

Mathematics Newsletter

Dr. Jeff Scroggs, Director
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News for the Undergraduate

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Can You Solve This?

1. Let $0 < u < 1$ and define

$$u_1 = 1 + u, \quad u_2 = \frac{1}{u_1} + u, \quad \dots, \quad u_{n+1} = \frac{1}{u_n} + u, \quad n \geq 1.$$

Show that $u_n > 1$ for all values of $n = 1, 2, 3, \dots$.

2. A Wolf standing at the center of a circular arena sees a Tarheel at the wall. The Tarheel runs around the wall and the Wolf purses it along a unique path which is determined by running at the same speed and staying on the radial line joining the center of the arena to the Tarheel. Show that the Wolf overtakes the Tarheel as it reaches a point one-quarter of the way.
3. If a, b, c denote the lengths of the sides of a triangle show that

$$3(bc + ca + ab) \leq (a + b + c)^2 < 4(bc + ca + ab).$$

Submit your answers to Bisa Meek in HA 255.

It's remarkable to discover how many connections mathematics makes, how many lightbulbs it suddenly turns on.

- Sylvia Spengler (Biologist)

Summer and Fall Graduates

Twenty-one students graduated with B.S. Degrees in Mathematics or Applied Mathematics in Summer and Fall of 2001. Congratulations to these graduates!

Summer

Bobby Carrol Croom	Mathematics
Asmaa Bassam Shaker	Mathematics
Nathan Darden George	Applied Mathematics
Matthew Scott Lasater	Applied Mathematics
Wallace Martind Mehran	Applied Mathematics
Neal Matthews Provost	Applied Mathematics
Carla Amoi Rudder	Applied Mathematics

Fall

Eugene Edward Bennett	Mathematics
Laura Elizabeth Fischer	Mathematics
Maggie Louise Hall	Mathematics
Courtney Jannel Hodge	Mathematics
Robin Ellen Lail	Mathematics
Michael Robert McDuffee	Mathematics
Jennifer Sheffield	Mathematics
Nicholas Aaron Stoute	Mathematics
Yoshihito Nathan Aiyama	Applied Mathematics
Joseph Collins Hunter	Applied Mathematics
Robyn Dolores James	Applied Mathematics
Mark Christopher Lovin	Applied Mathematics
Jynelle Lenise McCoy	Applied Mathematics
Mingchu Tsai	Applied Mathematics

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Mathematics Electives

Here is a tentative list of mathematics courses being offered Summer and Fall Semesters, which can be used as mathematics electives by students in MA or AMA. There will be additional courses at the graduate level that can also be used.

SUMMER 2002

MA 421	Introduction to Probability
MA 501	Advanced Mathematics for Engineers and Scientists I
MA 511	Advanced Calculus I
MA 513	Introduction to Complex Variables
MA 401	Applied Differential Equations II
MA 502	Advanced Mathematics for Engineers and Scientists II
MA 512	Advanced Calculus II

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MA 293C	Matrix Applications and Computations
MA 401	Applied Differential Equations II
MA 402	Computational Mathematics: Models, Methods and Analysis
MA 408	Foundations of Euclidean Geometry
MA 421	Introduction to Probability
MA 426	Mathematical Analysis II
MA (CSC) 427	Introduction to Numerical Analysis I
MA 430	Mathematical Models in the Physical Sciences
MA 433	History of Mathematics
MA 491H	Reading in Honors Mathematics
MA 493R	Special Topics - Putnam Seminar
MA 493X	Special Topics - Long-Term Actuarial Models
MA 499	Independent Research in Mathematics
MA 501	Advanced Mathematics for Engineers and Scientists I
MA (OR) 504	Introduction to Mathematical Programming
MA (OR) 505	Linear Programming
MA 513	Introduction to Complex Variables
MA 520	Linear Algebra
MA 522	Computer Algebra
MA 523	Linear Transformations and Matrix Theory
MA (OR) 531	Dynamic Systems and Multivariable Control I
MA 532	Ordinary Differential Equations I (prereq MA 341)
MA 534	Introduction to Partial Differential Equations
MA (ST) 546	Theory of Probability (prereq MA 425 or 511, and 421)
MA (CSC) 565	Graph Theory
MA/BMA 567	Modeling of Biological Systems
*MA (BMA) 573	Mathematical & Experimental Modeling of Physical Processes I
MA (CSC) 580	Numerical Analysis
MA 584	Numerical Solution of Partial Differential Equations--Finite Difference Methods

* This class may be used for the math modeling requirement for AMA majors.

