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Undergraduate Mathematics Day

at the

University of Dayton

Saturday, November 5, 2011

Major funding for this conference was provided by

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The College of Arts & Sciences, the University of Dayton

Alums through the Endowed Schraut Memorial Lecture

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**Undergraduate Mathematics Day
at the University of Dayton**

Saturday, November 5, 2011

Program

8:45 - 9:30	Check In, Folder Pick-Up, Refreshments	Science Center Auditorium Lobby
9:30 - 9:45	Welcome and Introduction Courtney Perkins Math Club, University of Dayton	Science Center Auditorium
9:45 - 10:45	Invited Address: Perfect and Abundant Numbers - a Perfect and Abundant Source for Undergraduate Research projects Judy Holdener , Kenyon College	Science Center Auditorium
11:00 - 11:55	Contributed Papers Sessions (Part I)	SC 114, 107, 146 or 150
12:00 - 1:00	Lunch	Auditorium Lobby
1:00 - 1:15	Introduction: Schraut Memorial Lecture Lydia Kindelin , Vice President Math Club, University of Dayton	Science Center Auditorium
1:15 - 2:15	The Twelfth Annual Kenneth C. Schraut Memorial Lecture: Imaginary Numbers, Unsolvable Equations, and Newton's Method Jeffrey Diller , University of Notre Dame	Science Center Auditorium
2:15 - 2:30	Break with Refreshments	Auditorium Lobby or Atrium
2:30 - 3:45	Contributed Papers Sessions (Part II)	SC 114, 107, 146 or 150

Schedule for Contributed Paper Sessions, Part I

	S.C. 114 Auditorium	S.C. 107	S.C. 146	S.C. 150
Moderator	William Balbach, University of Dayton	Kristen Edwards, Central State University	Sean Meehan, University of Notre Dame	Nicholas Nagel, University of Dayton
11:00-11:15	A Geometric Representation of the Abundance Index Katherine Moore, Kenyon College	Bernoulli Numbers: Developments and Applications Kristara Lee, Fort Lewis College	Mathematical Modeling of Antimicrobial Behavior of Metal-Intercalated Polymers Nicholas Jones, University of Dayton	Formalizing Course Materials for a Quantitative Reasoning Course Marissa Morin, Millikin University
11:20-11:35	Growth of Groups Defined by Automata Lydia Kindelin, University of Dayton	Partially Balanced Incomplete Block Designs with Two Associate Classes Cody Watson, Wright State University	Role of the Resolvent in a Perturbed Nonlinear Volterra Integral Equation Bader Masry and Emad Mikael, University of Dayton	Investigating the Properties of Henry Functions Zachary Hadaway, University of Dayton
11:40-11:55	Compressed Zero-Divisor Graphs of Finite Commutative Rings Lane Bloom, Millikin University	Decompositions of Complete Graphs into Cycles and Stars on the Same Number of Edges Chester Lian, University of Dayton	Basic Models for Credit Risk Analysis Danping Wang, University of Dayton	Some Interesting Problems Related to Improper Integrals Zi Ouyang, University of Dayton

Schedule for Contributed Paper Sessions, Part II

	S.C. 114 Auditorium	S.C. 107	S.C. 146	S.C. 150
Moderator	Katherine Moore, Kenyon College	Courtney Perkins, University of Dayton	Lydia Kindelin University of Dayton	Cody Watson, Wright State University
2:30-2:45	Algebraic and Operator-Theoretic Properties of Hardy-Hilbert Space PTOs Mehdi Nikpour, University of Toledo	Decomposition of Complete Multipartite Graphs into 4-Cycles William Balbach, University of Dayton	The Graph with Largest Maximum Singular Value of an Associated Row Stochastic Matrix Sean Meehan, University of Notre Dame	A Numerical Algorithm to Value an American Call Option Junyao Zhang, University of Dayton
2:50-3:05	Multiple Structural Changes in a Linear Regression Model Ziqi Qiao, University of Dayton	On a Special Class of Polynomials in Two Variables Over a Finite Field Courtney Brown, Ohio Northern University	Just Add a Pinch of Redundancy: Using Frames to Send and Receive Messages Veronika Furst, Fort Lewis College	Quantum Magic: A Review of Algorithms that Motivated Quantum Computing Research Nicholas Haynes, University of Dayton
3:10-3:25	Effect of Dominance Theorems on the Single-Machine Weighted Tardiness Problem Craig Birkemeier, Sinclair Community College	Decompositions of Complete Graphs with Holes of the Same Size into the Graph-Pair of Order 4 Courtney Perkins, University of Dayton	Decoding the Matrix: Compressed Sensing Paul Havris, Fort Lewis College	Nutritional Disparity Among African Americans Kristen Edwards and Denetra Porties, Central State University
3:30-3:45	Development of a Statistically Based Validation Process for Computational Simulation Joshua Craven, University of Dayton	Non-Existence of Relative Difference Sets in Several Previously Unsolved Cases Jonathan Esala, Wright State University	Investigations into Solids of Revolution Corinn Herrick, Fairmont High School	A Synthesis of Finite Difference Methods and Jump Processing Arising in the Pricing of Contingent Claim Dan Zhang, University of Dayton

