Gathering 4 Gardner 8
Presentation Directory

Speaker	Presentation	*(Tentative) Schedule*
Scott Aaronson *Massachusetts Institute of Technology*	The Limits of Quantum Computers In the popular imagination, quantum computers would be almost magical devices, able to "solve impossible problems in an instant" by trying exponentially many solutions in parallel. In this talk, I'll describe several results in quantum computing theory, due to myself and others, that directly challenge this view. So for example, we now know that, at least in the "black-box model" that we know how to analyze, quantum computers would need exponential time to break cryptographic hash functions or find local optima, just as classical computers would. I'll also describe how one can sometimes "turn lemons into lemonade," and use the limitations of quantum computers to create new quantum learning algorithms. **www.scottaaronson.com/thesis.html**	*Sunday PM*
Adam Atkinson	Applications of Vampires in Law and Medicine Given what we know about vampires from shows such as Buffy and Ultraviolet, various ways they could be used to solve legal and medical problems spring to mind. **www.ghira.mistral.co.uk**	*Sunday AM*
Tom Banchoff *Brown University*	Slicing (Hyper)Cubes in "Flatland: the Movie" Slices from the new animation "Flatland: the Movie" recall sections of Martin Gardner's four-dimensional columns, challenging new generations of students and teachers. Look for 4 x 8. **www.math.brown.edu/~banchoff**	*Thursday AM*
Lowell W. Beineke *Purdue University*	Loyd's Courier Problem: Pythagoras, Diophantus, and Martin Gardner In Sam Loyd's Courier Problem, an army fifty miles long is marching at a constant speed. A courier, also going at a constant speed, rides from the rear of the army to the front and back again, returning at exactly the time when the army has advanced its length, fifty miles. The problem is to determine how far the courier travels. In a second version, the army has a square formation, fifty miles on a side, and the courier goes all the way around the army, again returning just when the army has advanced its length. In both versions, the answer is an irrational number. We present some work of Owen O'Shea on versions of the puzzle for which the answer is an integer.	*Saturday PM*
George Bell *Boulder, CO*	The shortest game of Chinese Checkers and related puzzles In one of his Scientific American columns, Martin Gardner introduced several puzzles originating from the game of Chinese Checkers (now a chapter in his book: Penrose Tiles to Trapdoor Ciphers). In 1971, Octave Levenspiel considered how quickly a single player could move their pieces from one side of the board to the other, and found a solution in 27 moves. We employ computational search to show that this is the shortest possible such crossing. David Fabian found a complete game of two-person Chinese Checkers in 15 moves by each player, we show that no shorter game is possible. **arxiv.org/abs/0803.1245**	*Sunday AM*
George Bohigian *St. Louis, MO*	An Ancient Eye Test-Using the 8 Stars of the Big Dipper Vision testing in ancient times was as important as it is today. The predominant vision testing in some cultures was the recognition and identification of constellations and celestial bodies of the night sky. A common ancient naked eye test used the double star of the 8 stars of the Big Dipper in the constellation Ursa Major or the Big Bear. The second star from the end of the handle of the Big Dipper is an optical double star. The ability to perceive this separation of these two stars, Mizar and Alcor, was considered a test of good vision and was called the "test' or presently the Arab Eye Test. This presentation is the first report of the correlation of this ancient eye test to the 20/20 line in the current Snellen visual acuity test. This presentation describes the astronomy, origin, history and the practicality of this test and how it correlates with the present day Snellen visual acuity test.	*Thursday PM*

Gathering 4 Gardner 8
Presentation Directory

Speaker	Presentation	*(Tentative) Schedule*
Robert Bosch *Oberlin College*	Recent Progress in Opt Art We will describe recent progress in using mathematical optimization techniques to create pictures, portraits, and sculpture. Examples will include Domino Artwork, TSP Art, and Edge-Constrained Tile Mosaics.	*Saturday PM*
Kenneth Brecher *Boston University*	A Torque About Tops Spinning tops have delighted and intrigued people for at least three thousand years. By seeming to defy gravity while pointing towards a fixed direction in space or precessing around it, they offer puzzlers and magicians as well as mathematicians and physicists, much food for thought. In this presentation, I will give a brief overview of the history of tops as both toys and scientific tools. I will also demonstrate the motion of several kinds of tops with unusual properties, ending with the counter-intuitive motion of rattlebacks made of wood, glass, pewter and other materials. (Note: My exchange gift for each participant at the gathering (given jointly with Scott Kim, whose G4G8 logo will be inscribed on them) is a plastic rattleback. Part of the point of the talk is to share with the participants at G4G8 the history and properties of these wonderful objects.) **lite.bu.edu**	*Thursday PM*
Vladimir Bulatov *Corvallis, OR*	Making Organic Geometrical Sculpture I will show and explain process of creating organic sculptures based on various geometrical ideas using custom interactive software and rapid prototyping technologies. **bulatov.org**	*Thursday PM*
Wyatt Casey	Promoting Math Education through Math Magic Math magic can be used to engage students into mathematical studies and activities. It can intrigue, inspire, and empower children at the elementary level on up. I have performed voluntary classroom magic for the last five years. Much of what I do has been inspired by the writings of Martin Gardner. In particular, his book "Mathematics Magic and Mystery" has provided me with a wealth of tricks and an inspiration to promote mathematics education through Math Magic. I would like to present four math magic tricks that I use to primarily intrigue students: 1. Crystal Cube - a cube form of the binary cards. I have developed my own device for determining the number the volunteer is thinking of. 2. Crystal Pyramids - a ternary extension of crystal cube. 3. Animal Magic - A tribute to a submission by Martin Gardner to Children's Digest in 1956 called "Tap an Animal". I have developed a wooden version and extended the concept. 4. Amazing Sorting Machine - a fully developed version of Rose Wyler's and Gerald Ames' "Who Did It" from "It's All Done With Numbers". I have developed the binary sorter that they present and have extended the concept to a ternary sorter. It uses laminated cards with animal pictures and names along with a wooden sorting machine.	*Saturday PM*