Class times are listed at
<http://www.math.ncsu.edu/Courses/Sprg02.txt>

Long-Term Actuarial Models

There are only about 19,000 actuaries in North America, but their calculations and projections are the backbone of the insurance and financial security industries. Actuaries improve financial decision making by developing mathematical models to evaluate the current financial implications of uncertain events in the distant future. In this course students learn how to formulate and apply probability models incorporating future contingent payments and failure-time random variables, to calculate a variety of compound interest and actuarial functions using current software, be introduced to various quantitative measures of interest and annuities-certain. The instructor is Charles W. Dunn, an independent consulting actuary and a Fellow of the Society of Actuaries. Questions concerning the course may be directed to Mr. Dunn by voice (787-8989) or e-mail (cwd0926@aol.com). Actuaries attain professional status by passing a series of examinations covering these and other topics. For more information on the exams and entry-level jobs, refer to www.BeAnActuary.org and www.actuarialgrads.com or stop by HA 255.

Mathematics is not playing with numbers and doing accounting. Mathematics is dealing with ideas in a creative and yet precise way.

- Prusinkiewicz (computer science)

2001 Virginia Tech Regional Mathematics Contest

35 schools took part and there were 269 participants. The maximum possible score was 70. 12 students scored 40 and above, 25 scored 30 to 38.

NC State students did a good job compared to other universities. Among the top contestants:

- Luke E. Cherveney
Math/Phys/Hist., 2003 ranked 11. His score is 41.
- David R. Johnson
Math/Phys 2003 ranked 14. His score is 38.

For your information. Among the top finishes. Duke got #2,3,4,7,9, 11,12,13. Wake Forest got a #18. A high school student in UNC Charlotte got a #5. C Chapel Hill cannot be found in the list.

Phi Beta Kappa

Math students initiated Fall 2001 are:

Luke Cherveney
Megan Early
Chris Flake
Robert Futrell

Congratulations!

Math Modeling

During the weekend of February 7-11, twelve NCSU students worked in teams of three on the Mathematical Contest in Modeling. This international competition for undergraduates involves solving an extended problem. This year, two teams worked on a problem that asked them to study ornamental water fountains and the spray they produce, and two teams worked on a profitable way for airlines to overbook flights. The problem statements and further information about the competition can be found at www.comap.com/undergraduate/contests/mcm/problems.htm. If you enjoy using your mathematics and your creativity to solve extended applied problems you should consider participating in the 2003 competition. The competition is generally held for four days early in February. Contact Dr. Scroggs for more information.

The students who represented NCSU in this year's competition are:

Patrick Barrow	Chris Lipa
Evan Daniel	Andy Matange
Jonathan Drew	John O'Dowd
Taymour Hammoudi	Brian Pike
Mark Harris	Joshua Smith
Jay Hodges	Brandon Tyndall

Pi Mu Epsilon News

New Math Majors for Fall 2001 were:

Richard McMullan	<i>Aerospace Engineering</i>
Nathan Buescher	<i>Mechanical Engineering</i>
Britt Houser	<i>Computer Science/Computer Engineering</i>
Morgan McKinney	<i>Mathematics Education</i>
Sarah Royo	<i>Physics</i>
Robert Barbeau Jr	<i>Mathematics</i>
Heather Basnight	<i>Mathematics</i>
Chad Bell	<i>Mathematics</i>
Sara Breece	<i>Applied Mathematics</i>
Eliza Britt	<i>Mathematics</i>
Karen Donaghy	<i>Mathematics</i>
Megan Early	<i>Mathematics</i>
Claude Goldsmith	<i>Chemical Engineering/Applied Mathematics</i>
Franklyn Gonzalez	<i>Applied Mathematics</i>
Denise Hammock	<i>Applied Mathematics</i>
Therese Huels	<i>Mathematics</i>
Nicholas Long	<i>Mathematics</i>
Kenneth Running	<i>Aerospace Engineering/Applied Mathematics</i>
Brett Unks	<i>Computation Physics/Applied Mathematics</i>

New Faculty

The Math Department would like to welcome two new Faculty members.

Dmitry V. Zenkov
and
Mette S. Olufsen.

Dmitry Zenkov was a GIG Assistant Professor at the University of Michigan before coming to NCSU. His research area is Geometric Mechanics and Nonlinear Geometric Control. He has a wife Jenny and a son Viktor.

Mette Olufsen's research experience is in the fields of biofluid dynamics, computational neuroscience, scientific computation, and interdisciplinary research in areas of mathematical biology. She has a Ph.D. in Applied Mathematics and a M.S. in Mathematics and Computer Science from Roskilde University, Denmark.