Abstracts of Invited Talks

9:45–10:45 a.m.

SC 114 Perfect and Abundant Numbers – a Perfect and Abundant Source for Undergraduate Research Projects, Judy Holdener, Kenyon College

Abstract: In June of 2009, the 47th perfect number was discovered by the Great Internet Mersenne Prime Search (GIMPS), a collaborative computing project involving volunteers from all over the world. Like all known perfect numbers before it, this number is even. Does an odd perfect number exist? Are there infinitely many perfect numbers? After more than 2000 years of study, the answers to these questions remain unknown. In my talk, I will introduce perfect numbers along with the closely related “abundant numbers”. After presenting some relevant background information, I will reveal some of the abundant mystery surrounding these perfectly intriguing figures and report on some of the results discovered in recent years by undergraduates at Kenyon College. In doing so, I hope to illustrate that number theory is fertile ground for students itching to get involved in answering open questions in mathematics.

1:15–2:15 p.m.

SC 114 Imaginary Numbers, Unsolvable Equations, and Newton’s Method, Jeffrey Diller, University of Notre Dame

Abstract: You might have been led to believe that math is all about solving equations. Sadly, however, most equations can’t actually be solved. The best one can do is to try to approximate their solutions. Newton’s method, usually taught in calculus, is one of the oldest and best methods for accomplishing this. The weakness to the method is that it depends on already having a reasonable guess at where the solution lies. In this talk, we look at what happens when you apply Newton’s method with no clue about the solution and even allow yourself to do ridiculous things like use imaginary numbers as starting guesses. Despite the unpromising premise, this story has a happy ending and some nice pictures.

Abstracts of Contributed Paper Sessions (Part I)

11:00–11:15 a.m.

SC 114 A Geometric Representation of the Abundancy Index, Katherine Moore, Kenyon College

Abstract: The abundancy index function, $I : N \rightarrow Q \cap [1, \infty)$, is given by $I(n) = \frac{\sigma(n)}{n}$, where $\sigma(n)$ is the sum of divisors function. Rational numbers greater than one in the range of I are called *abundancy indices* and those not in the range of I are called *abundancy outlaws*. In general, it is very difficult to identify a given rational as an index or an outlaw. In this talk, we will present a couple of classes of abundancy outlaws and illustrate a way of visualizing the outlaws among the set of rational numbers greater than one.

SC 107 Bernoulli Numbers: Development and Applications, Kristara Lee, Fort Lewis College

Abstract: This talk will discuss where Bernoulli numbers originate and the relationship they have to sums of powers of integers, as well as how Bernoulli numbers can be used to find the closed form for any sum of powers of integers.

SC 146 Mathematical Modeling of Antimicrobial Behavior of Metal-Intercalated Polymers, Nicholas Jones, University of Dayton

Abstract: Hydroxyapatite is a commonly used biocompatible agent in medical implants because it is known to be nontoxic. Silver has long been known to possess antimicrobial qualities, but its use in medical settings has been limited due to its toxicity in the human body. In hard-tissue implants bacterial infection and host acceptance are always chief concerns, so it would be preferable to create a material which combines the biocompatibility of hydroxyapatite with the antimicrobial activity of silver so that it is toxic to bacteria but not to humans. Antimicrobial testing was carried out to determine the toxicity of silver-intercalated hydroxyapatite to *Pseudomonas*. In preliminary tests, cultures containing 3mg of 20% silver-intercalated hydroxyapatite in 10 ml tryptone soy broth (TSB) showed no appreciable bacterial growth after 72 hours, while cultures containing the same concentration of hydroxyapatite were overgrown within the same period. In order to develop a mathematical model the population dynamics type models are under consideration.