Gathering 4 Gardner 8
Presentation Directory

Speaker	Presentation	*(Tentative) Schedule*
Harold Cataquet *Cataquet & Associates*	Presenting the Knight's Tour An overview of the knight's tour as a feat of mental and/or mathematical acumen. The talk will also discuss the most recent findings in the analyses of the knight's tours.	*Sunday AM*
Martin Chlond *University of Central Lancashire*	OR MAGIC:Mathematics, Art and Games in the Classroom The session will promote the use of interesting and unusual applications of OR modeling techniques taken from the literature of recreational mathematics. The purpose is to encourage the use of such offbeat examples to capture the attention of students and stimulate motivation to learn.	*Thursday PM*
Barry Cipra *Northfield, MN*	Sudokuniqueness The speaker will describe a sneaky ploy that can come in handy solving certain difficult sudokus.	*Saturday PM*
John Conway *Princeton University*	(TBA) **www.math.princeton.edu**	*Thursday AM*
Bill Cutler *Bill Cutler Puzzles, Inc*	A New Puzzle Program A computer program has been written to solve 2-d packing problems in which the pieces and box are irregular shapes. The program has been successful in solving most of Edi Nagata's puzzles. **billcutlerpuzzles.com**	*Saturday AM*
Wayne Daniel *Genoa, NV*	178 Saw Cuts & Some Glue Steps taken to construct a puzzle with the shape of the Icosahedron/Dodecahedron Dual. The 'talk' will be a video. **www.waynedaniel.net**	*Thursday AM*
Frans de Vreugd *Katwijk, The Netherlands*	Puzzle Locks from India India has a rich history in making padlocks with special tricks to open them. On a trip to India we visited Hiren Shah, who has a magnificent collection of over 500 of these (mostly antique) puzzle locks. In this talk I will show many of the wonderful mechanisms of these locks from his collection in full detail. Frans de Vreugd is a Dutch puzzle designer and collector, traveling around the world in the search for puzzles. He is one of the editors of the puzzle newsletter Cubism for Fun. He was the host for the International Puzzle Party 27 in Gold Coast, Australia in 2007.	*Friday AM*
Erik Demaine *Massachusetts Institute of Technology*	Hinged Dissections Do every two polygons of the same area have a hinged dissection, that is, a hinged chain of pieces that can be folded into either polygon? This problem goes back implicitly to 1902 and has been studied extensively in the past ten years, culminating in a complete solution only this year. It turns out that the answer is yes, even if the goal is to fold into several different polygons. Furthermore, the hingings can be folded continuously without self-intersection, and the number of pieces is somewhat reasonable. Our result (joint with Timothy Abbott, Zachary Abel, David Charlton, Martin Demaine, and Scott Kominers) generalizes and builds upon the result from 1814 that polygons have common dissections (without hinges). We also extend our result to edge-hinged dissections of solid 3D polyhedra that have an (unhinged) dissection, as determined by Dehn's 1900 solution to Hilbert's Third Problem. All of our proofs are constructive with algorithms to compute the hinged dissections and motions between configurations. Hinged dissections have possible applications to reconfigurable robots, programmable matter, and nanomanufacturing. **erikdemaine.org/papers/HingedDissections_SoCG2008**	*Thursday AM*

Gathering 4 Gardner 8
Presentation Directory

Speaker	Presentation	*(Tentative) Schedule*
Stewart Dickson *Beckman Institute, Univ. Ill. at Urbana-Champaign*	Vedic Geometry and Tactile Mathematics In the Hindu Vedic texts, there is contained a unified system of doing mental arithmetic. Most of these techniques can be taught in Elementary School. However, as intuitive as Vedic Mathematics is, it is also almost purely symbolic and abstract, having little connection or concern for Geometry. The practice of creating Digital, Mathematical sculpture reveals that the abstract description of form becomes separated from the form when it is rendered physical -- a breakdown in communication of Modernist Abstract sculpture. The speaker proposes self-describing mathematical sculpture and asks whether Vedic Mathematics can lead to an intuitive description of functions describing three-dimensional surfaces. **www.vedictantra.com/VedicGeomTactileMath.htm**	*Sunday PM*
Michael Ecker *Pennsylvania State University Wilkes-Barre Campus (Lehman, PA)*	A Survey of Fun Paradoxes Paradoxes - How can you pass your body through a postcard? Can a surface really hold a finite volume of paint but not be painted (infinite surface area)? How does this last example (Gabriel's horn) relate to fractals, the von Koch snowflake, Star Trek's warp drive, and the human intestines? We will also consider wordplay with logical paradoxes, such as those that are offshoots of Russell's paradox. More frivolous: What's the deal with time travel? How can removing balls from an urn lead to no balls or infinitely many? (This is a more fun version of Zeno's paradox that I owe to Underwood Dudley.)	*(TBA)*
Stanley Eigen *Northeastern University*	The 2008 IG Nobels A summary of the recent Ig Nobel winners and some video from the prize ceremony. **www.improb.com**	*Saturday AM*
Yossi Elran *Weizmann Institute of Science, Rechovot, Israel*	A Graeco-Latin Search Game Martin Gardner was intrigued by Graeco-Latin Squares and dedicated a chapter in one of his books to the subject (Euler Spoilers). The beauty of Graeco-Latin squares and their practical use in experiment design has been known for decades. In our talk, we will present a new puzzle based on both Graeco-Latin squares and the well-known word search puzzles. The mathematical aspects of the game will be discussed, as well as possible generalities and specific puzzles concerning the theme of G4G8 (eight, infinity). **www.weizmann.ac.il/young**	*Thursday PM*
Michele Emmer *University of Rome*	The Adventure of the Square The adventure of the square in the land of modern art until the vitory. **www.mat.uniroma1.it/people/emmer**	*Friday AM*
Daniel Erdely *Spidron bt.*	Spidron's oddities I am going to present some of our surprising new findings, which encourage us to continue our long-term investigation of the movement and other interesting properties of Spidrons . We undertook here to present the peculiar tilting of some of the spidron edges during the continuous spidron movement, spidronized Penrose-tilings, the Kepler-tile shadows of certain edges of quasicrystals that are defined by the bisections of them by specific spidron-nests, and other curiosities. **www.spidron.hu**	*Sunday PM*
Dick Esterle *nobbly wobbly*	8 ways to Sunday and the AMAZING geometry Machine A spinning figure 8 creates two spheres and it's lazy cousin on its side dance toward the spherical counterparts of the Platonic Solids counting from 1 to 6. The Amazing Geometry MAchine continues to stick to its loops.	*Thursday PM*
Jeremiah Farrell *Indianapolis, IN*	Word Ways A discussion of the 41 year old Journal started by Martin Gardner (Word Ways: Journal of Recreational Linguistics) **www.wordways.com**	*Thursday AM*

