University of Nebraska at Omaha Department of Mathematics

Fall 2004 Newsletter

November 2004 Volume 6, Issue 1

Professor Yi-Hsin Liu Retires

Yi-Hsin Liu

Professor Yi-Hsin Liu retired in August 2004. He has been in the UNO Mathematics Department since 1986. He received a BS degree in Computer Science from Chung Yuan University in Taiwan in 1974, an MS in Statistics from Mankato State University in 1981 and a PhD in Mathematics from UNL in 1986. He held the James Earl Diamond Professorship in Mathematics from 1993 – 1999. He was Chair of Mathematics from 1994 – 1996. During the 1995 – 1996 Academic Year he was a visiting research professor at the Institute of Traffic and Transportation at National Chiao Tung University in Taipai.

Dr. Liu has been an Associate Editor of the professional journals INFORMS (of the Operations Research Society) and the International Journal of Reliability. He has recently been appointed as the founding editor of the Journal of Information Science and Logistics Management. During his career he has helped to develop the new areas of Habitual Domain Theory, Hierarchical Optimization and Multiple Objective Theory.

Yi-Hsin has authored or coauthored more than 40 professional journal articles during his research career which is still ongoing. His current interests are multi-criteria programming, multi-level linear programming, discrete optimization, decision making, data mining, pattern recognition and discrete combinatorics.

We wish him an active and productive retirement as he continues his many professional activities.

Putnam Students (L to R): Andrew Gacek, Hing Lim Chan, Travis Deyle, Eric Manley, Vince Wesselmann, Nam Pham (top), John Herzinger, Zach Zaiss, Erin Carmody, Paul Frederick, Alex Vesper and Vladimir Ufimtsev.

Putnam Exam has a Record Turnout and UNO Places in Top 18% Among Universities in US and Canada.

Last December, 14 hearty souls gave up a Saturday to face the most formidable of challenges, the Putnam Mathematical Competition. Not for the weak of heart!! Andrew Gacek led the way with 32 points (top 5%). Eric Manley scored 12 points (top 18%). They were followed by Travis Deyle (top 36%) and Zach Zaiss (top 42%). Tom Formanek, Paul Frederick, John O'Dell, Nam Pham, Vladimir Ufimtsev, Alex Vesper and Vince Wesselmann all scored in the top 60%. UNO's team placed 83/479. (We placed 67/476 last year and 97/453 the year before.)

"God exists since mathematics is consistent and the Devil exists since we cannot prove it" - ***Andre Weil, 1906-1998***

From The Chair

The UNO Mathematics Department continues to grow in quality and impact. In the past year there have been a record number, 30, of graduating students from all of our degree programs (BA, BS, BGS, MA, MS, MAT) combined. Nine of these students earned double majors in CS and Math. One (Zach Zaiss) earned a triple major in CS, Math and Psychology. The large number of double majors is a result of the creation and rapid growth of the IST College in the Peter Kiewit Institute.

Outreach activities (some reported here) such as the Putnam Exam, Mathematics Awareness Month Symposium (in April each year), Problem of the Week contests for both undergraduates and high school students, and the newly created Kerrigan Research Minigrants Program, are also raising the visibility of the department both on and off campus.

Jack Heidel

Inside this issue:

News of Recent Graduates

December 2003

Kathi Beach (MAT 2003), *She is teaching at Harlan Community High School in Harlan, Iowa. Before earning the MAT degree, Kathi taught Pre-Algebra and Algebra. After earning the degree, she has taught dual credit courses where students can earn both high school credit and college credit (through Iowa Western Community College). She now teaches Honors Early Start Classes of Pre-Calculus, Trigonometry, and Calculus. "I have always loved my job teaching, but it is even more enjoyable when you are working with the highly motivated students."*
Jason Brau (BS).
Jennifer Cook (BS, Summa Cum Laude), *Substitute teaching full-time for OPS while studying for the first actuarial exam.*
Paul Karlik (BS, CS and Math).
Mandy Klockner (MS), *Currently a PT instructor at UNO and Iowa Western, and looking for a full-time teaching job.*
Andrew Mitchell (BS, Magna Cum Laude), *Doing graduate work at ISU in Mechanical Engineering.*

