UTEP DEPARTMENT OF MATHEMATICAL SCIENCES NEWSLETTER

Spring 1994

CALCULUS COURSES TO BE REVISED STARTING FALL 1994

Plans are underway to revise the way calculus is taught at UTEP. A pilot course of a renewed Calculus I is expected to be offered next fall. A committee made up of Simon Bernau (chair), Joe Guthrie, Carl Hall and Ralph Liguori has been at work since Summer 1993 planning the changes. The committee proposes to use what they have learned in their investigations of calculus reform projects at other institutions, incorporating the best of these ideas, curricular and pedagogical, into a renewed calculus curriculum at the University of Texas at El Paso. A complete implementation of this new calculus curriculum over the next few years is planned.

For the University of Texas at El Paso the question is not to devise a totally new and different method of teaching calculus. Rather, it is to find something that has worked in other places and will be applicable to our students and embraced by our mathematical sciences faculty. Current plans include:

- A renewed calculus curriculum based on a combination of the best features of the course materials developed on other campuses.
- Extensive use of graphing calculators as an integral part of the renewed curriculum. All students will be required to own a graphing calculator with power at least equivalent to the TI–85. Faculty will use graphing calculators as a primary teaching tool in the classroom. Assignments and all testing will require use of and familiarity with the calculator.

The renewed curriculum will be predicated on the following principles, which are common to reformed calculus courses at colleges across the United States.

- Topics shall be included because they are critical to the understanding of subsequent topics, or for their utility in dealing with problems that are agreed to be relevant.
- Traditional topics which seem to be in the course solely because they are susceptible of exact solution shall probably be omitted.
- The new curriculum shall exploit graphing calculator technology as a critical tool for its focus on understanding basic principles from geometric, graphical, numerical and analytical viewpoints.
- Homework, quizzes, tests and exams will all require use of the calculator and will be designed with the knowledge that the students' calculators are programmable. Questions requiring demonstrated understanding of principles, synthesis of ideas and numerical or graphical experimentation will make up a significant proportion of all assignments and testing.

A major advantage of requiring every student to own and use a programmable graphing calculator is that teaching algorithmic rote formula manipulation and examining for the same becomes essentially futile. At the same time the computational power in each student's hand should enable more instruction to focus on concept, understanding and use of calculus to solve problems. Class meetings under the new curriculum will provide a mix of traditional lecture with in-class group work.

We expect a modernized curriculum which better reflects what today's students need to know and new teaching techniques incorporating graphing calculators and cooperative learning to revitalize the courses. Calculus will be more interesting, easier to learn, and more relevant to the students. The experience of other universities which have adopted a similar renewed calculus program indicates that as a result of this reform more students will pass these courses and with higher grades .

At present the concept of calculus as a "filter" for beginning majors holds sway in our client disciplines such as engineering and science. We expect the rebirth of calculus as a "pump" which leaves students better prepared to apply the concepts from calculus and more confident and enthusiastic about the learning of challenging material will result in an increase in the number of graduates in those fields.

FROM THE CHAIRMAN'S DESK

There is much to tell you about from last year, including some major achievements.

We were all extremely proud at the Honors Convocation last April. Not just one, but *two* of our colleagues received awards for their outstanding contributions. First, Mike Gray received the Distinguished Service Award. Of course we in the department knew that this award was no more than his due. Mike has been exemplary in his efforts on behalf of students, serving as departmental advisor for many years, then adding a major role in the Academic Advising Center, first as an advisor, then associate director and TASP coordinator. Most recently he has brought the TEXPREP program back to UTEP where it is thriving and growing under his expert care. Second, Carl Hall received the Chancellor's Council Teaching Award. Again, in the department, we did not need the award to tell us what we have known for years. Carl's success and joy in teaching is legendary, and attested by testimonials from colleagues and students over many many years. Congratulations to our two fine colleagues!