Gathering 4 Gardner 8
Presentation Directory

Speaker	Presentation	*(Tentative) Schedule*
Robert Fathauer *Tessellations, Phoenix, AZ*	The Art of Fractal Knots A widely-applicable method for iterating knots is described. This method relies on substitution of portions of a knot with smaller copies of the entire knot. A starting knot is first arranged as a patch of tiles that contains individuals tiles similar in shape to the overall patch. Iterative substitution leads to the creation of complex knots that are often esthetically pleasing, particularly for knots possessing a high degree of symmetry. The iteration process is designed to allow repetition ad infinitum; i.e., an infinite number of iterations leads to a fractal knot that is in many cases unicursal. **members.cox.net/knotcompendium/index.html**	*Saturday PM*
David Finkelstein *Georgia Institute of Technology*	Decoding Dürer Dürer's engraving MELENCOLIA I has puzzled many viewers since 1514. It exists in two states with significant differences, and has dozens of unreported subliminal images and encipherments. It uses symbols all found in the Bible, the Hieroglyphica of Horapollo (already used by Dürer in the same year), and the Occult Philosophy of Agrippa (derided by Dürer, perhaps for Agrippa's astrology). Together these indicate a double message. Both messages are encapsulated in an anagrammatical legend that is now the name of the engraving. A rebus in Dürer's coat-of-arms for the word caelo, meaning both "I engrave" and "at heaven", helps to unscramble the anagram. The overt message, which has already been read by Panofsky, is that absolute truth and beauty are inaccessible to the artist/scientist, causing the melancholy of the legend. The covert message, however, is that Natural Philosophy, Gateway I to Heaven, is superior to Mathematical and Theological Philosophy. The innocuous admission of the limitations of science veils a manifesto of the impending scientific revolution that would otherwise have been a capital offense. **www.physics.gatech.edu/people/faculty/dfinkelstein.html**	*Sunday PM*
Greg Frederickson *Purdue University*	Unfolding an 8-high Square, and Other New Wrinkles A geometric dissection is a cutting of a geometric figure into pieces that we can rearrange to form another geometric figure. In this talk, I will focus on hinging the pieces with a "piano hinge", which connects two pieces along a shared edge and allows a folding motion. I will dissect and then fold a figure that is p levels thick to a second figure that is q levels thick, where q is not equal to p and all pieces are connected into one assemblage by piano hinges. Characteristic of such dissections, and apropos for G4G8, is a 12-piece folding dissection of an 8-high square to a 1-high square. Besides squares, I will also deal with Greek crosses, Latin Crosses, Crosses of Lorraine, regular hexagons and stars. Looking for folding dissections with the fewest number of pieces makes this activity more challenging. And for some dissections, just identifying an appropriate sequence of folds is not so easy. I will demonstrate some of these folding dissections with video and others with computer animation. **www.cs.purdue.edu/homes/gnf/book3/stackfold.html**	*Thursday PM*
Jordan Goldklang "Jordini" *Mill Valley, Indiana University*	Majoring in the Magic of Performance I am majoring in Magic at Indiana University through the Independent Major Program. I have been working with horn professor (and fellow magician) Jeff Nelson on the art of performance. I will be speaking about my past experience of performing through magic and also as a violinist, and what it takes to give a great performance. **www.Jordini.com**	*Sunday AM*

Gathering 4 Gardner 8
Presentation Directory

Speaker	Presentation	*(Tentative) Schedule*
Jan Grashuis *Arabesk*	Arabesk: the educational project Arabesk is a non-profit organization that promotes puzzles, games and objects related to physics, mathematics and logic. Amongst many other activities we developed (under the name Brainpleasers, in dutch: Breinkwekers) a package of two boxes containing 25 games and puzzles each for primary schools. In relation to these packages workshops are offered to introduce the teams of primary schools how to work with this kind of (addional) educational materials. These workshops are given by a school supporting organization. The content and philosophy will be elaborated on in the talk. **www.arabesk.nl**	*Sunday AM*
George Hart *Stony Brook University*	Screw-Together Puzzles Various people have designed geometric assembly puzzles in which the parts screw together in a surprising way. I will survey the ones I know and present some new ones of my own design, including my gift exchange item. **www.georgehart.com**	*Thursday PM*
Robert Henderson and Harry Nelson *Mason, MI*	Solving Harry Nelson's Pohaku Slide Puzzle Challenge Describes methods used to improve the shortest solution for Harry Nelson's IPP27 Pohaku slide puzzle challenge from 189 moves to the minimal 49 moves, winning the challenge prize of $151.	*Sunday PM*
Jim Henle *Smith College*	The Proof and the Pudding I am writing a book about mathematics and gastronomy. The two subjects don't interact. I don't apply mathematics to cooking. And I don't apply cooking to mathematics. Instead, I present the two fields side-by-side to show some essential similarities and also to make a few points about creativity, taste, problem-solving, philosophy, modern society, aesthetics, and the pursuit of pleasure. The talk will be about this project. **maven.smith.edu/~jhenle**	*Sunday AM*
Akio Hizume *Star cage institute of Geometry*	Inter-Native Architecture of Music I will talk about the music and architecture based on the Golden Mean. I will also talk about what I built in Tom's garden as mathematical heritage. **starcage.org**	*(TBA)*
Haruo Hosoya *Ochanomizu University (Emeritus)*	Discovery of Interesting Properties of 4000-Year Old Pythagorean Triples. Systematic Classification and Construction A right triangle T with integer edges is called Pythagorean triangle, and the set of three integers (a b c) forming T is called Pythagorean triple (PT). If these three integers do not have a common factor, this PT is called primitive and denoted by pPT. The smallest pPT is (3 4 5). More than 4000 years ago, i.e., more than 1000 years before Pythagoras, Babylonians already knew at least 16 pPT's. Although pPT's are thought to have been thoroughly investigated since then, no systematic analysis has been successful for efficient classification and generation of the family of pPT's except for the work by Hall and Roberts in 1970's by the use of three 3x3 matrices, U, A, and D. A dramatic improvement of this theory has been attained in the present study. By using this technique it was found that pPT's can be classified into three groups in terms of the differences between three different pairs among (a b c). These groups were found to obey different recursive relations, which were shown to be derived from U, A, and D. The most novel finding in this study is the discovery of general expressions for the j/k-th power of U and D, and a number of interesting mathematical properties were found and explained by these 3x3 matrices. Further, graph-theoretical interpretation for these findings was obtained by the topological index Z which has been proposed by the present author in 1970's. In this presentation all these findings will be explained easily so that no prior knowledge of sophisticated mathematics is necessary.	*Thursday AM*