May 2004

John Broderick (BS, Cum Laude), *Employed as an actuarial trainee at BC/BS Nebraska.*
Erin Carmody (BS, Cum Laude), *Doing graduate work in Mathematics at KU. Aiming for a Ph.D. someday.*
Andrew Gacek (BS, CS and Math, Summa Cum Laude), *Ph.D. program in Computer Science at University of Minnesota.*
Benjamin Carter Groelz (BS, CS and Math, Magna Cum Laude), *Doing actuarial and database work for the Homestate Company, a subsidiary of Berkshire Hathaway.*
Chad Haugen (MS), *Teaching math at Iowa Central Community College in Fort Dodge, IA.*
Irene Lee (MS), *Doing graduate studies in Operations Research at UNL.*
Eric Manley (BS, CS and Math, Summa Cum Laude), *Graduate student in Computer Science with a research assistantship at UNL. His research paper "On Quadratic Solutions of $x^n + y^n = z^n$" has been accepted by the Rocky Mountain Journal of Mathematics.*
Frank Mellion (BS, CS and Math, Magna Cum Laude).
Emily (Sybil) Morgan (BS), *Teaching math at Construction Careers Center, a charter school in St. Louis.*
Shawna Tierney (MAT 2004), *Graduated from Wayne State College with a bachelor's degree in Mathematics Education in 1996 and began teaching at Gretna Middle School. She is currently teaching eighth grade math at Papillion Junior High. She is the math club sponsor and the Math Counts team coach.*
Warren Heath Tutwiler (BGS, Summa Cum Laude Extra Muros), *Lockheed contractor at Offutt Air Force Base.*
Henry Unwin (BS).
Vincent Wesselmann (BS, CS and Math, Summa Cum Laude), *Teaching English in the JET program in Japan. For more on his adventures, visit www.omahatookinawa.com.*
Zachary Zaiss (BS, CS, Psych and Math, Summa Cum Laude), *Graduate student in Human-Computer interaction at Carnegie Mellon University.*

August 2004

Sheldon Apo (BS), *Moved to Ohio and is looking for government jobs. Plans to go to graduate school or be an actuary.*
Jennifer Doorlag (MAT 2004), *Before moving to the Omaha area, she taught high school mathematics for two years at a private school in Ripon, California. She started teaching at Lewis Central in Council Bluffs three years ago. She is considering working on a Ph.D. in statistics.*
James Kelly (BS), *Will talk with professors to help look for a job.*
Masahiko Kimura (MA), *Returned to Japan to find employment.*
John Lusajo (BA), *Applied to pharmacy school while working at the post office.*
Benjamin Quiner (BS), *Preparing to take the first actuarial exam in November. Seeking entry-level jobs in actuarial science.*
Cory Schmeichel (BS, CS and Math, Magna Cum Laude), *Going to graduate school at UNO in Computer Science. Has an internship/job in software engineering at Offutt Air Force Base.*
Stephanie Summers (MAT), *She taught for three years at Mission Middle School in Bellevue. She is currently teaching Mathematics/Computers in Ault, Colorado.*

Alumni News

Andrew Buchan (MA, 2003), *Teaching at the private Buckley School in Sherman Oaks, CA. The kids wear blazers and the parents are movie stars.*
Erica Johnson (BS 1989, MS 1990), *Received a Ph.D. in Math Education from UNL in 1998. She is now an Assistant Professor of Mathematics at St. John Fisher College in Rochester, NY.*
Chad Fulk (MA 2001), *Finishing up a doctorate in physics at UIC doing surface science.*

Library Holdings in Analysis Given A Boost

Robert G. Bartle, who is best known for his seminal graduate text *The Elements of Real Analysis* and whose most recent article *Return to the Riemann Integral* (published at age 70) won the Lester R. Ford Award from the Mathematical Association of America for best expository paper, passed away September 18, 2003. Over the course of his distinguished career at University of Illinois, Eastern Michigan University, Yale University, the University of California–Berkeley and Georgia Institute of Technology, he had put together a wonderful personal library.

