**Algebraic Topology and Robot Arms**

Speaker: Erin Manlove  
Time: Tuesday, May 8, 4:00 p.m.  
Location: CMC 206

Algebraic topologists study the shape of a space while ignoring distances, slopes, and sizes. Where is this viewpoint relevant? In my talk, I will introduce the idea behind algebraic topology, and then look at how we can use this idea to investigate positioning of robot arms.

**Operation Groundswell**

Operation Groundswell is looking for adventurous and committed students to volunteer and backpack abroad with us this summer! We are a student-run non-profit that takes students out of the classroom and into the world for some hands-on learning. Join us on a 6 week group program that combines cultural exchange, meaningful volunteer work, and off-the-beaten path adventure! Deadline to apply was this week, however they are still looking for volunteers. If you are interested apply as soon as possible.

For additional information:  
http://operationgroundswell.com/purpose/

**Magical Mathematics**

Colm Mulcahy has a bimonthly column sponsored by the Mathematical Association of America where he teaches and explains the math behind multiple card tricks. Colm hails from Ireland, where he earned bachelor and master degrees in Mathematical Science at UCD. He then went to Cornell — more or less along arcs of two great circles — where he did research in the algebraic theory of quadratic forms for his PhD.

Here is a link to his column:  
http://maa.org/columns/colm/cardcolm.html

**PROBLEMS OF THE WEEK**

1. A “knight’s tour” on a chessboard is a series of knight’s moves so that every square of the board is visited exactly once, with the last move returning to the original square. (A knight’s move is a simultaneous displacement of two squares in one [horizontal or vertical] direction and one square in a second, perpendicular direction; for example, two squares up and one to the left, or two squares to the right and one up. If that seems confusing, ask a nearby chess player.) It is a classic problem to find knight’s tours, when they exist, on “chessboards” of different sizes. The smallest square board on which a knight’s tour exists is $6 \times 6$. However, you can already come close on a $3 \times 3$ board, where you can find a closed knight’s path visiting all squares except the central square.

Now for the problem: Suppose we have a cube, each face of which is a $3 \times 3$ board, and we allow the knight to move from one face of the cube to an adjacent face if the move would be legal on the $6 \times 6$ (or $3 \times 6$) board obtained by
detaching those two faces from the cube and folding them flat. Does there exist a knight’s tour of the $6 \times 3 \times 3 = 54$ squares on the six different faces of the cube? (Note: Although a knight’s move can pass from one face to an adjacent one as described, at most one such “edge crossing” per move is allowed.)

2. Given that the system of equations

$$a^3 + 2abc + bcd = -19,$$
$$a^2b + b^2c + abd + bd^2 = 18,$$
$$a^2c + acd + bc^2 + cd^2 = -27,$$
$$abc + 2bcd + d^3 = 26$$

has a unique solution in integers $a, b, c, d,$ find that solution, without using technology. (A certain amount of calculation will be needed, but cleverness is much more effective than “brute force” here.)

Last week’s problems were solved by John Snyder in Oconomowoc (who used Mathematica for the second problem). Alas, nothing else to report; maybe everyone else has been as busy as I have?

- Mark Krusemeyer

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