Gathering 4 Gardner 8
Presentation Directory

Speaker	Presentation	*(Tentative) Schedule*
Thomas Hull *Merrimack College*	The Puzzle-Nature of Modular Origami Modular (or Unit) Origami involves folding multiple pieces of paper into identical shapes that can lock together, without glue, to form polyhedral shapes. Once the units are folded, the task of locking them together to make a desired shape is identical to that of a puzzler trying to reassemble a polyhedron dissection puzzle. There is also a strong parallel between the design of modular origami models and that of polyhedron dissection puzzles. In this talk I will illustrate these parallels, describe the process of modular origami design, and highlight some of the mathematical symmetries it can capture. **www.merrimack.edu/~thull**	*Thursday AM*
Ray Hyman *Professor Emeritus of Psychology, University of Oregon*	A Magic Square Routine A demonstration of a magic square where the magic total corresponds to the age of a relative merely thought of by a volunteer. I have gathered ideas from many sources to devise a square that requires a minimum of memory and mathematical ability. A volunteer secretly writes the name and age of relative. The performer quickly fills in the sixteen cells of a 4x4 matrix with numbers. When the volunteer reveals the age of her relative, the performer reveals that the relative's age equals the totals for each row, column and many other combinations of 4 cells of the square. As an added revelation, the performer asks the volunteer the name of her relative. The performer turns over the pad on which the square has been written to reveal that the relatives name is printed on the back. **www.markfarrar.co.uk/msfmsq01.htm**	*Sunday PM*
Glenn Iba *Lexington, MA*	Explorations of dynamic tiling (inspired by the game of Tetris) The video game Tetris can be viewed as an example of "dynamic tiling", where a rectangular space is filled with various shapes (tetrominos), but since completed (horizontal) rows are cleared, the tiling has a dynamic nature. In particular, gaps can later potentially be filled by clearing space to "uncover" the gap, and then fill it. I have developed a puzzle variant of Tetris, implemented as an interactive software game called "Target Tiling", that uses these ideas. The key ideas are: (1) to tile an exact rectangle using the dynamic row-clearing rule, (2) to define a clear objective (clearing all rows, or equivalently, dynamically tiling a rectangular space), and (3) making the piece sequence deterministic so that solving is feasible. The implemented game simulator is quite general (allowing 3-D rectangular space; 3-D pieces of varying sizes; variations of piece set; and changing parameters such as board width, height, & depth). The result is a very interesting space of challenges, and a rich domain for mathematical exploration. **glenniba.com**	*Saturday PM*
Hirokazu Iwasawa *Yokohama, Japan*	Tricky Solutions for Integrals with Crazy Lazy Eight Some improper integrals can be evaluated in some elementary but very tricky ways. I show several examples of such tricky solutions. And I invite you to enjoy what I call "Definite Integral Puzzle" as recreation.	*Friday AM*
Slavik Jablan *The Mathematical Institute, Serbia*	Knot Theory- Some Open Problems We will consider several open problems: uknotting (unlinking) number, unlinking gap, knots and links with unknotting number one, invertibility, amphicheirality, undetectability, non-algebraic tangles and polyhedral links. **math.ict.edu.yu:8080/webMathematica/LinkSL/cont.htm**	*Friday AM*
Harold Jacobs *North Hollywood, CA*	Euclid in Color One of the most eccentric mathematics books of all time was Oliver Byrne's edition of Euclid's Elements. Published in 1847, it is also one of the most beautiful. This talk will present the story of this wonderful book.	*Thursday PM*

Gathering 4 Gardner 8
Presentation Directory

Speaker	Presentation	*(Tentative) Schedule*
Kate Jones *Pasadena, MD - publisher of Martin Gardner's games*	Philosophy revisited: 8 great memes Martin Gardner's first interest and the field in which he has his degree was Philosophy. This important part of his life is often obscured by math, magic and puzzles. His book, "The Whys of a Philosophyical Scrivener," discusses all the -isms he isn't, and what he has finally chosen to be. Likewise, I shall enumerate 8 fundamental insights drawn from all those areas, including the games and puzzles I've designed, inspired by Martin's work. At G4G7 I had presented 7 principles and promised David Singmaster to supply 8 for G4G8. Here they are. **www.gamepuzzles.com**	*Sunday PM*
David C. Kelly *Hampshire College Summer Studies in Mathematics*	Problems from and Problems with the Interesting Test Since 1971 the Interesting Test (new each year) has been used to select exceptionally strong high school students for the Hampshire College Summer Studies in Mathematics. The IT, like the program, is designed to promote engagement with and enjoyment of the processes of mathematical thinking, not simply with the results of that thought. This talk will present some of the IT problems, puzzles, sources, and activities that have worked well and a few that flopped. **www.hcssim.org**	*Saturday AM*
Tanya Khovanova *Massachusetts Institute of Technology*	Number Gossip Have you ever heard of evil numbers? How about odious numbers? I will tell you what they are. What is the largest amount of coin money you can have without being able to make change for a dollar? You can bring your answer to this talk. What is so special about 1210? You will learn that too. You will be able to find out many things about your favorite numbers. **www.numbergossip.com**	*Saturday PM*
Ken Knowlton *Budd Lake, NJ*	Geometric strategies for "Knowlton" mosaic tilings Underlying mosaics, one of the oldest of art forms, lies the matter of partitioning space into areas - one such area for each item ("terresa"). I have used well-known methods, such as "large pixels" but also nonce (subject-specific, once only) methods, especially for my mathematician and puzzle minded colleagues, each of whom has inadvertantly suplied the idea. Several slides will illustrate my methods and observations. **www.KnowltonMosaics.com**	*Saturday AM*
Jerzy (Jurek) Kocik *Southern Illinois University*	Looking through the Apollonian Window The whole world seems to reflect itself in the Apollonian window — a special fractal design of circles. One can find there Pythagorean triples, intriguing integer recurrence sequences, pieces of sacred geometry (including Golden Ratio, Vesica Pisces, and pi), and puzzle-like rearrangements of circles with surprising properties. And even traces of Dirac scissors trick. **www.math.siu.edu/kocik/jkocik.htm**	*Saturday PM*
Yoshiyuki Kotani *Tokyo University of Agriculture and Technology*	The same puzzles which are seemingly different We sometimes find a puzzle is completely equivalent or similar in logic or mathematics to another puzzle. We sometimes transform some puzzle to totally different one in shape. There are such pairs of puzzles in all types, which are mathematical, logical, mechanical, or of their combination. They have the same logical internal structure, which can be enjoyed to study. I show a few pair of such puzzles, some are my original ones, and some are well known. There are four topics: (1)Batting order problems of baseball, (2) Square Filling Puzzles, (3) Sliding Puzzles and Ring Puzzles, and (4) A Digit Filling Puzzle.	*(TBA)*