SC 150 Formalizing Course Materials for a Quantitative Reasoning Course, Marissa Morin, Millikin University

Abstract: The general goal of this project was to collaborate with a faculty member to develop course materials that will be used in a quantitative reasoning course. Currently, the books on the market for this course are very expensive and only a small portion of the topics in the text apply to the course taught at Millikin University. In this presentation, the process the fellow used, as well as the resulting materials will be shared.

11:20–11:35 a.m.

SC 114 Growth of Groups Defined by Automata, Lydia Kindelin, University of Dayton

Abstract: Finitely generated groups of infinite order grow at many different rates. Growth functions are more commonly polynomial or exponential but there are rarer cases of intermediate growth. Grigorchuk found the first group of intermediate growth in the 1980's and these groups have been studied ever since. Understanding this group provides a foundation to explore similar finitely generated groups of infinite order. The Grigorchuk group is generated by an automaton and these structures are convenient for finding groups of intermediate growth. Nekrashevych conjectured that a specific kind of post-critically finite polynomial would produce an automaton which would generate a group of intermediate growth. This presentation will explain the Grigorchuk group and another group from an automaton with intermediate growth.

SC 107 Partially Balanced Incomplete Block Designs With Two Associate Classes, Cody Watson, Wright State University

Abstract: We provide constructions of cyclic 2-class PBIBD's using cyclotomy in finite fields. Our results give theoretical explanation of the two sporadic examples given by Agrawal (1987).

SC 146 Role of the Resolvent in a Perturbed Nonlinear Volterra Integral Equation, Bader Masry and Emad Mikael, University of Dayton

Abstract: We study the existence and uniqueness of the bounded continuous solution of the nonlinear perturbed Volterra integral equation

$$(1) \quad x(t) = a(t) - \int_0^t C(t, s)[x(s) + g(s, x(s))]ds, t \geq 0.$$

First, we shall obtain the solution using the resolvent equation and then we shall obtain the solution directly from (1). Finally, we shall show that there is no advantage using the resolvent equation.

SC 150 Investigating the Properties of Henry Functions, Zachary Hadaway, University of Dayton

Abstract: Math students studying inverse functions for the first time are often confused by notation. Students make the mistake of assuming equality between the inverse of a function and the reciprocal of a function. In general, this is not true. However, are there any functions for which this is true? Functions whose inverses are also their reciprocals are called Henry functions. In this expository presentation, we will investigate some properties of these functions, and provide a few examples. We will also consider the possibility of a piecewise continuous Henry function.

11:40–11:55 a.m.

SC 114 Compressed Zero-Divisor Graphs of Finite Commutative Rings, Lane Bloome, Millikin University

Abstract: The zero-divisor graph of a commutative ring R , denoted $\Gamma(R)$, is a graph whose vertices are the nonzero zero-divisors of a ring, and two vertices are connected if and only if their product is zero. These graphs have been studied for a number of years in the hope that the graph-theoretic properties of $\Gamma(R)$ can help us understand more about the ring-theoretic properties of R . We slightly alter the definition of the zero-divisor graph to obtain the compressed zero-divisor graph. In this talk, we will explore recent developments regarding these structures, including an algorithm for constructing these graphs.

SC 107 Decompositions of Complete Graphs into Cycles and Stars on the Same Number of Edges, Chester Lian, University of Dayton

Abstract: Let C_m and S_m denote a cycle and a star on m edges, respectively. We investigate the decomposition of the complete graphs, K_n , into cycles and stars. We give an algorithm that determines values of n , for a given value of m , where K_n is $\{C_m, S_m\}$ -decomposable. We also give necessary and sufficient conditions for such decompositions to exist for different values of m .

