Mathematics Society Conference on Statistics in Groups at the University of Michigan in June.

PROFESSOR E. SAFF, project director for the Department's Institute for Constructive Mathematics, was recently informed that, pending legislative approval, the Institute will receive a grant from the Florida Trust Fund for Postsecondary Education. The funds will be used to enhance the transfer of technology and knowledge of mathematics among scientists, engineers, and mathematicians in academe and industry. An estimated 100 scientists, engineers, and professionals will exchange ideas and collaborate on research with faculty.

PROFESSOR R. STARK has returned after two years of research at the AT&T Bell Laboratories in New Jersey.

PROFESSOR F. ZERLA gave an invited address entitled "The History of Imaginary Numbers" to the Florida Association of Mu Alpha Theta at their Twelfth State Convention on May 2. Professor Zerla also gave an invited address entitled "Geometric Topics and Those Who Discovered Them" on October 16 at the Florida Council of Teachers of Mathematics, 35th Annual Conference, in Fort Myers.

On sabbatical this year are Professors S. Lee at the University of Delaware, K. Nagle at the University of Texas at Arlington, and M. Parrott at Vanderbilt University.

NEW AND VISITING FACULTY

New faculty to the Department this year are Professors Mourad Ismail and Kandethody Ramachandran. Professor Ismail comes to USF from Arizona State University along with four of his graduate students. His expertise is in the areas of approximation theory, orthogonal polynomials, and special functions. He received his Ph.D. degree from the University of Alberta in 1974.

Professor Ramachandran comes to USF from Brown Unversity where he received his Ph.D. in 1987 under the direction of Professor Harold J. Kushner. Dr. Ramachandran's research areas include deterministic and stochastic control.

Among faculty visiting the Department this year for a semester or more are Professors Zhu-Rui Guo and Zhen Sha of Zhejiang University in Hangzhou, China; Professor Jine Liu from Hubei Teachers College in China; and Professor Vilmos Totik from Szeged University in Hungary.

STUDENT NEWS

In the Summer Semester, 1987, the following USF students received degrees in Mathematics:

VIRGINIA CLARSON received a Ph.D., with a thesis entitled, "Mathematical Classification of Evoked Potential Waveforms" (Advisor: Professor Liang); she is now working on pattern recognition and artificial intelligence at the E Systems Corp. in Clearwater.

DAVID KERR received a Ph.D., with a thesis entitled, "Perturbation of Monotone Operators in Banach Spaces" (Advisor: Professor Kartsatos); he now has a position at the Unviersity of North Carolina at Asheville.

MEHRDAD SIMKANI received a Ph.D., with a thesis entitled, "Asymptotic Distribution of Zeros of Approximating Polynomials" (Advisor: Professor Saff); he now has a position at Oakland University in Michigan. Master of Science degrees were awarded to Diana Harmon, Wanq-der Lee, William Martin, Scott Meeker, and Yan-hua Wang. Bachelor's degrees were awarded to Alexandra Connolly, Michael Foley, Sondra Livermore, and John Wilhelm (Cum Laude).

FACULTY PROFILE

EDWARD B. SAFF

Edward Saff moved with his parents to Florida from New York when he was thirteen. He enrolled as an undergraduate at Georgia Tech., intending to become a ceramic engineer, but was attracted to Mathematics by the lecture courses of W. J. Kammerer. After receiving his B. S. (with highest honors) in 1964, he went to the University of Maryland as a graduate student in Mathematics. He chose as his advisor J. L. Walsh, a senior expert in complex functions and approximation theory, who had lately moved to Maryland from Harvard; Walsh was "a marvelous person to work with", with whom Saff had an excellent relationship, and wrote two joint papers. Saff married Loretta Singer in 1966, and in 1968 he received his Ph.D. Next he spent a year at Imperial College, London, supported by a Fulbright Scholarship, which he calls "one of the most intelligent decisions I ever made". His intention was to strengthen his function-theoretic background (W. K. Hayman was then at Imperial College), but in England he also forged a set of contacts with British and visiting mathematicians which have led to collaborative work spanning two decades; e.g. Peter Graves-Morris, A. Iserles, Steve Ellacott, and Jim Clunie.

Saff came to USF in 1969. There were three things which attracted him: there were four complex function theorists at USF, including A. W. Goodman; his brother Donald worked in the Art Department; and he liked Florida, where his family lived. He became an Associate Professor in 1971, a Full Professor in 1976, and a Graduate Research Professor in 1986.

A considerable influence on his career has been R. S. Varga, also a student of Walsh, who visited USF in 1972. This influence has led Saff to focus on constructive methods of approximation, and Varga and Saff have co-authored about 25 papers.

During the last twenty years, Saff has written nearly 100 papers, many of them jointly with other mathematicians. He says that he particularly enjoys collaborative research. He is the co-author of two research monographs, three textbooks, and has edited three volumes of conference proceedings. He is the Editor-In-Chief of the Springer journal Constructive Approximation, whose editorial office is here in the Mathematics Department. Since 1970, he has received continuous support from major research grants from the National Science Foundation and the Air Force, as well as numerous smaller grants for travel and conference support. In 1978 he was awarded a Guggenheim Fellowship to spend a semester at Oxford University, England. He has made many foreign visits, for example, to Eastern Europe and China; the latter led to an ongoing exchange program between USF and a Chinese university. He currently has half a dozen research students, mostly from the People's Republic of China.

Besides his research achievements, Saff has made a substantial service contribution at USF. After helping to found the Center for Mathematical Services in 1978, Saff served on Florida's Task Force on Science, Mathematics, and Computer Science (1982-83). He has also authored 16 successful proposals for Training Grants awarded to the Center for Mathematical Services. He now runs the Institute for Constructive Mathematics, which attracts visiting researchers from all over the world, and is Associate Director of the Center for Excellence in Mathematics, Science, Computers and Technology.

