MOVES 2025

Monday Schedule (Aug 11)

	Room 101		Room 102		Auditorium 109	
	Talk	**Abstract**	**Talk**	**Abstract**	**Talk**	**Abstract**
10:10 - 10:30 am	**Making Proofs More Visual and Intuitive: the Reflective Properties of Conic Sections, and the Law of Cosines** *Rajeev Raizada*	*Why do parabolas and ellipses reflect light in such interesting ways? Where does that 2ab cos theta term in the Law of Cosines come from, and what does it mean geometrically? This presentation offers proofs (possibly new?) that try to be more intuitive than what is currently out there.*	**What Do We Learn From Carroll's Regress?** *Jason Rosenhouse*	*In an 1895 paper, Lewis Carroll published a paper meant to illustrate a potential paradox of logical inference. Since then, the paradox has generated a whole industry of published responses. We will consider these responses, and offer some thoughts of our own.*	**Slicing the Menger Sponge** *Ethan Berkove*	*The Menger sponge is a well-known fractal that can be built from a unit cube. In this talk we describe cross-sections that result from intersecting the Menger sponge with various planes. This includes all cross-sections parallel to an exterior face of the fractal.*
10:35 - 10:55 am	**Counting Similar Triangles on a Regular Polygonal Vertex Frame** *Stephen Erfle*	*The vertices of regular polygons can produce images with many similar triangles. These images are used to explore counting exercises. Counting sharpest isosceles and right triangles on regular polygons leads to alternative geometric interpretations of perfect squares and triangular numbers. Students can explore other images using the provided Excel file.*	**Tilt Fonts** *Tomoko Taniguchi*	*We design mathematical fonts where each letter consists of black and white tokens which can be transfered into any other letter by a sequence of just four "tilt" moves, where the tokens slide maximally in a direction until hitting carefully constructed obstacles. This builds on known universality results for four tilt moves. We also analyze what is possible with fewer tilt moves.*	**Origami Tessellation Design Possibilities from Two Simple Twists** *Madonna Yoder*	*Origami tessellations are folded from a single sheet of paper using twisting shapes that are connected by pleats. If we restrict ourselves to using two particular twists, how many different patterns can be made? This search yields several infinite families of distinct designs using unexpected applications of symmetries on tilings.*
11:00 - 11:20 am	**Right Triangles on a Grid** *Saad Mneimneh*	*Given integers n >= m >= 2 and n+m-1 points with integer coordinates in a two-dimensional mxn grid, we must have three points that make a right triangle. In fact, n+m-1 is the smallest number needed for such a guarantee. We ask about the minimum number of right triangles formed by placing n+m-1 points.*	**Math and Music: from Group Theory to Knot Theory** *Samantha Pezzimenti*	*Aspects of music theory can be understood via group theory in a surprisingly visual way. Certain chord progressions can be viewed as a path on the surface of a torus following a hexagonal tessellation. These paths can be knotted and we will perform some examples of knotted musical pieces!*	**Folding Gold: Origami-Inspired Jewelry Through Mathematics** *Hridyanshu*	*This talk explores how curved-crease origami and rigid folding patterns can be used to design jewelry. Using mathematical modeling and computational 3D design tools, I generated pendant geometries inspired by toroidal and superquadric forms. I will also show 22-carat gold pendants produced through precision casting from algorithmically designed 3D-printed molds.*
11:25 - 11:45 am	**The Helen of Geometry and other Fateful Mathematical Shapes** *Suzanne Sumner*	*Certain geometric shapes were impactful throughout the history of mathematics. These shapes have motivated new mathematical solutions and have inspired the development of new mathematics. Examples include conic sections, the catenary curve, and the cycloid curve, the "Helen of Geometry." Moreover, specific shapes validated Non-Euclidean and Fractal geometries.*			**Hexa-Hexaflexagon Double Puzzles** *Ann Schwartz*	*Anyone familiar with hexaflexagons knows that the challenge is to find all their faces, usually uniformly colored. But hexa-hexaflexagons can have additional puzzles based on their triangle rotations. In addition, when a particular flex is applied, hexa-hexaflexagons can also be scrambled like a Rubik's cube and present problem of descrambling.*

