Abstracts of Invited Talks

Rob Donnelly (Murray State University)

The joy of journaling

About four years ago, I started keeping mathematics journals. From bad math jokes to beautiful equations to flirtations with finitism to memorable exchanges with students and colleagues, no mathematical topic has been off-limits. Journaling has re-invigorated my teaching, my research, and my inner mathematical life. In this talk, I'll sample some of the variously fun and curious and hopefully instructive notions I've stumbled across in the past few years. I hope that some of these topics will pique your interest and maybe even challenge your perspective. I also hope to commend journaling to you as a deeply satisfying process and something you and/or your students might consider for a change of pace.

Henry Segerman (Oklahoma State University)

3D Shadows: Casting light on the fourth dimension

Our brains have evolved in a three-dimensional environment, and so we are very good at visualizing two- and three-dimensional objects. But what about four-dimensional objects? The best we can really do is to look at three-dimensional "shadows". Just as a shadow of a three-dimensional object squishes it into the two-dimensional plane, we can squish a four-dimensional shape into three-dimensional space, where we can then make a sculpture of it. If the four-dimensional object isn't too complicated and we choose a good way to squish it, then we can get a very good sense of what it is like. We will explore the sphere in four-dimensional space, the four-dimensional polytopes (which are the four-dimensional versions of the three-dimensional polyhedra), and various 3D printed sculptures, puzzles, and virtual reality experiences that have come from thinking about these things. I talk about these topics and much more in my new book, "Visualizing Mathematics with 3D Printing".

Talitha Washington (Howard University)

Ethics of Mathematics in Science, Society, and Students

Living through political turbulence has provided opportunities to reflect on the ethics of how we conduct ourselves in mathematics. This transcends to using mathematical models to prevent disease epidemics, to making sure that our mathematical landscape is inclusive to all persons, and creating learning experiences for students in preparation for careers that may not yet exist. We will discuss ways in which we can carry out our mathematics ethically to achieve justice for the benefit of all.

Abstracts of Contributed Talks

(u)=undergraduate, (g)= graduate, (f)= faculty member

Bandara, Udika; University of Louisville (g)
Multiple Change Point Estimation of DNA Copy Number using Next Generation Sequencing (NGS) Data
This talk considers on Multiple Change Point Estimation of DNA Copy Number using Next Generation Sequencing (NGS) Data. Mathematically, the main problem being considered is likelihood-based estimation of a step function where the jumps correspond to locations where the copy number changes, and the number of change points, location of the change points, and means of each of the continuous segments are unknown. A well-known algorithm called circular binary segmentation (with slightly modifications) is used for discrete random variables (such as Poisson and Negative Binomial) that are needed for analyzing NGS data.

Beck, Katheryn; Murray State University (g)
Solving a move-minimizing domino game using odd orthogonal distributive lattices
Recently several Murray State University mathematicians have studied a move-minimizing domino game played with integer partitions. The game can be solved using certain distributive lattices related to the special linear Lie algebras. Analogous results have been obtained in the symplectic case. Here we consider a move-minimizing domino game played with partition-like objects and use certain odd orthogonal distributive lattices to solve the game.

Bettersworth, Zachary; Western Kentucky University (f)
Simplifying knots via nullification
In nature, enzymes unknot DNA knots. In this talk, we model this simplification of knots using a simple operation called a nullification move. Since these operations are performed optimally in nature, the smallest number of nullification moves required to unknot something is of interest. We give bounds on the number of such nullification moves for a specific family of links known as the torus links. We further conjecture that these bounds are actually sharp.

Borjigin, Surina; University of Louisville (g)
An information theoretic thresholding technique based on particle swarm optimization
Image segmentation is an important and fundamental task in many digital image-processing systems. Image segmentation by thresholding is one of the simplest techniques. In this talk, we present a general technique for multilevel thresholding of digital color images based on Charvat-Havrda-Tsallis (CHT) entropy. The optimal threshold values are found by using enhanced particle swarm optimization method. The effectiveness of the proposed method will be demonstrated by using color images.