Gathering 4 Gardner 8
Presentation Directory

Speaker	Presentation	*(Tentative) Schedule*
Lee Krasnow *Pacific Puzzleworks (Oakland, California)*	Recent Advancements in Rhombic Dodecahedral Puzzle Analysis Software Exciting new advancements have been made in the field of interlocking puzzle analysis software! During this presentation, I will give the audience a brief overview of Andreas Röver's open source "BurrTools" puzzle analysis software, including demonstrations of how it may be used to solve rectilinear burr puzzles, and also how it may be used to help design new ones. From there, I will discuss how this software has been extended to work with non-rectilinear geometric dissections such as triangular prisms, spheres, and now (finally!) the Right-Angle-Tetrahedron joins the list. The addition of this new geometry space allows analysis of a wide range of "Stewart Coffin" style puzzles which are based on dissections of the rhombic dodecahedron. After discussing some of the considerations made (and problems encountered) as this new functionality was developed, I will demonstrate how to model and solve many of the R-D puzzles written about in Stewart Coffin's "Puzzling World of Polyhedral Dissections". Q&A to follow. **burrtools.sourceforge.net**	*Sunday PM*
Peter Lamont *University of Edinburgh*	The Rise of the Indian Rope Trick The Indian Rope Trick was, for many years, the best-known secular miracle in the world. It remains the greatest legend of the East, and one of the most famous illusions in the history of magic. According to historians, it is of ancient origin, the feat was observed by Marco Polo and, in 1875, a vast reward was offered by the Viceroy of India for a single performance. Magicians searched in India for the secret and claimed they had found it, and countless ordinary witnesses claimed to have seen it. But the legendary feat has never been performed, and the legend comes from neither the ancient past nor India. So how and where did the legend begin, how did a never-performed feat become so famous, and what did the witnesses see? In this talk, Dr Peter Lamont reveals the truth behind one of the world's most extraordinary myths.	*(TBA)*
Mogens Larsen *Department of Math. Sciences, Univ. of Copenhagen*	Physical Mathematics I present a sample of application of physical thoughts in proving mathematical theorems in a different way than the usual Euclidean standard.	*Sunday AM*

Gathering 4 Gardner 8
Presentation Directory

Speaker	Presentation	*(Tentative) Schedule*
Shannon Lieb *Butler University*	Soap Bubbles and Local Hidden Variables? Interest in spherical, colored bubbles has long caught the interest of the young and old alike. Soap bubbles are the common source of these amusing and ephemeral objects. Mathematicians, scientists and engineers (among others) are passionate in their desire to take the common everyday observations and abstract from them generalizations that can be applied to seemingly unrelated areas of knowledge. The general phenomenon of a tension existing in the surface of a drop of liquid and its manifestations, have applications that range from recent attempts to understand the nature of the atomic nucleus to the theories of the genesis of our planetary system [Ref 1]. Balloons as models of soap bubbles: In an attempt to explain the ideal gas law (PV=nRT) for closed, isothermal systems, teachers will use a balloon as an example of how to visualize the effect of increasing the pressure inside the balloon by increasing the exterior pressure on the balloon (i.e., squeezing the balloon with their hands) and then predicting the effect on the volume of gas. Because of the use of the balloon as an idealized boundary between the enclosed gas and the surroundings, one ignores the fact that the balloon surface is far from ideal (as is also the case for a soap bubble). The following proposed experiment can be performed with either soap bubbles or balloons with the same results. Attach two equivalent balloons to a connecting valve (three way stopcock for instance) and inflate them to two different sizes. Then allow the two balloons to be connected to one another through the valve so that they can exchange their contents. First, anticipate the results of this experiment. Include in your anticipated results an explanation based on your (educational) experience and/or common sense. Now do the experiment! Ref 1: Preface to the Dover Edition of Soap Bubbles, Charles Vernon Boys, unabridged republication of the revised 1911 edition.	*Saturday AM*
Roger Malina *Leonardo Organisation*	Mathematics Made Flesh: Art, Scientific Simulation and A Life The Leonardo organisation was founded in 1968 to promote interaction between contemporary artists with scientists and engineers. The first project was the publishing of the scholarly Leonardo Journal, now part of the Leonardo Publishing program with the Leonardo Book Series at MIT Press. Over 40 years more than 5500 artists and researchers have documented their work in the Leonardo projects (http://www.leonardo.info). From the early algorithmic artists to todays artists using genetic algorithms, scientific simulations and artificial life, mathematical and computer artists laid the foundations for digital media and interactive games. Today as new branches of mathematics develop, such as in network theory, artists rapidly incorporate new mathematical ideas into their work and sometimes make significant contributions to mathematical knowledge in the process. **www.leonardo.info**	*Saturday AM*
Scot Morris	Amazing Eight Scot extends his scrutiny of numerology, "the one true pseudoscience."	*Friday AM*