SC 146 Basic Models for Credit Risk Analysis, Danping Wang, University of Dayton

Abstract: Until the early 1970s, bond credit ratings agencies were paid for their work by investors who wanted impartial information on the credit worthiness of securities issuers and their particular offerings. This practice has been cited as one of the primary causes of the subprime mortgage crisis (which began in 2007). At that time some securities, such as mortgage backed securities (MBSs) or collateralized debt obligations (CDOs), rated highly by the credit ratings agencies, and thus heavily invested in by many organizations and individuals. Unfortunately, those securities were rapidly and vastly devalued due to defaults and fear of defaults. Impacted securities included home loans and credit card accounts. So, what's going on at the credit rating agencies? I am going to illustrate some basic models for the credit risk analysis: Z-score model and KMV structural model.

SC 150 Some Interesting Problems Related to Improper Integrals, Zi Ouyang, University of Dayton

Abstract: In the 71st Annual William Lowell Putnam Mathematical Competition, the problem A6 was posed to show if $f : [0, \infty) \rightarrow \mathbb{R}$ strictly decreases and converges to 0 as $t \rightarrow \infty$, then

$$\int_0^\infty \frac{f(x) - f(x+1)}{f(x)} dx$$

diverges. We consider one solution and motivate an argument to show that if $f : [0, \infty) \rightarrow \mathbb{R}$ strictly decreases and converges to 0 as $t \rightarrow \infty$, and $f''(x) \geq 0$, for all $x > 0$, then

$$\int_0^\infty \frac{f(x) - f(x+1)}{f(x)^\epsilon} dx < \infty,$$

for each $0 < \epsilon < 1$. Then we consider the case, $f : [0, \infty) \rightarrow \mathbb{R}$, $f(0) > 0$, $f'(x) \geq 0$, $f''(x) \leq 0$, for all $x > 0$, and $\lim_{x \rightarrow \infty} f(x) = L$ for some $L \in \mathbb{R}$, and show

$$\int_0^\infty \frac{f(x) - f(x+1)}{f(x)^q} dx < \infty,$$

for any $q \in \mathbb{R}$. We close with further variations and conjectures.

Abstracts of Contributed Paper Sessions (Part II)

2:30–2:45 p.m.

**SC 114 Algebraic and Operator-Theoretic Properties of Hardy-Hilbert
Space PTOs, Mehdi Nikpour, University of Toledo**

Abstract: From the matricial point of view, moving one step to the southeast, provides us a bounded operator-valued linear transformation on the C^* -algebra of all bounded linear operators on the Hardy-Hilbert space to itself, which enables us first to answer partially a spectral problem raised by Paul R. Halmos, and second to embed Toeplitz operators in an extended setting. In this setting, a new indexed-class of Hardy-Hilbert operators, namely Parametric Toeplitz Operators (PTOs), is defined, and some of their Brown-Halmos type algebraic and operator-theoretic properties are studied. At the end, some Toeplitz and Hankel-type operator-equations are considered and solved.

**SC 107 Decomposition of Complete Multipartite Graphs into 4-Cycles,
William Balbach, University of Dayton**

Abstract: We discuss necessary and sufficient conditions for the existence of an edge-disjoint decomposition of any complete multipartite graph into cycles of even length.

**SC 146 The Graph with Largest Maximum Singular Value of an As-
sociated Row Stochastic Matrix, Sean Meehan, University of
Notre Dame**

Abstract: Let G be a connected, undirected graph on n vertices. Let $B = A(G) + I$, where $A(G)$ denotes the adjacency matrix of G and I denotes the identity matrix. From B , we induce a row stochastic matrix R and we define the maximum singular value of the graph to be the maximum singular value of R . What do we know about the largest singular value of R ? What would happen if we ever so slightly changed the graph? It works out quite beautifully that over n vertices, the graph that produces the largest maximum singular value is the n -vertex star, which I will discuss.

**SC 150 A Numerical Algorithm to Value an American Call Option,
Junyao Zhang, University of Dayton**

Abstract: A numerical algorithm is developed to produce a numerical solution of a boundary value problem for the Black-Scholes partial differential equation on a certain region that includes a free boundary. In this algorithm, an artificial boundary is assumed to be the left boundary and a method to find the free boundary is developed. By this method, we can numerically value the American option to determine the optimal stopping time. This algorithm was introduced by H. Han and X. Wu, 2003.