This summer his son, John Bartle (Professor of Public Administration at UNO), generously donated over 150 of the most advanced volumes to the Mathematics Department. They will be kept among our regular library holdings. Valentin Matache, speaking for many in the department, responded" Robert Bartle's book collection is a valuable asset for any analyst. He was well-known for his work in the fields of real and functional mathematical analysis and his book donation reflects his field of expertise. We are most fortunate to receive it."

UNO High School POW Begins Third Year

The UNO High School POW Contest is off to a great start for the third year. There were 50 correct solutions submitted the first week from students in the Omaha area high schools. At mid (Fall 2004) semester almost 100 students have submitted at least one correct solution. Veteran student organizers of the contest, Zach Zaiss and Eric Manley, are off to graduate school now, but they left the contest in the capable hands of David Daro, Nam Pham and Vladimir Ufimtsev.

Problems for the contest are posted weekly on the Department of Mathematics web-site for twenty weeks during the school year. The on-line contest culminates in an on-site contest during Math Awareness Month in April. A traveling trophy is presented to the school with the highest team score in the on-site contest. The on-site contest winner the past two years has been Omaha North high school.

Kerrigan Research Minigrants Program

Supported by a donation from Patrick Kerrigan, BA, 1973, the retired executive vice-president of Information Technology, Inc, of Lincoln, the Mathematics Department has initiated a broad scale student research program. First of all, nine faculty members prepared brief descriptions of research projects which were then publicized to students (http://www.unomaha.edu/~wwwmath/minigrants/edu). Students who participate, and carry through a project to completion during the academic year 2004-2005, will receive a $300 award in May. This means not only doing the research but also writing it up in a professional manner, and making an oral presentation at the annual Mathematics Awareness Month Symposium in April.

Participants will be encouraged to further refine their work to result in either an undergraduate honors thesis or a graduate masters thesis. Thus the minigrants program complements and supports the Kerrigan Awards for Excellence in Mathematical Writing. These are the annual $350 award for best undergraduate honors thesis and the $500 award for best masters thesis. Below are described several of the projects, just getting underway in October 2004, along with the names of the faculty sponsors and student participants for each project.

Parametric Model Selection Techniques

Advisor: *Steve From* **Student:** *Gary Beck*

Description: Many parametric statistical models are available for modeling lifetime data. Given a data set of lifetimes, which may or may not be censored, which parametric model should be used to conduct statistical tests? In only a few cases can analytical expressions be found to answer this question in some optimal fashion. Various measures of discrepancy and other functionals of the distribution function will be considered for a finite number of competing parametric statistical models. An important tool for comparing these measures will be Monte Carlo simulation.

Dynamics of Some Asynchronous Random Boolean Networks with Constant Number of Parents

Advisor: *Dora Matache* **Students:** *Xutao Deng, Huimin Geng*

Description: Random Boolean Networks are networks of nodes that can be in one of two possible states ON or OFF, and whose evolution from one time point to another is governed by given Boolean rules. Each node's evolution is influenced by the state of other nodes called its parents. If all the nodes are updated at the same time then the network is called synchronous, otherwise it is called asynchronous. Recent research has focused on finding formulas for the probability of a node being ON at time t and using these formulas to study the dynamics of the network.

Statistical Estimation of Insertion-Deletion Stacked Pair Distance Between Random Strings Generated by Markov Sources and Generating New DNA Codes

Advisor: *Vyacheslav Rykov* **Student:** *Bob Slaughter*

Description: We will use the concept of block isomorphic subsequences to describe new abstract weighted string metrics that are similar to the weighted Levenshtein insertion-deletion metric. The metrics will be used to model a thermodynamic distance function on single stranded DNA sequences. Our model captures a key aspect of the nearest neighbor thermodynamic model for hybridized DNA duplexes. Our thermodynamically weighted distance function is a metric in the rigorous mathematical sense. Thermodynamic distance functions are important components in the construction of DNA codes and DNA codes are important components in biomolecular computing and other biotechnical applications that employ DNA hybridization assays. We show how new distance can be calculated and we will create algorithms for generating new DNA codes.