Chatham, Doug; Morehead State University (f)
Dragon placement problems
In Shogi, a Japanese relative of Chess, a dragon king is a piece that moves like a rook and king and a dragon horse is a piece that moves like a bishop and king. For each piece, we form a graph with vertices being the squares of an n-by-n board and with two vertices adjacent if and only if the piece can go from one square to the other in a single move. In this talk, we discuss the independence

number, domination number, and independent domination number for the dragon kings graph and the dragon horses graph.

Coulliette, David; Asbury University (f)
Field Scale Modeling of Rate-Limited Sorption in Production Transport Codes
Computational models of contaminant transport are used regularly for designing subsurface environmental remediation systems. In many soils, the contaminant sorbs to the solid matrix in the porous media. As a result, the rate of removal by traditional pump-and-treat flushing is much slower than predicted with equilibrium models. This phenomenon is called rate-limited sorption (RLS) and it is particularly problematic in cases where the contaminant has been in place for a long period of time. Although RLS is well known in academic literature, production models used for field work have failed to incorporate the effect. As a result, remediation designs and cleanup time projections are often inaccurate. In this project, a well-validated production subsurface transport model is modified with a simple analytical model for layers that incorporates RLS effects with reasonable computational costs. Laboratory-scale results are reviewed and the code is applied to a field-scale project. The site is a long-term (over 25 years) cleanup project that may exhibit RLS effects. The results contrast the potential shortfalls in remediation design by using equilibrium modeling.

Crowe, Cheryll; Asbury University (f)
Pyramid Power: Using Zometool to Explore Tetrahedrons
Zometool is a popular system of 3D struts and connector nodes that allows exploration of various topics in mathematics, science, and physics. This presentation will include a brief history and overview of Zometool. Participants will use a Zometool set to generate unique tetrahedrons and discuss applications of the system beyond triangular pyramids.

Crowe, Cheryll; Asbury University (f)
Introducing the Kentucky Association of Mathematics Teacher Educators
Kentucky has a new affiliate of the Association of Mathematics Teacher Educators (AMTE). The Kentucky Association of Mathematics Teacher Educators (KAMTE) would like to invite all Kentucky mathematics teacher educators to this session to learn more about KAMTE and its mission, which includes promoting excellence in the preparation and continuing development of teachers of mathematics and establishing collaborative working groups of mathematics teacher education professionals. The KAMTE Executive Board will facilitate a discussion with participants in order to learn more about how KAMTE can best serve them. Participants will leave feeling excited about this new Kentucky affiliation with AMTE.

Curtin, Dan; Northern Kentucky University (f)
One Hundred Years Old, KYMAA
The Kentucky Section was founded in 1917, two years after the founding of the MAA itself. The first meeting was at Berea College, as is the centennial meeting. The talk will be an overview of the history of the section with emphasis on the earlier years.

Dasenbrock-Gammon, Nathan; Northern Kentucky University (u)
Even False Addition
The primary World War II Japanese naval cipher JN-25 was enciphered code. Initially random additives were combined with clear code by the operation of false addition – addition of digits modulo 10. Near the end of the war, the operation was changed by the use of conversion tables,

which describe operations that are not group operations. This presentation will explore the recovery of additives from JN-25 when the operation is not false addition.

Davis, Andrew; Western Kentucky University (u)
Applying a density-dependent Leslie matrix model with steady-state distribution control to logistic populations
The Leslie matrix model allows for the discrete modeling of population age-groups whose total population grows exponentially. Many attempts have been made to adapt this model to a logistic model with a carrying capacity, with mixed results. This presentation will describe a new model for logistic populations that tracks age-group populations with repeated multiplication of a density-dependent matrix constructed from an original Leslie matrix, the chosen carrying capacity of the model, and a chosen steady-state age-group distribution. The total populations from the model converge to a discrete logistic model with the same initial population and carrying capacity. This presentation will also describe an algorithm to complete the model for a given data set.