	Room 101		Room 102		Auditorium 109	
	Talk	**Abstract**	**Talk**	**Abstract**	**Talk**	**Abstract**
1:45 - 2:05 pm	**Computing Rook Polynomials for Column-Convex Polyominos** *Max Alekseyev*	*The rook polynomial for a given board provides a concise analytic description of the numbers of non-attacking rook placements as the coefficient of x^k in it gives the number of non-attacking placements of k rooks. The rook polynomials can be easily computed for rectangular boards of any size, but as soon as some of the cells are cut off such a board (and thus are unavailable for placing a rook), the problem becomes more complex. The Ferrers boards, composed of columns of varying heights, form yet another class of boards, whose rook polynomials admit a simple formula. Column-convex polyominos represent a natural generalization of Ferrers board, but without a known extension of the formula for*	**Building Better Bones** *Joe Fields*	*Napier's bones are a mechanical aid to computation invented (in the 1600's) by the same guy who created logarithms. We'll demonstrate how to use the bones to multiply 4 digit numbers. (Woo hoo!) Then, using ideas from Design Theory, we present a puzzle and solution inspired by "the bones."*	**Max Bill, Mathematician** *Barry Cipra*	*"I am training myself to solve, as best I can, within firmly fixed boundaries, certain problems that I have set myself," the Swiss artist Max Bill (1908-1994) once said. We'll consider one of his paintings, "gelbes feld" from 1948, in which he apparently did just that.*
2:10 - 2:30 pm	**On n-Dimensional Subtraction Games** *Mariya Naumova*	*We study subtraction games whose positions are nonnegative n-dimensional integer vectors. Given set S of n-dimensional integer vectors with positive sums of elements, two players move alternately from position x to y by choosing any s from S such that y = x-s is nonnegative until it's impossible.*	**Bluffing in Scrabble** *Timothy Chow*	*We exhibit what we believe is the first ever explicit example of a Scrabble position in which the optimal strategy (meaning the minimax equilibrium, ignoring spread points) is to make one move (the "setup") with probability 1/3 and another move (the "bluff") with probability 2/3.*	**Rainbow Barrycades** *Brian Hopkins*	*Barry Cipra posed a problem about ordered sums that Richard Guy dubbed Barrycades and enhanced with visual representations. Using the color scheme of Cuisenaire rods, manipulatives developed for elementary education, we consider a related new puzzle. There are some results to prove, but it's mostly play and combinatorial explosion.*
2:55 - 3:15 pm	**Solving Mapmaker: The Gerrymandering Game using MCMC Redistricting Algorithms** *Madhukara Kekulandara*	*We apply a Markov Chain Monte Carlo (MCMC) redistricting algorithm to solve Mapmaker: The Gerrymandering Game, revealing how real-world gerrymandering techniques can be computationally modeled—even in board games—to consistently generate winning strategies.*	**Coming Soon to MoMath: Programmable Randomness** *Jim Propp*	*In a quincunx exhibit, balls bouncing off pins and landing in bins form a bell-shaped distribution. When we change the biases at the junctions intelligently, we can nudge the balls into forming complicated curves specified by the user of the exhibit. The relevant formulas perform a quirky kind of image-compression.*	**Escher's Word-Puzzle Designs for Wrapping Paper** *Doris Schattschneider*	*In 1933, graphic artist M.C. Escher designed wrapping paper for five major department stores in Europe. Each design repeated the name of the store in 4 or 6 directions, criss-crossing in bands, creating what he called a "word-puzzle." Each design was printed from a minimal woodblock.*
3:20 - 3:40 pm	**Rook in the Menagerie** *Kai Maffucci*	*Rook is a card game in the Bridge-Whist family. The principal version uses a special deck of 41 playing cards. We examine bidding and playing strategies through computer simulations. These are based upon a colorful cast of amusing characters appearing in Victor Mollo's Bridge in the Menagerie book series.*			**Patterns, Shapes, and Structure in Mathematical Poetry** *E. R. Lutken*	*It is well known that mathematics has played a role in meter and rhyming patterns of poetry throughout history. In this presentation, we will review this history, then further examine relationships of math and poetry with an emphasis on new and unique poetic forms, shapes, patterns, and structure involving mathematics.*

