Program Abstracts

TIM CHARTIER, Davidson College, *March Mathness*

Abstract: Sports analytics is a growing field. The larger field of data analytics is exploding with its urgent call for skills in mathematics and computer science. Every year, people across the United States predict how the field of teams will play in the Division I NCAA Men's Basketball Tournament, often called March Madness, by filling out a tournament bracket for the postseason play. Dr. Chartier and his students at Davidson College have received national media coverage from such outlets as CBS Evening News, for a ranking method that can help you create your own predictions for the tournament. Learn tips on how to create your own math model to take some of the madness out of the March Madness tournament.

NIKKI MESHKAT, Santa Clara University, *Parameter identifiability of biological models*

Abstract: Models arising in systems biology can be structurally unidentifiable, meaning that some of the parameters in the model can take on an infinite number of values and yet yield the same data. In this case, identifiability approaches can reduce the model and determine combinations of parameters that can be estimated even when individual parameters cannot. I'll discuss a class of unidentifiable models and find conditions to obtain identifiable reparametrizations of these models using techniques from computational algebra and graph theory. In more detail, I'll review an important class of biological models called linear compartmental models and show how identifiability can be determined by simply looking at the graphical structure of these models.

SAM VANDERVELDE, Dean of Mathematics and Head of Proof School, *It's Not Polite to Point*

Abstract: How many ways are there to place up or right arrows on some of the squares within a rectangular grid so that no arrow points at any other? This innocent question will lead us on a merry mathematical adventure that includes something for everyone, from accessible results to clever identities. Along the way we will rediscover the Worpitzky number triangle, a less well-known but nonetheless quite worthy collection of combinatorial numbers. Our presentation will culminate in a proof of the main result in which we learn that it pays to listen to sixth graders.

MARIEL VAZQUEZ, UC Davis, *Packing, folding and simplifying DNA topology*

Abstract: Cellular processes such as replication, recombination, and packing change the topology of DNA. Controlling these changes is key to ensuring genome stability. Techniques from knot theory and low-dimensional topology, aided by computational tools, now make it possible for us to ask questions about the topological state of the genome and to study the specific action of enzymes that control DNA topology. I will illustrate the use of these methods with examples drawn from my ongoing study of unlinking of newly replicated bacterial chromosomes.

JILL PIPHER, Santa Clara Univ., *Cryptography: from ancient times to a post-quantum age*

Abstract: The concept of public key encryption was introduced in the famous 1976 paper "New Directions in Cryptography" by Diffie and Hellman. Within a couple of years, Rivest, Shamir and Adelman produced the first published example of a public key cryptosystem, and RSA encryption is still widely used for secure communication. In this lecture will give some historical background to encryption, both private and public key, and explain some of the mathematical ideas involved in several different encryption systems. In particular, we'll focus on lattice-based encryption schemes, like NTRU, an efficient public key system due to Hoffstein, Silverman and myself, which continue to remain secure against quantum attacks.