DNA Codes Generating

Advisor: *Vyacheslav Rykov* **Student:** *Vladimir Ufimtsev*

Description: We will use new theoretical results for designing new DNA codes generating algorithms. The weighted string metrics based on the concept of block isomorphic subsequences will be used for determination of a thermodynamic distance function on single stranded DNA sequences and code distance. Our model captures a key aspect of the nearest neighbor thermodynamic model for hybridized DNA duplexes. Thermodynamic distance functions are important components in the construction of DNA codes and DNA codes are important components in biomolecular computing and other biotechnical applications that employ DNA hybridization assays. We will use the Monte-Carlo method for generating Markov chains quaternary sequences and designed algorithms for generating new DNA codes.

Set Theoretic Topology from Scratch

Advisor: *Andrzej Roslanowski* **Students:** *Vladimir Ufimtsev, Adam Walling*

Description: Topology is an area of mathematics that is closely connected to set theory and which provides language and methods for many other mathematical disciplines. Therefore many students planning to go to graduate schools and/or to get involved in active mathematical research should get familiar with many topological concepts which are at the heart of functional analysis, measure theory, dynamical systems etc. However, the advisor feels that there is no good textbook which could be used in a topology course for students with a background similar to that of UNO's students. The aim of the project is to write such a textbook and make it freely available to UNO students for course use, independent studies or just self-study. The book should give a rigorous presentation of some concepts of topology, set theory and descriptive set theory including: 1) ordinal and cardinal numbers, characterizations of various algebraic and order structures by their properties, the number line through the Dedekind cuts, 2) metric spaces: open sets, continuous functions, the hierarchy of Borel sets, 3) complete metric spaces: completion, Banach spaces, Polish spaces and their Borel isomorphisms, and 4) topological spaces: compact, connected, arc connected, metrizability, separation axioms

Nonlinear Multiregressions for Data with both Numerical and Categorical Attributes

Advisor: *Zhenyuan Wang* **Student:** *Jin Hui*

Description: Based on Choquet integrals with respect to generalized fuzzy measures, a model of nonlinear multiregression that can catch the interaction among mixed-type predictive attributes toward the objective attribute has been established recently.There are three aspects in the above work that can be improved: (1) Using a signed fuzzy measure to replace the generalized fuzzy measure so that the regression can more precisely describe the relation among the objective attribute and the predictive attributes. (2) reducing the complexity of the genetic algorithm that is used to search the optimal estimation of the regression coefficients, taking part of the unknown regression coefficients, the values of the signed fuzzy measure, out from the chromosome involved in the genetic algorithm. (3) Optimally projecting the states of the categorical attribute(s) into a partial ordered space, but not into a total ordered space as done in the previous work, to "numericalize" the categorical attribute(s) when there are more than two states for a predictive attribute.

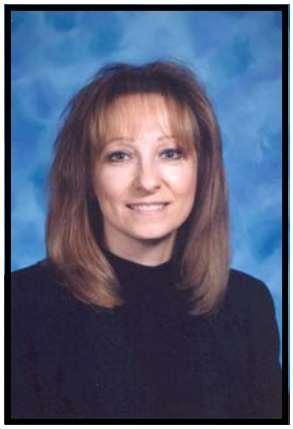
Solving Nonlinear Optimization Problems with Nondifferentiable Objective Function by Pseudo Gradient Search

Advisor: *Zhenyuan Wang* **Student:** *Marie Spilde*

Description: In an optimization problem, when the objective function is not differentiable, such as the least square error involving nonlinear integrals, the gradient search fails. In this case, we may replace gradient with a pseudo gradient to determine the optimal search direction. The pseudo gradient can be obtained via statistical learning based given data for the objective attribute and relevant arguments of the objective function. Once the optimal search direction is determined, the optimal step length can be determined by statistical learning as well. Similar to the gradient search, its advantage is fast convergence, while easily falling into some local extremum is its disadvantage. Hence, choosing a suitable initial point is rather important. With some valid initialization method, such as a genetic algorithm, the pseudo gradient search can be applied in nonlinear multiregression, classification, and decision making widely.