2:50–3:05 p.m.

**SC 114 Multiple Structural Changes in a Linear Regression Model,
Ziqi Qiao, University of Dayton**

Abstract: In applications of time series, regime shifts can influence results severely. For example, the stock market is a popular topic which employs time series analysis. In different regimes such as “Bull Market” or “Bear Market”, investors will change their investment behavior due to shifts in the corresponding expectations. Such time series in a long horizon as a whole typically overlook the possible significant influence of regime shifts, while separated regimes can provide more valuable insights reflecting real circumstances. In this talk, we introduce a well-known process - Bai-Perron method - for testing multiple structural changes (regime shifts) in a linear regression model. We present how the method determines the number of breaks and the date of each break theoretically and convey the numerical algorithm followed by examples.

**SC 107 On a Special Class of Polynomials in Two Variables Over a
Finite Field, Courtney Brown, Ohio Northern University**

Abstract: We provide an explicit construction of a family of irreducibles in $F_p[x, y]$ that induce the null function from F_p^2 to F_p .

**SC 146 Just Add a Pinch of Redundancy: Using Frames to Send and
Receive Messages, Veronika Furst, Fort Lewis College**

Abstract: A frame is a generalization of an orthonormal basis for a vector space. Any vector in the space can be uniquely represented as a linear combination of the basis vectors, where the weights are the inner products of the given vector with each basis vector. By contrast, vectors in the space can be written as linear combinations of the frame vectors, but this representation is not unique. Far from being a detraction, this talk will argue that the inherent redundancy of frames that leads to non-unique representations of vectors allows us to transmit signals reliably despite possible errors and losses.

**SC 150 Quantum Magic: A Review of the Algorithms that Motivated
Quantum Computing Research, Nicholas Haynes, University
of Dayton**

Abstract: As early as the 1970s, physicists proposed ways of encoding information on quantum particles, thereby allowing the information to exist in a superposition of “0” and “1” states. This idea, however, did not gain traction until the early 1990s, when several algorithms capable of producing remarkable results were discovered. Two of these algorithms - the Deutsch-Jozsa algorithm and quantum teleportation - and their unintuitive implications will be discussed.

3:10–3:25 p.m.

**SC 114 Effect of Dominance Theorems on the Single-Machine
Weighted Tardiness Problem, Craig Birkemeier, Sinclair Com-
munity College**

Abstract: In single-machine job scheduling problems, there are n jobs to be assigned in n positions of a sequence with each job i defined by a processing time p_i , due date d_i , and weight w_i . One of the key performance metrics of a job schedule is weighted tardiness, which is the sum of each job's weight times its tardiness, $\sum_{i=1}^n w_i T_i$. Job tardiness is defined as $T_i = \max\{0, C_i - d_i\}$, where C_i is the job's completion time in the schedule. A branch and bound method is used to test the effect of including dominance theorems developed by Kanet (2011) in solving these problems.

**SC 107 Decompositions of Complete Graphs with Holes of the Same
Size into the Graph-Pair of Order 4, Courtney Perkins, Uni-
versity of Dayton**

Abstract: The talk gives necessary and sufficient conditions for the decomposition of complete graphs with multiple holes into the graph-pair of order four.

**SC 146 Decoding the Matrix: Compressed Sensing, Paul Havris, Fort
Lewis College**

Abstract: Compressed Sensing is a new branch of linear algebra, which serves as a new method to acquire a correct data set from an incomplete source. We will be looking at different ways to solve a general underdetermined equation, $y = Ax$, by using matching pursuit decoders and minimization algorithms. Compressed Sensing, which is in its first decade, has numerous real world applications and may become an integral part of new complex technologies.

**SC 150 Nutritional Disparity Among African Americans, Kristen Ed-
wards and Denetra Porties, Central State University**

Abstract: Vitamin D is a key nutrition for the human body - it helps to make the bones, muscles and other parts of human body healthy. Without Vitamin D, a person can generate a wide variety of diseases, such as cancer, high blood pressure, depression, immune system disorders (sclerosis), rheumatoid arthritis and diabetics. African American women are at greater risks of having diseases related to Vitamin D deficiency. It affects African American women of all ages; nearly 70% are not getting enough Vitamin D.