Dennerlein, Jacob; Murray State University (u)
Finiteness of Posets Structured by Certain 2x2 Integer Matrices
In the latter half of the nineteenth century, Killing and Cartan famously classified the finite-dimensional complex simple Lie algebras. This classification result is now most often rendered using a peculiar collection of matrices/graphs. This matrix/graph-classification has since been found to have many occurrences. In this talk, we attempt to obtain a new Cartan-Killing type of classification result relating to the structure of certain edge-colored posets.

Donovan, Elizabeth; Murray State University (f)
Playing Dominos on Lattices – Part 1
Given two $k\times (N-k)$ partitions, we present a modified ``domino game'' where the objective is to find, if possible, the least number of ``domino moves'' to get from one partition to the other, where a domino move is, with one exception, the addition or removal of a domino-shaped pair of tiles. We solve this domino game by demonstrating the somewhat surprising fact that the associated ``game graphs'' coincide with a well-known family of diamond-colored distributive lattices which shall be referred to as the ``type A fundamental lattices.''

Dutta, Neelav ; University of Kentucky (u)
Gonality of Expander Graphs
Gonality is a graph invariant motivated by an analogous quantity for algebraic curves. It is connected to the expansion properties of a graph, which are of interest in computer science and applied math, in particular the theory of networks. Another graph invariant, the edge expansion constant, is a measure of expansion in a graph. In this presentation, we prove a relationship between the gonality of a graph and the edge expansion constant. Our approach provides the strongest lower bound on graph gonality in the literature to date.

Endicott, Lauren and Shacklette, Sienna; Morehead State University (u)
Generating Functions and Stackings of Spheres
Spheres can be stacked in lots of ways like oranges in a grocery store. It's not too hard to find recurrence relations for stackings of spheres, at least for special formations. Generating functions can be applied to solve recurrence relations to find explicit formulas. Using generating functions, we'll show how to count "rectangular" stackings of spheres.

Ernst, Claus; Western Kentucky University (f)
Curvature and Torsion of knotted polygonal curves
Curvature measures the turning angles of a polygonal curve and torsion measures how sharply it is twisting out of the plane of curvature. In this talk we talk about how these quantities change when the cure is knotted and when in addition it is confined in a small ball.

Gipson, Ryan; University of Louisville (g)
Atomic and AP Semigroup Rings F[X;M]
We investigate the atomicity and the AP property of the semigroup rings F[X;M], where F is a field, X is a variable and M is a submonoid of the additive monoid of nonnegative rational numbers. In our investigation, we introduce the notion of essential generators of M.

Gratton, Larry; Berea College (f)
A Novel Approach to Polynomial Interpolation in Precalculus
Two points define a line, and three points define a parabola. These ideas are related, but in a typical precalculus course, the two situations are handled very differently. In this talk, a novel approach to polynomial interpolation is presented which has several pedagogical advantages over the typically taught method of undetermined coefficients. Extending the idea recursively results in an algorithm equivalent to Newton's divided differences.

Guerrero, Pamela; Murray State University(g)
A mathematical model of honeycomb construction
It is no secret that pollinators, such as honeybees, play a vital role in the production of food for the human species. Here we examined a system of partial differential equations that captures the dynamics of parallel comb construction in a hive. Several different initial conditions are considered and we examine stationary solutions, varying parameter values, and the graphical model at different times of construction. Some of the tools we use are finite differences, correlation coefficients, Latin hypercube sampling, and the extended Fourier amplitude test.