Gathering 4 Gardner 8
Presentation Directory

Speaker	Presentation	*(Tentative) Schedule*
David P Moulton *Center for Communications Research*	Averaging Points Two at a Time In 2006 Brendan McKay asked the following on sci.math.research: We have n points in a disk centered at the centroid of the points. We successively replace the two furthest points from each other by two copies of their average. (After each move we still have n points with the same centroid.) How many moves are necessary to guarantee that all points lie in the concentric disk of half the radius? This really is the wrong question: it turns out that the situation is easier to study if we use a general Euclidean space and look at the rate of decay of the diameter in terms of number of moves. We get sharp asymptotic upper and lower bounds on the maximum diameter after certain numbers of moves. This involves interesting geometrical configurations and simple linear-programming arguments. **runner.princeton.idaccr.org:12080**	*Thursday AM*
"Card Colm" Mulcahy *Spelman College, Atlanta*	Genetic Evolution - One to Eight Inclusive We explore some card tricks based on new discoveries involving special arrangements of the numbers 1 to 8 inclusive.	*(TBA)*
Ted Nelson *Oxford Internet Institute*	A New Agenda for Mathematics Math teaching today is pessimized for discouragement and disaffection. Ask most people and they will say they hated mathematics, along with history. Now this is particularly strange. Consider history. History can be learned in any order. Yet they spoil it. And guess what? Math too can be learned in any order. What's that you say? We've tried different curricula? You're not hearing me. The problem is HAVING a curriculum-- a fixed sequcnce and schedule for all students. Students are consumers, whether you like it or not. If we want to entice them, they must be given great choice and variety-- instead of the grind of fixed sequence, we must give them the fun of shopping. (Shopping, it should be noted, is research.) I propose, instead of a curriculum, a cafeterium. We tell the students what they must know and offer them different pathways to get there. (What they should know is a juicy question separate from this proposal.) Of course this must be testable. But we need minimal testable modules, connected in as many ways as possible. We want to show the crystalline beauties of the mathematical universe much earlier than is presently allowed. What's that you say? This can't fit in today's educational system? It's the system that doesn't fit. The system doesn't fit the subject and it certainly doesn't fit the students.	*Saturday PM*
Bruce Oberg *Sucker Punch Productions*	I H8 8 Wherein the prosecution makes its case.	*Friday AM*
Adrian Ocneanu *Penn State*	Shadows of four dimensions and a mechanical quaternion machine We present several constructions, large scale sculptures and movies on four dimensional regular structures and of their movements. We present a large scale quaternion machine which uses 25 cogwheels to convert interactively these sculptures into symmetries. **www.science.psu.edu/alert/math10-2005.htm**	*(TBA)*
Tohru Ogawa *The Interdisciplinary Institute of Science,Technology and Art & University of Tsukuba*	A New Type of Transformation from 4D to 3D and Some 3D Designs A New Type of Transformation from 4D to 3D and Some 3D Designs including a family of space curves and "Ms Donut" (A Torus-related design) and some other interesting motions. **www.koalanet.ne.jp/~ogawa-t/G4G8OGAWA.htm**	*Thursday PM*
Chris Palmer *University of Colorado at Boulder*	SlideTab Surface Creation System **www.slidetab.com**	*Sunday PM*
Jean Pedersen *Santa Clara University*	Stop-Sign Theorems The Star of David Theorems, involving six binomial coefficients are well-known. In this talk we will discuss a way to arrive at the generalized Star of Daivid Theorems and then discuss some new Stop-Sign theorems involving eight binomial coeffieicnts.	*Saturday AM*

Gathering 4 Gardner 8
Presentation Directory

Speaker	Presentation	*(Tentative) Schedule*
Ed Pegg Jr.	Meet the Attendees An Introduction Machine! **www.mathpuzzle.com**	*Friday AM*
Sebastien Perez-Duarte *Frankfurt, Germany*	Conformal mappings and photography Conformal mappings are an 19th century area of mathematics, and their application to cartography goes back to those heroic times. Unknowingly (or not) they are also the subject of many drawings by M.C. Escher, and recent work has shown the connection to conformal mappings. I will show how these techniques can be applied to photography, both traditional and spherical, to produce interesting results. **www.flickr.com/photos/sbprzd/sets/72157594172266668**	*Saturday AM*
Jim Propp *University of Massachusetts Lowell*	Pi over 8, by way of infinity I'll demonstrate a simple mathematical contraption that uses rotating arrows and moving chips to compute better and better approximations to pi over 8, generating an interesting 4-colored picture in the process. **www.cs.uml.edu/~jpropp/rotor-router-model**	*Sunday AM*
Rinus Roelofs *Hengelo, the Netherlands*	Single Surface Structures Normally structures of interwoven layers are built with two or more surfaces. In my talk I will show and explain structures of interwoven layers built with only layer. **www.rinusroelofs.nl**	*Sunday AM*
Karl Schaffer *De Anza College/Dr. Schaffer and Mr. Stern Dance Ensemble*	Imaginary Dances Mathematical descriptions of a swirling movement pattern popular in many forms of dance often make use of the quaternions. In this interactive presentation the mathematics becomes part of a divertissement on the real and the unreal in an age of ubiquitous video imagery.	*Friday AM*
Daniel Scher *KCP Technologies*	Thought-Provoking Sketchpad Puzzle Challenges for Young Learners For over 15 years, the Geometer's Sketchpad software has been a powerful tool in the study of high-school and college-level mathematics. With puzzles as its unifying theme, this talk will demonstrate how Sketchpad is now being used in grades 3-5 to foster young learners' development of mathematical reasoning. **homepage.mac.com/dscher**	*Sunday PM*