New Faculty and Staff

Mary Dennison — *Math Lab Director*



Mary Dennison

MaryRita Dennison is the new Mathematics Laboratory Director. Ms Dennison has been the Assistant Math Lab Director for the past two years. Dr. Janice Rech, the previous Director, is returning full time to the classroom, especially to concentrate on mathematics education for elementary teachers.

Mary has a Masters Degree in Statistics from Creighton University. She has taught previously at Creighton Prep and Northwest High School in Omaha.

The Math Lab provides instruction in Math 1310, Intermediate Algebra, and Math 1320, College Algebra. In Fall 2004 it has 900 students enrolled in these two courses with a full time staff assistant, in addition to the director, and a part-time staff consisting of three GTA facilitators and thirteen undergraduate tutors. It is a very busy place.

As Assistant Director Mary helped to develop a supplementary online testing system, Pathways to Success. This Fall the Lab is providing red and black polo shirts for student workers to help identify them from algebra students. Mary is off to a good start in her new job.

Kelly McNamara — *Academic Coordinator*

Kelly McNamara

A new staff position was created in the Mathematics Department on August 1, 2004. Ms Kelly McNamara has been hired for this position. Kelly is a 2003 UNO honors graduate with a double major in Mathematics and Physics. She has previously been employed by the Physics Department as an undergraduate teaching assistant and as an instructor in the summer educational programs "Aim for the Stars". She also has experience working as a tutor and as a facilitator in the Mathematics Laboratory. Before that she was a student and a versatile tutor at Metropolitan Community College.

As Academic Coordinator Kelly will be involved in all aspects of undergraduate mathematics education at UNO. She will coordinate advising of math majors and minors. She will assign a faculty advisor to each new major and then follow each students progress toward completing the major requirements. Kelly will administer the department's growing number of internship opportunities and make sure that students are kept aware of new openings on a regular basis. She will organize the MFAT exam which compares the mathematical knowledge of our majors with national averages. She will conduct oral questionnaires of graduating seniors in order to judge their satisfaction with their educational program.

The departmental website is intended to be a complete and up-to-date source of information about everything the department does. It takes a lot of work to make sure the website is updated in a timely manner. Kelly will help the faculty webmaster with this task. She will also act as editor of the website for the UNO NSF STEP grant.

The Mathematics Department, along with several other UNO departments, has become involved in a Dual Enrollment program with Omaha area high schools. It offers high school students, enrolled in Advanced Placement calculus, an opportunity to obtain UNO credit. Kelly will help faculty administer this growing initiative by evaluating high school teacher credentials, course syllabi, tests, and monitoring student learning in DE.

The department is happy to have such a qualified person as Kelly McNamara to help faculty provide the best possible education in mathematics at UNO.

2004–2005 Faculty and Staff

Mary Dennison, *Director-Math Lab*
Parsla Dineen, *Instructor*
Judith M. Downey, *Instructor*
J. Scott Downing, *Professor*
Jerome Drakeford, *Instructor*
Dean Ann Edwards, *Special Projects*
G. Griff Elder, *Associate Professor*
Steve From, *Professor*
Margaret Gessaman, *Professor Emeritus*
Jack Heidel, *Chair and Professor*
Betty Hickman, *Associate Professor*
John Konvalina, *Professor*
Margaret Mainelli, *Staff Assistant*
John Maloney, *Professor*
Dora Matache, *Assistant Professor*
Valentin Matache, *Associate Professor*
Kelly McNamara, *Academic Coordinator*
Janice Rech, *Associate Professor*
Jim Rogers, *Visiting Assistant Professor*
Andrzej Roslanowski, *Associate Professor*
Vyacheslav V. Rykov, *Associate Professor*
Laura Schaben, *Instructor*
Larry Stephens, *Professor*
Cindy Teller, *Staff Assistant-Math Lab*
Zhenyuan Wang, *Professor*