Awards have come to our students too. Alex White, who finished his Master's degree last May working with Bill Kaigh received an award from the Graduate School for the best Master's thesis of the year. Alex, and his wife Maria Sorto, another student of Bill's, have moved on to doctoral study at Michigan State University where Maria promptly won an Excellence in Teaching award. Another student, Carmen Thompson, received an award for a poster in the Science Exposition held on campus last spring.

The Biostatistics Laboratory is well into its second year of operation under the direction of Javier Rojo. He has most of his equipment now but the move into newly renovated space in Bell Hall has been held up by delays in moving Computer Center equipment into its new home in the Union.

Last May we gathered for a bittersweet celebration of the retirement of J. R. Provencio and Fred Strauss. The retirement dinner was held at the El Paso Club with a full complement of colleagues, family and friends. If we measure only the success of the evening we would encourage them to retire more often. It was an excellent opportunity to hear from them both and to be reminded, by their friends, of some of the high points of their time with UTEP. We wish them very well for the future. I can also report that retirement is a relative thing. Both have been back to the department on numerous occasions and we are delighted to see them.

In faculty news, for this year Bill Leahey and Loki Natarajan are both on leave. Bill is spending his time here in town, while Loki is visiting at Tufts—not the best winter to be on the East Coast!

We have four visiting faculty members this year, temporarily filling the positions of Bill, Loki, J. R., and Fred. Our visitors are Kazik Alster, from Poland, Fouad Chaatit and Phil Schafer, recent graduates from the University of Texas at Austin, and Steve Gunhouse a recent graduate from Bowling Green State University. We welcome all four, we appreciate their presence and their willingness to learn our ways and help with our students and our mathematics.

(continued on page 4)

ALUMNI UPDATE

Grayce Johnson (Jones), B.A. '41 is living in Nice, California and helping teach math to fifth graders as a volunteer.

George B. Thompson, B.S. '61 of Lompoc, California is retiring from the Department of Defense after 38 years of civil service.

Donna Hatfield (Hoover), B.S. '68 has her own company, Donna's Designs, in Schenectady, New York.

Lelia Hobson (Safi), B.S. '69 is now an attorney with the firm of Scott Hulse here in El Paso.

Peter Rock, B.S. '71 is the business manager and for the Shrewsbury Public Schools and lives in East Brookfield, Massachusetts.

W. Jeanne Bando (Daulton), B.S. '72 uses a Fourier Transform Infrared Spectrometer in her work as a lab technician in Albuquerque.

Robert B. Williamson, B.S. '74 is a senior engineer for Texas Utilities in Arlington, Texas.

Dennis Pugh, B.S. '76 is a systems engineer for Martin Marietta and has been living in Ambler, Pennsylvania.

Carol Russell (Schuler), M.S. '76 has been teaching math and computer science at Indiana University, Southeast and finishing her Ph.D. in Computer Science and Engineering at The University of Louisville.

David A. Dampier, B.S. '84 is a captain in the army in Monterey, California, and is completing a Ph.D. in computer science.

Ceci Flores (Sanchez), B.S. '76, MAT '90 Teaches math at Del Valle High School in El Paso.

Chairman's Desk (continued from page 2)

Our big emphasis this year is on curriculum review at all levels. I am personally very excited about the moves, discussed elsewhere, which we are making in renewing our calculus sequence. The mathematical community at large has been working intensely on this for eight years now. Many new ideas have been tried and we are well positioned to take advantage of what others have learned. Nor is calculus our only focus. Nancy Marcus is experimenting with a modularized version of precalculus I which requires students to be successful on a month's worth of the course before they can move to the next segment, and to repeat the month if necessary before continuing. In a different vein Les Foged has been working with the College of Engineering on an honors enhancement approach to precalculus, which he is trying in the classroom this year.

Mike Gray's TEXPREP program, a summer program for high school students who have talent in math and science, has generated excellent reviews from its first year of operation and a flurry of proposal and planning activity. I congratulate Mike and his helpers on a splendid start.