13th Floor	
Talk / Presentation	**Abstract**
Omnificent Ominoes *Skona Brittain*	*Dictionaries define "omnificent" as "unlimited in creative power". Omino shape patterns seem to have that power – they've inspired the creation of seemingly unlimited varieties of puzzles. I will introduce the basic ones then proceed to posing a plethora of perplexing problems. Plastic omino pieces will be present for playing with.*
Reinventing Magic Squares: Designing Math Puzzles That Educate by Design *Christopher Jarvis*	*Video games can transform mathematical learning by prioritizing discovery over instruction. I'll showcase how our non-profit designs games that allow players to teach themselves complex concepts through exploration, featuring case studies, a demonstration of our upcoming release, and principles for creating genuinely effective educational gaming experiences.*
Bubble Tiles: Finding a Recreational Math Treasure *Lauren Siegel*	*In 2023 we read a tweet by David Bailey "Is it just me, but is there anyone else who didn't know that the famous Japanese artist Hokusai had an interest in tiling?..." Today MathHappens Foundation are distributing Bubble tile kits to students and educators around the world.*

13th Floor Lounge
Family Activity
Exploring Group Theory and Symmetry Through Coloring Challenges (*Alex Berke*) *The Wallpaper patterns have inspired artists like M.C. Escher and mathematicians, opening a visual portal into Group Theory. We will explore the symmetries of Wallpaper patterns through puzzles and "coloring challenges".* **The Geometry of the Game Set** (*Matteo Fiori*) *The game Set contains cards with images, each of which represent a point in an affine four-dimensional space. "Sets" in this game are lines in this space. We present an interactive hypercube cube (a 3D cube with color as the fourth dimension) that depicts the four-dimensional geometry of the game.* **PENTRAM: The Next-Level of Tangram** (*Emil Simeonov*) *Pentram is a special dissection puzzle invented by Emil Simeonov. It is based on a regular pentagon that can be used to extend mathematical knowledge beyond that of the well-known Tangram shapes. The golden ratio hidden in the pieces leads to the forming of many aesthetically appealing images.* **Flexagon Fun** (*Ann Schwartz*) *"Flexagon Fun" would teach children and adults how to make hexaflexagons and tetraflexagons, plus an unusual, not generally known flexagon. Participants would also be shown how the hexa-hexaflexagon can be a challenging puzzle and invited to create their own.*
Islamic Geometric Patterns with Modular Arithmetic: Hands-On Creations and Digital Exploration (*Rebin Muhammad and Alexandra Veremeychik*) *Explore the connection between math and art through Islamic geometric patterns. This session demonstrates how modular arithmetic can be used to design intricate and captivating patterns, blending tradition with mathematical structure. Participants will engage in hands-on activities and use a custom app to create, transform, and analyze designs.* **The Artistry and Mathematics of Siku Kolam** (*Maya Vishnoi and Elisa Celis*) *Explore siku kolam, an Indian art form passed down through generations of women. In this hands-on, family-friendly session led by an 8-year-old and her mother, loop lines around dots to reveal symmetry, recursion, and constraints—and discover how math, mindfulness, and tradition meet in beautiful designs.* **Designing a Mandala** (*Nicole Williams*) *Mandalas are deeply connected to mathematics. Join me in designing your own mandala and learning about the math hidden in the beauty.* **Seeing Math Differently: Artistic Dialogues with Geometry** (*Juan Sutachan*) *This hands-on activity invites participants to explore geometry through artistic creation. Using digital tools and visual design, students and families engage with concepts like symmetry, tessellation, and transformation. A companion art exhibit connects original illustrations with videos that reveal the underlying mathematics, encouraging new ways of seeing and experiencing math.*