Math Lab Student Workers:
Dustin Waderich and Janna Eckhardt

Internships for Math Majors

Internship opportunities continue to become available to our students. These internships include work such as assistance in insurance underwriting, financial analyst & benefits consultant, and statistical support. Local companies such as Milliman Consultants and Actuaries, National Indemnity Co. (a member of a Berkshire Hathaway Group), and Avantas, a provider of health industry work strategies, as well as others, are often looking for our qualified students to work with them to perform necessary functions while providing the student with valuable real-world experience.

One such company, Avantas, has employed students of mathematics in the past and has recently hired graduate student Jerome Bownes for its Information Strategies Department. Holly Wedemeyer, a representative of the company, has let us know how pleased she is that they have hired "another talented UNO math student," referring to recent graduate, Erin Carmody.

Math students are sent information via email about internships as soon as it becomes available. As well, this information is posted on the departmental bulletin board and the math department website: http://www.unomaha.edu/~wwwmath.

REU in Mathematical Biology

During the time between June 6th and 31st July 2004, I participated at the "Research Experience for Undergraduates" at the University of Nebraska at Lincoln. This was a series of projects designed specifically for undergraduate students to obtain some insight into how the process of research works. Melissa Wilson, a student from Creighton University, and I worked on a project to engineer a mathematical model for the dynamics of cancer. We took into consideration the biological knowledge that already exists on cancer and tried to explain part of it in terms of the mathematical language.

Cancer comes in many different forms. Our project was based on a malignant tumor developing in the liver. Ultimately, this process can be considered as a competition between *healthy* cells and *cancerous* cells. It is believed that the presence of *phosphorus* is required in any process involving growth. Phosphorus can thus be thought of as *prey* and the growing cells can be thought of as the *predators*. The body is then the universe in which these predators live. If this was all there was to it then we could apply known systems of differential equations to model this predator/prey system. It is not that simple so we have to create new systems of equations. Biological processes are extremely complicated. The dynamics of these processes are non-linear. If we use the theory of differential equations to analyze them then we are bound to obtain large systems, possibly chaotic for some initial conditions, of non-linear equations. Indeed, this was the outcome of the project I worked on at Lincoln.

In the dynamical system that we created, we considered only a few of the known factors involved in the growth of a malignant tumor. Healthy cells of the organ - *O*, tumor cells of the organ - *T*, vascular cells of the tumor - *V*, effector cells of the immune system - *E*, phosphorus amount in the bloodstream - *P*, and healthy cells in the rest of the body - *H*, were the quantities that we analyzed in our system. The tumor and the healthy cells of the organ are in competition for the phosphorus that is circulating in the bloodstream as well as the space in which they are able to grow. The vascular cells of the tumor aid it in its battle for phosphorus. The effector cells of the immune system attack the tumor cells. We considered an existing model to describe how the predators in our system prey on the phosphorus. This was the Holling disc equation. The predators, it is assumed, engage in two activities; searching for prey and consuming the prey. The Holling disc equation is an approximation to predation primarily based on the amount of time that each predator spends on consuming one unit of prey being constant. The main result of the disc equation is that as the prey density increases to infinity, the rate at which each predator captures the prey converges to a certain quantity; the inverse of the time spent consuming a unit of prey. *Holling disc equation specified for our study*:

$$\frac{dX}{dt} = \frac{C_X P}{S_X P}$$

Variables: X = Prey captured, P = Prey
Constants: C_X = Maximum growth rate, S_X = Half