Gathering 4 Gardner 8
Presentation Directory

Speaker	Presentation	*(Tentative) Schedule*
Alan Schoen *Carbondale, IL*	Five Platonic Polyhedral Puzzles For each of the five regular convex polyhedra Π, one can construct a combinatorially complete set of *p* polyhedra, dubbed 'Korners' (*tetrons*, *octons*, *cubons*, *icons*, and *dodecons*), which can be arranged to pack *n* copies of Π. The lengths of the *v* edges incident at the Korner vertex that coincides with a vertex of Π are defined by the *v*-tuple $P=\{i_1,i_2,\ldots,i_v\}$ $(1 \le i_1,i_2,\ldots,i_v \le m)$. The smallest—and therefore preferred—Korners sets result from minimizing *n*: then $(p,m,n)=(24,4,6)$ for tetrons, $(24,3,4)$ for octons, $(24,4,3)$ for cubons, $(24,2,2)$ for icons, and $(20,4,1)$ for dodecons. Except in the case of dodecons, each *v*-tuple *P* corresponds to one of the *p* ways of coloring the vertices of a *v*-gon using ≤ *m* colors, allowing only rotations (*cf*. A006537 in Sloane's OEIS). For dodecons, both rotations and reflections are allowed; hence they define a Grünbaum-Shephard *basic* set, while the other four Korners sets are *reflective.* Korners puzzle pieces are fitted with magnets on their external faces to facilitate packings. The following topics will be summarized: (1) the properties of symmetrical *vs.* asymmetrical pieces in a Korners set; (2) the relation between the symmetry of the data base structure (a symmetrical graph in which each node is a *v*-tuple *P*) and global packing solutions; (3) dual pairs of Korners (*P-duality*); (4) dual pairs of Korner face polygons (*face-duality*); dual polygons are assigned a unique color; (5) a special packing of the eight asymmetrical cubons that is invariant under a *twist transformation* at its vertices; (6) counting packings with Mathematica; (7) analogous 2-dimensional 'korners' sets. Gatherers at G4G8 are invited to play with the Korners (and korners) sets displayed in the Exhibits room.	*Thursday PM*
Rich Schroeppel *Woodland Hills, UT*	7^3 TicTacToe is a draw TicTacToe played on a size 7 cube is a draw. I give a Generalized Pairing Strategy that draws for the second player. I also show Pairing Strategy Draws for 11^4 and 14^5 boards. **www.cs.arizona.edu/~rcs**	*Saturday PM*
Caspar Schwabe *Kurashiki, Japan*	Jitterbug Magic In the course of unfolding these mathematical models into 'three space', they unveal interesting kinematic phenomena like rotation and inversion, doubling and jitterbugging and beyond. **snec.synergeticists.org/pipermail/snec/2007/000112.html**	*Thursday AM*
Ann Schwartz *New York, NY*	A Flock of New Flexagons Presenting about 10 brand new flexagons, as well as new discoveries of the hexadodecaflexagon. **eighthsquare.com**	*Saturday PM*
Carlo Sequin *University of California, Berkeley*	Art and Math Behind and Beyond the Eight-fold Way Explore some of the math and the artistic possibilities in the {7,3} tessellation of the genus-3 Klein surface and of some other regular tilings of higher-genus surfaces. **www.cs.berkeley.edu/~sequin**	*Sunday AM*
Dale Seymour *Los Altos, CA*	Introduction to tessellations Although the mathematics of tiling can become quite complex, the beauty and order of plane tessellations is accessible through elementary geometry. This presentation will introduce the basics of tessellations. Examples of application of these principals to Islamic art and M.C. Escher's work will be shown.	*Saturday PM*

Gathering 4 Gardner 8
Presentation Directory

Speaker	Presentation	*(Tentative) Schedule*
Rhonda Roland Shearer *Art Science Research Laboratory*	How Marcel Duchamp, Dada jokester's original optical illusions and photo trickery put "ha ha" into the "aha" Marcel Duchamp (1887-1968), along with Picasso, is commonly identified by art historians as having the greatest influence upon 20th century art making. Duchamp's impact continues unabated today. Shearer will discuss how her examinations of Duchamp's series of "Readymade" objects (such as "Hatrack," 1916), have revealed significant and measurable departures from traditional perspective and photography that, laughably remained hidden in plain sight and outside conscious perceptions of both art experts and the general public for almost 90 years. Shearer will argue that Duchamp's tricks are not merely Dada jokes--but coexist within his original researches into optical illusions and what he called his pursuit of "rehabilitated perspective." Shearer will bring along Duchamp's "Rotorelief Discs" (1963) to demonstrate his 1923 original scientific discovery, which later scientists coined the "Stereokinetic effect." **asrlab.org/rrs_cv.htm**	*Saturday AM*
Steve Sigur *The Paideia School*	Synthesis of a gong A complex sound is synthesized as a combination of pure tones. For a sound as complex a that of a gong, this is an interesting process. We will present the acoustic elements of a gong sound and show how this sound can be created from pure tones.	*Sunday AM*
Jorge Nuno Silva & Patricia Silveira *Lisboa*	Old pedagogical games. A survey. The oldest known pedagogical game, Rythmomachia, is almost a thousand years old. In this talk we will describe some others, mainly focused on Astronomy, Teology and Mathematics.	*Friday AM*
David Singmaster *London*	The Boy's Own Conjuring Book Clarified Many of the mid 19C books on conjuring, tricks and puzzles have obscure authorship and even publishers, with considerable copying. One notorious example is The Boy's Own Conjuring Book. I have recently acquired an example with different contents than the examples I had previously seen. Examination of the standard bibliographies and several examples at the Harry Price Library shows that there are two different versions of the book of this name and this has not been pointed out previously. Although the book claims to be published in New York, we now see that it was published in England by Milner & Sowerby. The first version is a smaller format (20mo or 12.4 x 7.8 cm) with 416pp, entirely taken from The Magician's Own Book, (MOB), US edition, 1857, so it is an abridgement of MOB. The second version is in a larger format (16mo or 16.5 x 9.9 cm), with 384pp, comprising the previous book with the addition of a few more items from MOB plus about 130 further items and 38pp on Charades, etc., so it is a substantial extension of the earlier version, but I have not yet determined where most of the additional material comes from. Both versions were published in various bindings. I will bring several versions for display.	*Thursday AM*
Neil J. A. Sloane *AT&T Shannon Labs*	Eight Hateful Sequences Dear Martin Gardner: In your July 1974 Scientific American column you mentioned the Handbook of Integer Sequences, which then contained 2372 sequences. Today the On-Line Encyclopedia of Integer Sequences contains 137000 sequences. Here are eight of them, suggested by the theme of the Eighth Gathering: they are all infinite, and all 'ateful in one way or another. I hope you like 'em! Each one is connected with some interesting unsolved problem. **www.research.att.com/~njas/sequences**	*Thursday PM*
Raymond Smullyan *Elka Park, NY*	Puzzles and Paradoxes Some variants of famous paradoxes. And some new ones.	*Friday AM*