The pathways Vitamin D follows inside the healthy body are very complicated. Knowledge of this complex dynamics of Vitamin D is very limited. The purpose of this research is to understand this complex dynamic through system biological approach, so that experimentalists can use our model outcomes as a guideline for their future endeavors.

In this paper we will present a basic simple model that explains the complex network of Vitamin D. An extensive computer simulation has been done to analyze the model. The parameters of the model are chosen arbitrarily. Our system dynamical model is now available for experimental use with real clinical data.

3:30–3:45 p.m.

SC 114 Development of a Statistically Based Validation Process for Computational Simulation, Joshua Craven, University of Dayton

Abstract: A statistically-based process is being developed for validation of modeling & simulation (M&S) results with experiments. Critical parts of this process are uncertainty quantification, sample size specification, and sample distribution. Standard Monte Carlo (MC) methods rely heavily upon large sample sizes as well as pseudo-random number generation (RNG) to determine sample distributions. A newer sampling methodology is presented and discussed based upon quasi-RNG. Results of the pseudo-RNG and quasi-RNG techniques are compared for efficiency and effectiveness using several benchmark cases to quantify the differences in the methodologies. The extension of the more powerful quasi-RNG technique to areas of interest to the aerospace community are discussed.

SC 107 Non-Existence of Relative Difference Sets in Several Previously Unresolved Cases, Jonathan Esala, Wright State University

Abstract: In the group $G = H \times P$ where H and P are cyclic groups of order $n + 1$ and p respectively, it is of interest to know whether a subset $R \subset G$ is an $(n + 1, p, n, \frac{n-1}{p})$ relative difference set relative to P . Depending on the parameters n and p , a suitable R may or may not exist. We seek to establish the non-existence of such an R in several previously unresolved cases.

SC 146 Investigations into Solids of Revolution, Corinn Herrick, Fairmont High School

Abstract: We will discuss “Complementary Coffee Cups,” an article which appeared in The College Mathematics Journal. The author considers the relationship between the axes of revolution of two solids which share the same profile curve and have equal volumes. This led us to investigate the relationship between the profile curves of two solids of revolution that share an axis of revolution and where one is twice the volume of the other.

SC 150 A Synthesis of Finite Difference Methods and Jump Process Arising in the Pricing of Contingent Claim, Dan Zhang, University of Dayton

Abstract: It is demonstrated that approximation of the solution of the Black-Scholes partial differential equation by using a finite difference method is equivalent to approximating the diffusion process by a jump process and therefore the finite difference approximation is a type of numerical integration. In particular, we establish that the explicit finite difference approximation is equivalent to approximating the diffusion process by a jump process, initially introduced by Cox and Ross in 1976. We then show the implicit finite difference approximation amounts to approximating the diffusion process by a more general type of jump process. This work has been introduced by Brennan and Schwartz, 1978.

Electronic Proceedings of Undergraduate Mathematics Day

<http://academic.udayton.edu/EPUMD/>

Undergraduate Mathematics Day at the University of Dayton (UMD) is an undergraduate mathematics conference that is held in November of odd numbered years. We celebrate undergraduate mathematics in all its forms: research, history, teaching, and learning.

One purpose of UMD is to provide a platform for undergraduate students to experience the excitement of investigation in the world of mathematics. The conference allows an opportunity for students to present results; the Electronic Proceedings gives the student experience to formally write a research or expository article. The articles are refereed for correctness and style.

We appreciate your interest in UMD. We encourage you to submit an article, based on your presentation at UMD to EPUMD. We believe this is a meaningful part of the process to share your ideas with the mathematics community.

Instructions for Authors

The deadline to submit an article for review will be December 31 of that year. All submissions can be sent to

Paul.Eloe@notes.udayton.edu

with the subject line, Electronic Proceedings, UMD.

The first round of the review process will be complete by March 1. We anticipate working with students on style, historical context, and bibliographies, as well as mathematics content. In particular, we anticipate that time will be allotted for revisions to manuscripts; we intend to publish the proceedings by May 1 in even numbered years.