The structure of the Holling equation was used in our model to imitate the contribution that phosphorus consumption makes to the growth rate of the quantities mentioned previously. Other factors that the model considered were; death rates of cells - d_x, crowding of cells - m_x, immune cells preying on cancerous cells - A(T,t), phosphorus consumption - PO, phosphorus excretion - ∂P and immunotherapy - I(t). The current state of the system is described by the equations:

$$\frac{dH}{dt} = \frac{C_H P}{S_H + P} H - d_H H - m_H H^2$$

$$\frac{dO}{dt} = \frac{C_O P}{S_O + P} O - d_O O - m_O O^2 - m_c (T+V) O$$

$$\frac{dT}{dt} = \frac{C_T P \frac{\mu V}{\alpha H + \beta O + \mu V}}{S_T + p \frac{\mu V}{\alpha H + \beta O + \mu V}} T - d_T T - m_T T^2 - \frac{\partial A(T,t)}{\partial t}$$

$$\frac{dV}{dt} = \frac{C_V P}{S_V + P} T - d_V V$$

$$\frac{dE}{dt} = \frac{C_{E_1} P}{S_{E_1} + P} E - d_E E - m_E E^2 + \frac{C_{E_2} P}{S_{E_2} + P} E \cdot ind \cdot \frac{\partial A(T,t)}{\partial t} + I(t)$$

$$\frac{dP}{dt} = [P_O - \sigma P] - (\frac{C_H P}{S_H + P} H + \frac{C_O P}{S_O + P} O + \frac{C_T P \frac{\mu V}{\alpha H + \beta O + \mu V}}{S_T + p \frac{\mu V}{\alpha H + \beta O + \mu V}} T + \frac{C_V P}{S_V + P} T + \frac{C_{E_1} P}{S_{E_1} + P} E +$$

$$\frac{C_{E_2} P}{S_{E_2} + P} E \cdot ind \cdot \frac{\partial A(T,t)}{\partial t}) + r(d_H H + d_O O + d_T T + d_V V + d_E E + m_H H^2 + m_O O^2 +$$

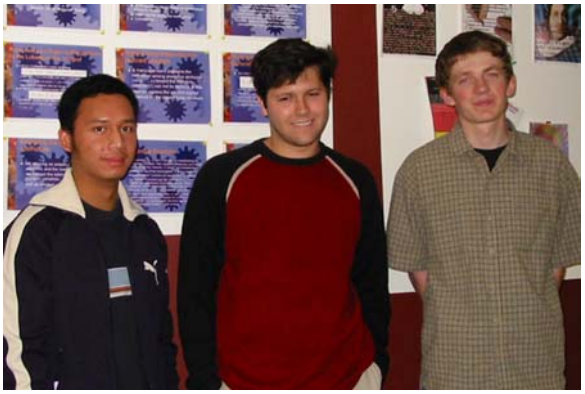
$$m_T T^2 + m_E E^2 + m_C (V+T) O + \frac{\partial A(T,t)}{\partial t})$$

The actual dynamics of cancer are extremely complicated. If we knew the actual dynamics then we would be able to cure the disease. The only thing that we can do, on the scale that we were working on, is make approximations to the dynamics of the disease. The better the approximations, the closer we are to making new insights into the mystery of cancer. The experience of working on such an interesting problem is very eye-opening. The understanding we have of biological processes seems to be primitive if we look at the complexity of them. The different fields of mathematics will hopefully elaborate the process of studying biological processes and progress our understanding of these extremely important things.

I would recommend engaging in the process of research to all students. If enough time and effort is spent on any problem, the result is very rewarding, even if the actual problem itself was not fully solved.

Vlad Ufimtsev

Math Club Picnic (October 2, 2004) A good time was had by all!



Earl Scholars: Rifyan Nasution, Travis Deyle and Vladimir Ufimtsev

"Leibniz never married; he had considered it at the age of fifty; but the person he had in mind asked for time to reflect. That gave Leibniz time to reflect too" - ***Bernard Fontenelle, 1657-1757***

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