Hart, Camuel; Western Kentucky University Gatton Academy (u)
Planar diagram codes of knot diagrams
A planar diagram code (or PD code) is an encoding of the information contained in a knot diagram in a form that a computer can manipulate. In the talk the PD code will be explained and how it can be used to simplify a knot diagram. A flype is defined as a 180-degree rotation of a tangle within a knot diagram. The long term goal of my research is to detect which tangles in a given knot are "flype-able" by looking at the PD code of a diagram.

Heinss, Seth; Asbury University (u)
Security Line Frenzy
This research is a diagnosis of airport security lines. Our research consists of two different mathematical models that allow us to review airport security and identify where delays might occur. Our first model is computer based, and our second model is equation based. Our computer model is based off of smaller airports to look closely at the security check process and to identify bottlenecks and causes of variance in wait time. Our equation model runs for any size airport because it accounts for the number of security check lines and number of carry-on bags per line. We use these models to test improvements that could be implemented into the security check process to minimize delays.

Hough, Wesley K.; University of Kentucky (g)
Discrete Morse Theory and Poset Homomorphism Complexes
The main idea of discrete Morse theory is to pair cells in a cellular complex in a manner that permits cancellation via elementary collapses, reducing the complex under consideration to a homotopy-equivalent complex with fewer cells. In this talk, we introduce the notion of a homomorphism complex for partially ordered sets, placing particular emphasis on maps between chain posets and the Boolean algebras. We extend the notion of "folding" from general graph homomorphism complexes to the poset case, and we define an iterative discrete Morse matching for these Boolean complexes. We provide formulas for enumerating the number of critical cells arising from this matching as well as for the Euler characteristic. We end with a conjecture on the optimality of our matching derived from connections to 3-equal manifolds.

Hull, Margaret; Asbury University (u)
TSA Line Management
TSA security lines are in constant flux, changing based on time of day, time of year, who's on duty, the size and location of the airport, and a number of other variables, making them almost impossible to model mathematically. Simulations, however, are capable of processing much more data than conventional systems. We used ProModel Processing Software to implement a discrete time interval model of airport lines, allowing us to pinpoint bottlenecks and suggest improvements.

Kelly, Michael; Transylvania University (f)
Optimal implementation of the Trojan Y-Chromosome eradication strategy of an invasive species
Invasive aquatic species continue to be a persistent problem around the world. The Trojan Y Chromosome (TYC) eradication strategy has recently been developed to help fight the problem in aquatic systems by targeting only the invasive species, sparing native marine stock. The talk will describe a mathematical model developed for finding the optimal implementation of the TYC eradication strategy of an invasive species using optimal control theory as well as a modified, potentially more cost effective strategy.

Lee, Duk; Asbury University (f)
Mathematical Music? Is it a good idea or stupid idea?
Melody is a sequence of musical notes. By assigning a number to each note, melody becomes a sequence of numbers. Sequence? We know it: It is an important topic in mathematics and there are many interesting ones: Fibonacci, for example. Let us make a melody line based on Fibonacci. How would it sound? If not, what can we do to make it sound more like a music, per say?

Love, Jordan; Murray State University (g)
The Mathematics of Artificial Neural Networks
Artificial Neural Networks (ANNs) are becoming ubiquitous within computational and data-intensive industries. The original formulation of the mathematical model of biological neural networks was published in 1943 by computational neuroscientist Walter Pitts and neurophysiologist Warren McCulloch. Since then, ANNs have developed significantly and are now performing categorical abstraction under the name "Deep Learning." This talk introduces foundational concepts related to ANNs including learning paradigms, network topologies and the Universal Approximation Theorem, activation functions, as well as gradient descent and the backpropogation algorithm. A demonstration of a neural network performing a classification task will be included.

Lugo, Jessica; Murray State University (u)
An Enumerative and Order Theoretic Study of some Symplectic Distributive Lattices
A certain classical family of distributive lattices of integer partitions arises naturally in the study of simple Lie algebra representation theory and Weyl symmetric function theory. In the symplectic case, this family of distributive lattices can be used to model the so-called ``one-rowed'' irreducible representations, which yields many combinatorial consequences. In this talk, we present a second family of distributive lattices that have recently been discovered and which serves as a wonderfully nice combinatorial companion to the classical family.