It is assumed that if you submit an article for review to the Electronic Proceedings of Undergraduate Mathematics Day at the University of Dayton, you have not submitted your article to any other outlet for publication.

What you need to submit:

- A letter in which you state your intentions to submit an article for publication. Clearly state the title, all co-authors, and the technical word processing language you have used. State clearly who serves as the corresponding author and give that author's email address. If you have worked with a faculty member, please give that faculty member's name and email address.
- Attach the text file of your manuscript. We prefer LaTeX but we will try and work with whatever format you use.
- Attach a pdf file of your manuscript.

Format of the manuscript (an example is given below):

- Title
- Authors' names, affiliations, email addresses
- Abstract (Abstract used for UMD is acceptable; a revised abstract is also acceptable.)
- Body of the manuscript
- Bibliography (if appropriate)

For Example:

This is the Title of My Paper

Paul W. Eloë

University of Dayton

Dayton, OH 45469-2316

Email: Paul.Eloë@notes.udayton.edu

Abstract: Here you provide your abstract. You may use the one you submitted in preparation of your talk; you can feel free to submit a revised abstract. The abstract represents an important component to the paper. What is the paper about? Why is it of interest?

The body of the paper follows the abstract. You do not need to break the paper into sections, but do introduce your paper with care. State clearly, and early, what the problem is. Historical context and a clear statement as to why the problem is of interest are always useful. When referring to your bibliography you can refer to Eloë [2] by name or you can simply refer to the work [2]. The order in the bibliography is alphabetical by author's last name.

Mathematical results must be correct. Of course, this comment does not necessarily apply if your work is expository, historical, or pedagogical in nature.

Below, in the bibliography, we provide two examples of bibliographic items. One example, [1], represents an appropriate format for a book, the other, [2], represents an appropriate format for an article.

References

- [1] R.P. Agarwal, *Difference Equations and Inequalities*, Marcel Dekker Inc., New York, 1992.
- [2] P. Eloë, Criteria for right disfocality of linear difference equations, *J. Math. Anal. Appl.* **120** (1986), 610–621.

The Twelfth Kenneth C. Schraut Memorial Lecture

The Kenneth C. Schraut Memorial Lecture was established entirely with the generous support of alumni donations in the memory of Dr. Kenneth C. Schraut, who was a long-time faculty member and chair of the Department of Mathematics. The Memorial Lecture was established for the purpose of sponsoring invited lectures by noted mathematicians for undergraduate students.

2011	Jeffrey Diller, University of Notre Dame Imaginary Numbers, Unsolvable Equations, and Newton's Method
2010	Eugene Steuerle, The Urban Institute Every Time I Turn Around There's Dr. Schraut or You Can't Take Mathematics Out of a U.D. Mathematics Major
2009	Thomas Santner, The Ohio State University These Aren't Your Mothers and Fathers Experiments
2008	Robert Bolz, Lockheed Martin Corporation Leadership Founded in Habits of Inquiry and Reflection
2007	William Dunham, Muhlenberg University An Euler Trifecta
2006	Gregory Campbell, Food and Drug Administration The Role of Biostatistics in Medical Devices: Making a Difference in Peoples Lives Every Day
2005	Patrick Flinn, National Security Agency Gröbner Bases: A Natural Extension of Gaussian Reduction and the Euclidean Algorithm
2004	Jane Pendergast, The University of Iowa Beyond Reasonable Doubt: The Role of Statistics in Health Research
2003	Robert E. Lewand, Goucher College How Not to Get Lost While on a Random Walk
2002	Paul J. Campbell, Beloit College How to Keep Up With Mathematics
2001	Richard M. Schoen, Stanford University Geometry in Two and Three Dimensions
2000	Joe Diestel, Kent State University Sums and Series in Vector Spaces

Remarks Offered at The Funeral of Dr.
Kenneth C. Schraut
November 3, 1997
Prepared and Presented by
Dr. Harold G. Mushenheim
Department of Mathematics, University
of Dayton



Family members, relatives, and friends of Doctor Schraut,

When Doc's family requested that someone in the Department say a few words about him at the service, and that that someone might be me, my initial response was to decline. In part, my reluctance arose from the fact that without a piece of chalk, an eraser, and a blackboard to run around in front of, I find public speaking not one of my favorite things. In greater part, though, I believe I hesitated because of the severe boundary condition contained in the phrase "a few words." I realized that rendering even small justice to Doc's accomplishments and life would require much more than that.