Financial Math Course:

New Financial Math Program

Thinking about graduate school? N.C. State is developing a new, multidisciplinary Master's of Financial Mathematics Degree Program. The Financial Math program is a four-semester program consisting of six core courses, four elective courses and a six-credit project/internship. The core courses have been chosen to provide students with a strong mathematical background, statistical and computational tools, and a comprehensive description of financial markets. Students can then choose electives to meet their interests and career goals. The departments participating in this program include Mathematics, Industrial Engineering, Statistics, Economics, Agricultural and Resource Economics, Business Management, and Computer Science. This program is expected to begin Summer 2003.

For more information, please see the Financial Math web page, located at www.math.ncsu.edu/finmath or contact jmjones4@math.ncsu.edu.

Scholarships

Last year, 30 scholarships were awarded to undergraduate math majors. This was a total of \$155,450 in financial support. If you are interested in a scholarship, please complete the form available at www.math.ncsu.edu/undergrad/scholarships/index.html.

Courses in Mathematical Biology

How is a disease transmitted through a population? How do Malaysian fireflies synchronize their lights with each other? How often should a patient get chemotherapy? How does a cell pinch itself in two? If you've ever wanted to answer a biological question with a mathematical answer, perhaps you should try a course in mathematical biology. Mathematical biology encompasses all of biology and most of mathematics. There are several courses in mathematical biology at NCSU, which can count as applied math electives:

MA 432, Mathematical Models in Life and Social Sciences, SP (prereq. MA 301 or 341, 305 or 405, programming language)

BMA 567, Modeling of Biological Systems, FA (prereq. MA 131)

BMA/MA 573 (or) **574**, Mathematical & Experimental Modeling of Physical Processes I, II, FA, SP (prereq. MA 341, MA 405, programming language)

BMA/MA/ST 771, Biomathematics I, FA (prereq. MA 241, MA 305 or 405, and some biology)

Don't be intimidated by the high course numbers. If you are an upper-level math major who has had some biology courses, you are prepared for these courses. Learn how to translate a biological question into a mathematical model, analyze the model, and turn your analysis into a biological answer (or perhaps into another question!).

Meet Denise Seabrooks

I began working in the Math Dept in 1982. I started as a Secretary III with former Associate Dean Bob Savage. When I started my job as a Secretary III the Math Lab was officially called the AudioVisual Tutorial Center. I operated the studio which made the videotapes of the introductory courses (some of which are still in use although now in a different format.) I scheduled the graduate students who were assigned to tutor in the center as part of their graduate assistantship. Currently, I am the Multimedia center Manager and do those things plus post the info on the MMC webpage. I also provide helpdesk information to students and faculty using the lab and portable equipment maintained by the department.

I have three sons, Jonathan, 17, Alex, 15 and Jason 12. My husband, Leroy Seabrooks, is a comedian, currently working out of Charlie Goodnight's Comedy Club in Raleigh.

I'm a graduate of UNC-Chapel Hill with a B.A. in Political Science. I was a member of the Carolina Choir, which was picked as the host choir for an international youth Festival in Graz, Austria in July 1972. I am also a member of First Missionary Baptist Church of Smithfield, NC where I sing in the choir. I am an avid reader of Sci-fi and Fantasy and am overjoyed by the revival of the Tolkien Trilogy which I have read a number of times over the past 30 years. I support the Athletic departments of the Smithfield Middle and High School where my children play football, soccer and track and field. They also play basketball for Smithfield Parks and Recreation. We are a musical and theatrical family and between us we play, clarinet, drums, french horn, piano, trumpet and tuba. We have participated in productions of Amahl and the Night Visitors, the Wizard of OZ, To Kill a Mockingbird, and My Fair Lady. We have a very fine baritone, two tenors, a boy soprano (only for a short while longer) and a mezzo soprano.

NC High School Math Competition

Enloe High school won the 2001-2002 competition. 13 high schools from Wake County participated (a total of 79 students).

Contact undergrad@math.ncsu.edu for more information.

There is no science which teaches the harmonies of nature more clearly than mathematics.

- Paul Carus

SUM News

The SUM (Society for Undergraduate Mathematics) Club provides students, with an appreciation for Mathematics, opportunities to extend their horizons. Club meetings open the doors to learn about current research in Mathematics, talk with executives hiring students who have Math backgrounds, find out about study abroad programs and meet students and faculty on a social level. If you wish to join the SUM Club, just register yourself to be on the mailing list by going to www.math.ncsu.edu/GroupsOrgs/SUM. Due to the financial support from PAMS, and the math department, there are no dues!

For the things of this world cannot be made known without a knowledge of mathematics.