Luke, Ryan; University of Louisville (g)
The Way-Below Relation and Maps on Res(L,M)
In this talk, we will briefly introduce the way-below relation and what it means for two elements in Res(L,M) to have this relationship. Results will be presented on whether this relationship is maintained under order automorphisms, residuated maps, and monotone functions.

Martin, Andy; Kentucky State University (f)
Four Concrete Discrete Sine Cases
Case 1 is Gilbert Strang's "1000 Points of Light" investigation of sin(n) for integer n. Case 2 proves the density of sin(n) on the interval [–1 ,1]. Case 3 is a reminder of the discreteness of calculator mathematics. Case 4 is counting solutions to sin(x) = mx.

Martin, Andy; Kentucky State University (f)
Folding Developmental Mathematics into the Liberal Arts Requirement: One University's Attempt to Save Student Time and Money while Increasing Retention and Graduation Rates
After years of disappointing results requiring one (or two in some cases) pre-college, non-credit arithmetic/algebra courses for our students as qualification for the college level liberal arts math requirement, Kentucky State University ended that developmental experiment. We are into our second full year of "folding" into our liberal arts math course the needed background review. In this talk I will share how it is going so far.

May, Rus; Morehead State University (f)
Rolling a Yahtzee
Yahtzee is a classic dice game in which players roll dice to attempt to make special scoring combinations. Yahtzee is also the hardest combination to achieve in the game. We examine statistics of the game, involving basic results, approximations of varying precision, and recent research.

Munson, Jacob; Murray State University (g)
Some Graphical and Probabilistic Features of the Board Game RISK
In this talk we consider some graphical and probabilistic features of the board game RISK. Standard graphical features and measures will be explored. Probabilistic features include the Markov Chain modeling of the individual skirmish as well as expected outcomes over the course of a game.

Owens, Dakota; Asbury University (u)
Sustainable Cities
The urban population is growing at a staggering rate. As shown in history, drastic increases in the populations of cities can lead to significant problems. Therefore, it is important to incorporate smart growth methods into urban development. We developed a metric that includes the three E's of

sustainability (Economically prosperous, socially Equitable, and Environmentally stable) through which a city's growth can be measured as successful or unsuccessful. By looking at data from various cities we were able to compile a metric that we believe most fully encompasses the three E's. To test our metric, we analyzed the growth plans from two cities that have relatively large populations and edited their plans to fit in with our metric.

Pervenecki, Tim; University of Louisville (g)
Density Dependent Phenology May Cause Allee Effect
Strong Allee effect is a biological phenomenon in which a critical population threshold exist, which must be overcome for a species to survive. We start with an ODE model, where growth is controlled by a phenological kernel whose parameters are density dependent. We solve the ODE, create a year-to-year mapping, and present integral conditions for the existence of strong Allee effect in our model. Some simulations will be presented that show the model can exhibit complex dynamics.

Pham, Van; Western Kentucky University (g)
When are loop numbers knot invariants?
A knot diagram is a drawing of a knot. A loop number of a knot diagram is a way to divide the diagram into loops. We want to use loop numbers in an effort to tell knots apart. In this talk, we identify conditions under which these numbers are knot invariants.

Powers, Bob; University of Louisville (f)
An Axiomatic Characterization of the Median Function
Let G = (V, E) be a finite connected graph with vertex set V, edge set E, and where d is the minimum path length metric on G. Using a mini-sum criterion with respect to d, the median function Med on G takes as input any n-tuple of vertices (for any positive integer n) and outputs a nonempty subset of V. We will show that Med has a simple axiomatic characterization on the class of median graphs.