My own first encounter with Doc occurred in the early fifties in his office in the Albert Emanuel Library building, when he directed the project which eventually grew into the Research Institute. He had then already been on the campus scene for some twelve years or more. I am sure that most of us here today can recall clearly the circumstances of our first meeting with him. Perhaps, for you, it was as a freshman pre-med or engineering student who, just told-in no uncertain terms-to "mount the sphere, young man," realized only later that Doc was telling you to "get on the ball." Indeed, many of us here can say that our lives would probably be much different today had we not entered into Doc's force field.

His special genius as an educator derived, I think, from the intense personal interest he had in each of his students and in getting them to collaborate with him and each other in the learning process.

In his position as chair of the Mathematics Department, he developed a highly successful program of employing undergraduate teaching assistants. This provided many students with the opportunity of putting their knowledge at the service of others, and, in so doing, of perfecting their own. A disproportionately high percentage of these students were inspired by Doc and this experience to take on the challenge of graduate school and/or a career in mathematics education.

The biennial alumni seminars which he began, and which still flourish, evolved out of this philosophy of passing on to others the educational advantages which one received.

Over the years, Doc was involved in the advising of pre-medical students, and he taught a calculus course specially designed for them. The lecture notes which he generated for this class were in a constant state of development. Revision began immediately upon the completion of each new draft.

Again, Doc—as he did in mathematics—brought back to campus many alumni physicians to enrich the education of the current class of pre-meds.

Doc had a strong sense of how the university ought to be run for the good of all, and he did not hesitate to inform those who had need of this knowledge. In all likelihood, at this moment, there are, in many file drawers on campus, examples of what he himself termed “fussing letters,” communications directed to right a wrong or set a policy straight.

He loved languages, and once even set himself to learning a bit of Arabic, in order to assist some of our Mid-Eastern students. He had a rich vocabulary and liked to use it, especially in his letters, “fussing” or otherwise. His annual letter to hundreds of alumni and friends was a harbinger of the Christmas season.

Doc possessed an excellent memory and an arsenal of stories, some involving himself and some very funny. I once went with Doc to a mathematics convention in New Orleans. At that time, he was feuding with a certain Father so-and-so about some parish matter. Doc was really looking forward to meeting with his mathematical brethren, getting out of Dayton’s January chill, and certainly being out of touch with his nemesis on the homefront. As we were settling our registration business at the hotel desk, I looked up and was startled to see this very Father so-and-so coming out of the elevator. I started to tell Doc not to look in that direction, but it was too late. For the rest of the meeting, Doc was—as he would put it in his own words—“not quite [him]self.” Doc liked the Rumpole stories and the television shows based on them. I personally thought this very appropriate, as it seemed to me that there was something of Doc in Rumpole and something Rumpolean about Doc. When, for instance, he would chortle about something that the character “She Who Must Be Obeyed” said or did, I knew that he was speaking affectionately of his own beloved Virginia.

His intelligence and interests were wide and deep. He was in fact a fine woodworker. Examples of his craftsmanship were displayed in a beautiful exhibit of photographs at the funeral home yesterday.

As for all of us, some of the day-to-day circumstances of life moved his spirits. For Doc, having a good secretary lifted them skyward; having a poor one was a source of deep travail.

Even though I did not intend to provide an archival record of Doc’s work in these “few words,” I must mention his long service to the American Society for Engineering Education and to Honor Seminars of Metropolitan Dayton with which he was associated from its inception. I have tried, rather, to provide a few strokes of the pen, swiftly drawn, so that each of you can fill in your own portrait of this father, grandfather, teacher, adviser, mentor, colleague, and friend.

How fitting that the University of Dayton conferred upon Doc the title of Distinguished Service Professor. His life was indeed one of service, truly distinguished.

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For more information, contact

Paul Eloe

Paul.Eloe@notes.udayton.edu

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