Gathering 4 Gardner 8
Presentation Directory

Speaker	Presentation	*(Tentative) Schedule*
Gerald Jay Sussman *Massachusetts Institute of Technology*	Evolvability and Robust Design It is hard to build robust systems: systems that have acceptable behavior over a larger class of situations than was anticipated by their designers. The most robust systems are evolvable: they can be easily adapted to new situations with only minor modification. How can we design systems that are flexible in this way? Observations of biological systems tell us a great deal about how to make robust and evolvable systems. Techniques originally developed in support of symbolic Artificial Intelligence can be viewed as ways of enhancing robustness and evolvability in programs and other engineered systems. By contrast, common practice of computer science actively discourages the construction of robust systems. Robust designs are built on an additive infrastructure: there are exposed interfaces for attaching new functionality without serious disruption of preexisting mechanisms. Indeed, the ability to harmlessly duplicate a mechanism and then modify the copy to supply useful new functionality is one of the principal ploys appearing in natural evolution. What are the preconditions that support such augmentation? Can we engineers arrange our systems to be extensible in this way? Are there exploitable analogies between the techniques that we have created to make extensible artifacts and the mechanisms that we find in biological systems? I will address these and related issues, and show, in terms of explicit and concrete examples, how some of the insights we glean can inform the way we do engineering in the age of information. **www-swiss.ai.mit.edu/~gjs**	*Thursday AM*
Amy Szczepanski *University of Tennessee*	Designing Patterns for Knitting Geometric Shapes Traditional knitting patterns approximate many common shapes. Hats are like hemispheres; shawls take on many plane shapes; other garments are based on cylinders. How can we design patterns that focus on the mathematics of the shapes? Patterns for circles and spheres will be discussed. (This work is inspired by projects of sarah-marie belcastro and Carolyn Yackel.)	*Thursday PM*
Naoaki Takashima	Newly found booklet of Japanese Silhouette Puzzle At the G4G2 held in January 1996, I introduced a woodcut printing of Japanese silhouette puzzle playing with nineteen pieces. And, at this G4G8, I would like to introduce again the same silhouette puzzle from the newly found problem booklet. The name of the booklet is "Chie Ita Hikan (Ge)" that literally means "Secret Volume of wisdom plate (lower volume)". If time permitted, I would like to talk on a math joke in addition to the above.	*Sunday AM*
Hideki Tsuiki *Kyoto University*	Gray-code Expansion of Real Number and Continuously-Changing Infinite Sequences. (Binary reflected) Gray-code is a coding of natural numbers with 0 and 1 which is different from the ordinary binary code. Gray-code appears in many branches of mathematics and computer science, and as Martin Gardner wrote in Scientific American column, it is connected with solutions of some puzzles. In this talk, we explain Gray-code expansion of real numbers. With binary expansion, we have two expansions for some real numbers. For example, 1/2 has two expansions 0.0111... and 0.1000.... It is also the case for Gray-code expansion, and 1/2 has expansions 0.01000... and 0.11000.... However, they are different only at one digit and thus we can define the code of 1/2 as 0.⊥1000... with ⊥ the undefinedness character. In this way, we have a topological embedding of the unit interval in the space $\{0, 1, \bot\}^{\omega}_{1,1}$ of infinite sequences of {0, 1, ⊥} with at most one ⊥. We explain that this modified Gray-code expansion can be used for computation over real numbers. We also explain that this result can be generalized to other spaces and the topological dimension of a metric space coincides with the number of bottom characters we need in a representation. **www.i.h.kyoto-u.ac.jp/~tsuiki**	*Sunday AM*

Gathering 4 Gardner 8
Presentation Directory

Speaker	Presentation	*(Tentative) Schedule*
Rik van Grol *Rijswijk, The Netherlands*	Puzzle Food: Food for Thought? Puzzles disguised as food, puzzles made of food, puzzle food: looking at the history of puzzles there seems to be a fascinating relation between puzzles and food. The talk will give an introduction to puzzle food and a menu suggestion for further culinary puzzling.	*Thursday AM*
Gerard Villarreal *San Antonio, TX*	How to make a perfect star in one scissor cut Using the mathematics of the law of sines, a perfect star can be made with one scissor cut. Houdini's Paper magic does not give the angle to cut neither does ushistory.	*Sunday AM*
Robert Wainwright *New Rochelle, NY*	Digital Challenges "Digital Challenges" is based on an idea introduced over a century ago by William Rouse Ball and asks the reader to develop mathematical expressions which equal a particular target number using a given set of base digits and allowed arithmetic operations.	*Friday AM*
William Waite	Puzzles with Holes The presentation focuses on 2D tray puzzles that do not fill the plane completely, but leave some holes. The main point is to show how holes can, in some instances, make for better puzzles. **www.puzzlemist.com**	*Thursday PM*
John Watkins *Colorado College*	Eight Chessboard Tales Martin Gardner and his column in Scientific American were the single most important inspiration in my early mathematical life. Quite by chance, and much later in my life, I discovered, or perhaps I should say, rediscovered, his enormous interest in chessboard problems. In this talk, I will present my eight favorite chessborad problems involving the number 8.	*Sunday PM*
David Wolfe *Gustavus Adolphus College*	Parity Party with Picture Proofs: An Odd Checkerboard Problem How many ways can checkers be placed on an nxm grid so that each square (whether or not it is occupied) is orthogonally adjacent to an odd number of checkers? **homepages.gac.edu/~wolfe/papers/odd-squares/slides.pdf**	*Sunday PM*
Haizi Xu *Beijing, China*	Androids in Ancient China There have been many accounts for androids along China's ancient history. An unearthed articulated human model dates from 200 BC. Researchers have restored a few ancient androids. And traditional puppets might help us better understand ancient androids.	*Sunday PM*
Carolyn Yackel *Mercer University*	Josephine's Hyperbolic Pants We present the problem of knitting the mathematically well-known octagonal hyperbolic pants so that they will fit. We give an 8-colored solution for people of certain proportions. Our example exhibits the extreme of the Heawood bound if the octagon is identified to form the double holed torus instead.	*Saturday AM*
Zdravko Zivkovic and Toby Gottfried *Novi Sad, Serbia*	Tiling with edge-colored octagons - reaching towards infinity A new edgematching puzzle consisting of 24 octagons with diffently colored edges is introduced and analyzed. It combines the properties of edge-colored and corner-colored squares, from the footsteps of Percy MacMahon to lightyears beyond either. Interesting shapes and patterns and results of computer solving are presented.	*Saturday AM*