Richmond, Tom; Western Kentucky University (f)
Functionally Alexandroff Topological Spaces
A function f from X to X defines a topology P_f on X by taking the closed sets to be the sets A with f(A) contained in A. A topology on X is functionally Alexandroff if it is P_f for some function f. We will discuss some properties of functionally Alexandroff topologies.

Riehemann, Robert; Thomas More College (f)
Social Justice, Mathematics and Reductionism
There are many intersections between philosophy and applied mathematics. Social decisions about drug safety or economic policy posit mathematical models to measure their effectiveness and safety. This is, unsurprisingly, only part of the issue because the decision about which policies and models to use---of which there are usually infinitely many---are based on prior philosophical and ethical concerns. This talk discusses the uses of philosophy to choose such measures and considers the oft-stated (negative) critique of ``reductionism." We consider Rawls' Theory of Justice, Hobbes' Social Contract and the work of economists Amartya Sen and Kenneth Binmore, among others. In particular, we suggest that standard courses in statistics in the college/university level should include explicit information and discussion of the philosophical and ethical considerations (including appropriate references to philosophical literature) inherent in most hypothesis testing relating to health and well-being.

Roach, David; Murray State University (f)
Image Compression and Wavelets
In this talk, I will discuss the mathematics behind image compression for gray-scale images using wavelets and a zero-tree encoder.

Robinson, Mark; Western Kentucky University (f)
An Introduction to Gaussian Quadrature
A highly accurate method for approximating definite integrals in which an explicit formula for the integrand is available is provided by Gaussian quadrature, which involves computing a linear combination of function values selected in such a way as to maximize the degree of precision of the approximation formula. An elementary introduction to this approximation technique is provided, first considering integrals of functions of a single variable and then generalized to treat multiple integrals.

Roller, Kristyn; Asbury University (u)
Mathematical Art
This presentation will focus on a method for making a sculpture that appears different from various vantage points. The sculpture displays one word from one direction, a different word from a second point of view, and a third from another view. The art piece essentially starts with a rectangular prism and then the unneeded materials are cut away from three different perspectives, each starting at a point. This process must follow a set of mathematical rules involving proportions and cross sections. Using mathematical principles and processes, participants will learn how to take a uniform rectangular prism and transform it into a sculpture that appears differently depending on viewing angle.

Roller, Kristyn and Towanna; Asbury University (u/f)
Accommodations for Math Majors with Special Needs
University professors are familiar with general student accommodations such as enlarging print on tests for students with visual difficulties or addressing substantial excused absences for students with medical conditions. A fair number of these accommodations are expected in general education courses. However, professors are less trained on how special needs affect students in math major courses. This presentation will examine how faculty can support gifted mathematicians with special needs throughout the mathematics major.

Schroeder, Timothy; Murray State University (f)
Playing Dominos on Lattices -- Part 2
Reviewing the Domino Game in Part 1, we show a coordinatization of $k\times (N-k)$ partitions in which each domino partition is viewed as an element of $\mathbb{Z}^{N-1}$. This coordinatization has a basis in which each vector corresponds to a move in the domino game. We show that through the lens of this coordinatization, the solution of the domino game can be encoded via a transformation $\mathbb{Z}^{n-1}\rightarrow\mathbb{Z}^{n-1}$. Moreover, we discuss a connection between Catalan and ballot numbers and certain sublattices formed by restricting the domino game.

Stuffelbeam, Ryan; Transylvania University (f)
Two-sided Composite Sequences
We create infinite sequences by alternately appending two digits to either side of a positive integer. Our goal is to find conditions on the appended digits and the `seed' integer to guarantee the sequence consists only of composite numbers. We discuss a novel factorization method to discuss small seeds dependent on the values of the appended digits.

Thomas, Cassie; Murray State University (g)
Curiosities of subgroup lattices of finite groups
It is known that lattices of certain subgroups of finite groups are modular. In this talk, we present some interesting examples of this algebraic-combinatorial phenomenon, and we also consider situations where the lattice of subgroups is distributive.