In fact, we have so much going on just on the curriculum front that if everything we are trying to do is fully funded we will be hard pressed to find enough people to get the job done.

Finally I must thank those of you who contributed to our Excellence Fund last year, whether through the telephone campaign, in response to the newsletter or just out of the kindness of your hearts. Our Excellence Fund makes it possible for us to undertake activities not covered by our regular budget. Your gifts do make a difference. Because of your generosity we can support our undergraduate math club, Club Zero, we have funded scholarships for graduate students, and we have been able to help overseas travel for those of our faculty whose excellent work has resulted in invitations to present their results or attend important meetings overseas. Thank you again.

— Simon Bernau

SOFTWARE REVIEW

Mathematica: A System for doing Mathematics

You don't have to remember your calculus anymore! There are new software systems for doing mathematics on a computer that do it all. **Mathematica**, the best-known of these, is a general, all purpose software system for doing mathematics on a computer. The system combines extensive numerical and non-numerical computing capabilities, outstanding graphics, symbolic manipulation capabilities, and a very sophisticated programming language that is flexible enough to handle almost any programming task. It was first released by Wolfram Research, Inc. in 1988 on the Apple Macintosh and was immediately acclaimed as a major advance in mathematical technology. By 1990 **Mathematica** was running on most computer platforms including Macintosh, MS-DOS, UNIX, and DEC. It has established itself as the computer algebra system of choice for well over 100,000 computer users. Two thirds of the users are in government and industry, about 28% are engineers, 21% are computer scientists, 20% physical scientists, 12% are business, social and life scientists, and 12% are mathematicians (we are trying to get the word out!). While traditional languages such as BASIC, COBOL, Fortran or Pascal include around 30 mathematical operations, **Mathematica** has over 750 built in. On the other hand, most of the calculus class of problems: differentiation, integration, solving systems of equations, matrix manipulations, solutions to differential equations, and 2 or 3 dimensional plotting, can be learned quickly and these applications usually are simple one line, calculator type commands. For example the symbolic manipulation commands, Integrate[$1/(1-x^3)$,x] and D[Sin[Tan[x]],x] would integrate and differentiate, respectively, the functions given in the first argument with respect to the variable x. You can probably guess at the results of the following commands: Factor[$x^{24}-1$], Coefficient[Expand[$(3+2x)^{10}$], x^5], and Plot3D[Sin[x*y],{x,-3,3},{y,-3,3}].

Languages like Fortran generally have both single and double precision modes where one can typically compute using 7 and 16 significant digits, respectively. **Mathematica** has the capability for exact arithmetic or arithmetic in any number of significant digits. For example, one could use the command Binomial[1000,500] to compute the 300 digit number representing the number of combinations of 500 taken from 1000. Exact arithmetic with rational expressions saves, at each stage of the computation, two integers p and q where p/q is the exact value of the computation. At any time one can convert the ratio to as many digits of accuracy as desired. Irrational constants such as π may be specified to be correct to any number of decimal places. The price you pay for exact arithmetic is in computer storage (you can't have too much memory!) and in computer time for computations that are carried out by software instead of hardware.

In the UTEP Mathematical Sciences Department we have **Mathematica** running in our SUN Microsystems lab in Bell Hall 215 where it is used by both faculty and student researchers as well as in graduate and select undergraduate courses. We are also in the process of installing **Mathematica** in our SUN lab in the new Biostatistical Consulting Center. **Mathematica** is expensive. Recent prices range from \$500 to well over \$2000 depending on the computer and the number of users to be licensed. However, there have been promotions where microcomputer users could purchase a single user system for under \$200. For more information and current price quotes on **Mathematica**, contact:

Wolfram Research, Inc
telephone: 217-398-0700 fax: 217-398-0747

ALUMNI INFORMATION

Have you moved? Have some good news to report? Please let us know. Send the information to Newsletter editor Joe Guthrie at the UTEP Mathematics Department so we can update our files. Watch your mail for an announcement of next fall's Homecoming activities.