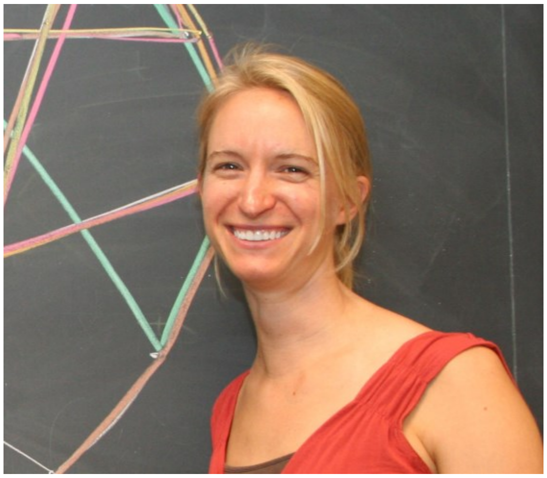
Spring 4-12-2016

Solving the KO Labyrinth

Alissa S. Crans
Loyola Marymount University, acrans@lmu.edu

Faculty Pub Night – Spring 2016
Date: April 12, 2016
Speaker: Alissa Crans




About the Author

Alissa S. Crans is currently an Associate Professor of Mathematics at LMU and one of the Associate Directors of Project NExT, a professional development program by the Mathematical Association of America (MAA) for new and recent PhDs in the mathematical sciences. She earned a B.S. in Mathematics from the University of Redlands and a Ph.D. in Mathematics from UC Riverside.

Alissa's research interests lie in the field of higher-dimensional algebra and some of her recent work involves categorifying algebraic structures called quandles with the goal of defining new knot and knotted surface invariants. She is also interested in the connections between mathematics and music, and enjoys playing the clarinet with the Santa Monica College wind ensemble.

Alissa has extensive experience mentoring and supporting women mathematicians through her involvement in the Summer Mathematics Program for Undergraduate Women, the Summer Program for Women in Mathematics, and the Enhancing Diversity in Graduate Education program. Alissa is also extremely active in helping students increase their appreciation and enthusiasm for mathematics through co-organizing the Pacific Coast Undergraduate Mathematics Conference, now in its 10th year.

Alissa is a recipient of the MAA’s 2011 Merten M. Hasse Prize for expository writing and Henry L. Alder Award for distinguished teaching by a beginning college/university mathematics faculty member. In addition, Alissa has been an invited speaker at the Museum of Mathematics and in the MAA Distinguished Lecture Series, and was a keynote speaker at the Expanding Your Horizons Conference at James Madison University, the Sonya Kovalevskey Mathematics Day at CSU Fresno, and the Southeastern Conference for Undergraduate Women in Mathematics at Clemson University.

About the Author’s Work

The *KO Labyrinth* is a colorful spherical puzzle with 26 chambers, some of which can be connected via internal holes through which a small ball can pass when the chambers are aligned correctly. The puzzle can be realigned by performing physical rotations of the sphere in the same way one manipulates a Rubik's Cube, which alters the configuration of the puzzle. There are two special chambers: one where the ball is put into the puzzle and one where it can exit. The goal of the puzzle is to navigate the ball from the entrance chamber to the exit chamber.

We will explore questions related to solving the puzzle, both as originally intended and under modified rules. We first consider a "goal-directed" player who is motivated to reach the end of the maze as quickly as possible and show that the shortest path through the maze takes only 10 moves. Next, we turn to a "random" player who wanders aimlessly through the puzzle and show that such a player makes, on average, about 340 moves before reaching the end. We also determine the most- and least-visited chambers. Finally, we consider two variations of the traditional rules for the *KO Labyrinth*, as this provides the opportunity for deeper mathematical exploration. We use the puzzle to play a simple game modeled after a well-known problem from probability known as the gambler's ruin problem and, separately, as a way to make the puzzle more challenging, ask whether a player can still solve the puzzle when certain chambers are considered off limits.