Thome, Alex; Murray State University (u)
Unit shapes and a wealth of calculus problems
For a given family of similar shapes, what we call a "unit shape" analogizes the role of the unit circle within the family of all circles. For many such families of similar shapes, we will present what we believe is naturally and intrinsically "unital" about our unit shapes. We also present a number of calculus problems related to the question of minimizing the area of collections of unit shapes. (This is a joint talk with Dr. Rob Donnelly of Murray State University.)

Thompson, Tyler; Asbury University (u)
Modeling Throughput in Airport Security Checkpoints
Since the events of September 11, 2001, concerns for airline security have led to extended screening methods, resulting in long delays for airline passengers. These delays have been a source of annoyance to many airplane passengers. Using the ideas of queuing theory we construct a mathematical model to describe the movement of passengers through security screening checkpoints. The model simplifies the situation to an equation defined by arrival rate, service rate, and number of parallel service channels, based on the conclusions of Stephen Dorton and his research on the topic. Having developed a model that may be used as a tool for developing policy, we undertake to identify and rectify potential bottlenecks and inefficiencies in the screening process. We provide practical advice to security managers and policy-makers in order to increase the efficiency of the security process.

Vincent, Stanton; Murray State University (g)
Modeling of Pancreatic Beta Cells
One of the major diseases that has impacted modern life recently is diabetes mellitus. A debatably huge perpetrator of this vile disease is over-consumption of simple sugars (glucose, galactose, etc.) within peoples' diets. Beta cells within the pancreas react to signals from the body after consuming simple sugars. However, mishaps in this system lead to diabetes mellitus. We describe a mathematical model for beta cells regarding the effects of glucose, calcium (Ca2+), potassium (K+), and other necessary chemicals/signals in order to further understand beta cell functioning and the onset of diabetes mellitus in certain individuals.

Wilkinson, Steven; Northern Kentucky University (f)
Teasing climate signals from one hundred year-old seasonal data of Nova Scotia
Starting in 1892 and continuing for 30 years, Alexander MacKay, Superintendent of Public Schools in Nova Scotia, directed a program of citizen science for the collection of seasonal data on plants and animals. Students in hundreds of schools amassed the data. MacKay, a brilliant scientist as well, summarized the collected data and published the summaries in Nova Scotia's premier science journal. We pick up where MacKay left off, using his summary data. We incorporate meteorological data, sea ice data, etc. to tease out the impact of climate on changes in first appearance of flowers in five plant species (MacKay's favorites). We built a complete data set for 23 years of MacKay data, dealing with region changes and missing values through weighted averages and imputation based on the Singular Value Decomposition (SVD). Then we focus on physical aspects of place (e.g. winds and ocean currents) as well as climatic factors (e.g. air temperatures and Arctic sea ice extent, precipitation and snowfall) to model First Appearance as a function of latitude, longitude, air temperature, and sea ice extent. We use linear and non-linear regression, and application of a tensor variant of the SVD.

Wilson, John; Centre College (f)
Mathematics of a Dramatic Warm-up Activity
Many drama warm-up exercises involve actors standing around in a circle responding to cues given by other actors in the circle. In this talk, I devise a mathematical model for one such exercise and present some mathematical questions that arise. In the warm-up, which I will call Swing, an actor calls out a cue that passes the cue-calling responsibility clockwise to another actor in the circle who in turn calls a cue and so forth around the circle of actors. The ``Swing'' cue passes the action to the person immediately adjacent to the caller. The ``Ramp'' and ``Tunnel'' cues skip one and two people respectively. By using modular arithmetic and some basic number theory we will identify sequences of calls that are fair and balanced.

Ziegler, Uta; Western Kentucky University (f)
What is the probability that a random triangle is obtuse?
This problem goes back to a book called "Pillow Problems" by Lewis Carroll (1895, the author of Alice's Adventures in Wonderland). This talk derives several different answers to this question.