- Roger Bacon

Can You Solve This? Solutions to Previous Problems

1. If $f(x) = x^2 + x$, prove the equation $4f(a) = f(b)$ has no solutions in positive integers a and b .

Solution: Suppose that a, b are positive integers with $4a(a+1) = b(b+1)$. Then

$$4(a+1)^2 = 4(a+1)(a+1) > 4a(a+1) = b(b+1) > b^2,$$

so $b < 2(a+1)$ and

$$4a^2 < 4a(a+1) = b(b+1) < (b+1)^2, \text{ so } 2a < b+1.$$

Thus $2a \leq b \leq 2a+1$, so $b = 2a$ or $b = 2a+1$. In either case, we get $a \leq 0$, which is a contradiction.

2. Prove that, for any positive integer n , $1492^n - 1770^n - 1863^n + 2141^n$ is divisible by 1946.

Solution: $x - y$ is a divisor of $x^n - y^n$, and $2141 - 1863 = 1770 - 1492 = 278$, so the given expression is divisible by 278. Similarly, $2141 - 1770 = 1863 - 1492 = 371$, which is relatively prime to 278, and also divides the expression. Hence $(278)(371) = (53)(1946)$ is a divisor.

3. A gambling student tosses a fair coin and scores one point for each head that turns up and two points for each tail. Prove that

the probability of a student scoring exactly n points is $\frac{1}{3} \left[2 + \left(-\frac{1}{2} \right)^n \right]$.

Solution: Let p_n denote the probability of scoring exactly n . Note that $p_n = \frac{1}{2} p_{n-1} + \frac{1}{2} p_{n-2}$, since a score of n can be obtained either by scoring $n-1$ and throwing a head or by scoring $n-2$ and throwing a tail. This recursion formula can be used to prove the statement above by mathematical induction. (An alternate formula that can be used is $p_n = 1 - \frac{1}{2} p_{n-1}$.)

Remark: John Bishir pointed out to the Problem Editor that to understand this problem and its solution, you need to identify the experiment clearly. The experiment is to toss a fair coin an infinite number of times, and p_n is the probability that, after some toss, the total score is n .

Courtesy: Bob "Rocky" Ramsay
ramsay@math.ncsu.edu

Math Honors News

Michael McDuffee graduated in December 2001 in the math honors program and is currently working on a master's degree at NC State. He also gave a presentation on "Distance Geometry Techniques and the Spherical Tetrahedron" to math faculty and students last semester. Other students presenting research results were Luke Chervený, talking about hysteresis Models for High Performance Piezoelectric Materials" and Chris Flake, discussing "A Block and Spring Model for Sheared Granular Material". Several students will do presentations this semester on their research/independent study work. Times, places and titles will be announced.

Chris Flake and Luke Chervený are attending the Budapest Semesters in Mathematics this semester, bringing to 10 the number of NC State students who have participated in the Budapest Semesters. At last report, they were working hard and doing a LOT of traveling - they've either been to or are planning to see: southern Hungary, Bratislava, Belgrade, Vienna, Prague, Krakow, Bucharest, Transylvania, southern France and Italy.

Students participating in the Math Honors Program are encouraged to attend study abroad programs such as the Budapest Semesters in Mathematics or the Math in Moscow program as well as do math research at NC State and in summer programs such as the NSF sponsored Research Experiences for Undergraduates (REU'S). In the last 10 years, 15 math majors have done summer REU's at schools including Rutgers, U of Illinois, Lafayette College, Hope College, Rose-Hulman, Oregon State, Florida State, Colorado School of Mines, Penn State, U of Washington, U of Puerto Rico, and Indiana. As a result 9 students have received NSF Fellowships for graduate study. In fact, in NSF Fellowships in math since 1994, we're ranked 10th nationally, tied with Harvey Mudd, U of Chicago, U of Illinois at Chicago and U of Washington. Graduate schools attended by our students include Princeton, MIT, Stanford, NYU, Cornell, Wisconsin, Rutgers and several other schools.

Megan Early, Chip Killian, Joel Koerwer, Billy Switzer, Laura Taylor and David Weaver will graduate in May 2002 and all are planning to go to graduate school, either in math or a math-related area. Students joining the honors program since last October include Jason Blevins, Chucky Ellison, Denise Hammock, Robert Futrell, Stephanie Morgan, Mark Lavin, Song Zhong, Jay Hodges, Dmitri Morozov, Joseph Wagner, and Nick Vance. Thirty-three students are currently participating in the Math Honors Program and invitations to join the program will be extended sometime during pre-registration. Students interested in more information about the program should contact Dr. Paur, HA 202, 515-2598, sopaur@math.ncsu.edu or check out the honors program web site; <http://www.math.ncsu.edu/honors>.

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