How does he combine his administrative functions with his prodigious research output? He says that his day's work from 9:30 til 5 is devoted to administration and teaching, and he does his research from 10 p.m. to 2 a.m. after his family (daughters aged 16, 14, and 5) have gone to bed.

DISTRIBUTED PROCESSES, MATHEMATICS, AND NEURAL NETWORKS

Nature is the ultimate source of the mysterious and the beautiful. Of her mysteries, some of the most spectacular and evasive have been phenomena that have recently become known as distributed processes. Distributed processes are seen in the evolution of life, in the interaction of life forms in ecosystems, in the internal operation of multicellular organisms, in animal brains, in insect societies, in social institutions, in human society, and recently in the most advanced computers. These processes and their central problem have been the object of scientific, mathematical, and philosophical speculation for hundreds of years. But, it seems that a fundamental feature of them has -- until recently -- stood in the the way of non-trivial progress.

What exactly are distributed processes, what is it that they process, and what is this fundamental feature which has kept them out of reach? A distributed process is a large collection of simple semi-autonomous individual processes linked together by some form of communication. They process a variety of things: information, the chemicals of life, energy, or the materials necessary to build a nest for a colony of insects. An abstract view suggests that information processing is the root of it all (e.g., if a molecule is a word expressing information, then metabolism can be viewed as a form of information processing). Distributed processes tend to exist at two levels: a very fine-grained local level, and an almost unbelievable global level. Look at multicellular organisms: at the local level there is the relatively simple internal processing and intra-cellular communication of individual cells, at the global level there is life. In a brain, the simple activities of neurons are the local level while intelligent thought and even consciousness are processes at the global level. You'll see this local-global dichotomy in processing in the other examples too. This is the fundamental feature mentioned above.

The central problem -- the development of theories supporting a general understanding of the mechanisms which lead from the local to the global -- had remained out of reach largely because of this dichotomy. The conceptual gap between the two levels of processing is usually enormous and lacking the intermediate stepping stones that would allow systematic bridging.

Things began to change in the 1970's. As soon as engineers could produce an entire computer on a silicon chip about the size of a postage stamp, other engineers planned to join large numbers of them into a communicating networks. Now most major computer manufacturers are building experimental distributed processors, with the largest commercially available machine composed of up to 64,000 very small individual computers (this year's number). Having real machines to work with seems to be providing the missing stepping stones. Scientist now have the opportunity to create their own distributed processes from the ground up (i.e., from the local level to the global). But, when programmers and scientists sat down at these new machines (a.k.a., parallel computers), they had very little success in developing non-trivial programs. They had almost no idea of how to orchestrate the local processes into an impressive global process.

"Where are the paradigms?" "How do we develop a general understanding of programming powerful global processes from communicating local processes?" These questions were passed up the ladder to all sorts of experts. Natural scientists had some answers, but to be really useful they needed to be abstracted and expressed as an mathematical theory. After years of looking into appropriate corners of mathematics, very few answers were found. Eventually it became evident that the vast array of tools and techniques that mathematics has collected over the last two or three thousand years had little if anything to offer. The ideas of communication between computations and its role in creating a new and different global computation has not been a traditional part of mathematics.

In particular, the very successful abstract theory of computation developed since the 1930's -- a theory which had discovered the existence of absolutely "unsolvable problems", which included the legendary theory of Gödel, and which had answered all the fundamental questions of traditional computation, was seen to be off track as far as distributed processing is concerned. Quite possibly, this classical mathematical theory of computation is to the required theory as classical Newtonian mechanics is to quantum mechanics. An opportunity for very significant new work in theoretical computer science and the abstract mathematics of computation is present.

In the Mathematics Department, a group consisting of new faculty members Greg McColm (recently arriving from UCLA, with expertise in abstract mathematical theories of computation), K.M. Ramachandran (from Brown University with expertise in stochastic processes), and established members Edwin Clark (abstract algebra), Joseph Liang (abstract algebra), and Richard Stark (abstract mathematical theories of computation) is currently working in this area. As a group, our ultimate objective is to contribute to this new mathematical theory of computation (for distributed processes). Such a theory will provide a solution to the central problem as described above. Presently, the group's efforts are focused on the computational properties of a particular model of distributed processing known as neural networks. There are many abstract models of distributed processing, but neural networks were chosen as this year's focus.

A neural network is a mathematical abstraction of a brain-like computer and at the same time it is a real object (AT&T Bell Laboratories has been fabricating large neural networks since 1985). At the level of local processing they are composed of neurons -- two-state processors which asynchronously change state on the basis of a weighted sum of the states of their neighbors (this involves communication). At the global level they have been programmed to solve large NP-complete problems ("hard" problems of artificial intelligence). For example, a 150-location traveling salesman problem was solved in a specially designed neural network in a few milliseconds -- whereas to have solved the problem on a Cray supercomputer could have taken over a month!

RECENT COLLOQUIUM TALKS IN THE DEPARTMENT

Professor Bernard Pinchuk of Bar Ilan University spoke on "Minimal Distances in Conformal Maps" on August 31.

Professor Annie Cuyt of the University of Antwerp spoke on "Multivariate Rational Hermite Interpolants" on September 4, 1987.

Professor George Cantopulous of University of Athens spoke on "Recent Development in Cosmology" on Ocotober 16.

Professor Rudolf Dvorak of the University of Vienna (Austria) spoke on "Chaotic Motions of Satellites" on October 23.

Professor George Lorentz of the University of Texas at Austin spoke on "Bernstein-Type Inequalities in the Approximation Theory" on October 30.

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