09/29/11 **MATHEMATICS DEPARTMENT, FERRIS STATE UNIVERSITY**
MATH COLLOQUIUM, THURSDAY, SEPTEMBER 29, 2011,
11:00 AM, STARR 138

SPEAKER: Michael J. Dekker, Ph.D., Associate Professor,
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TITLE: **Highlights from the first 150 Problems of the Week**

Abstract:

In the spring of 2005 I posted the first official Mathematics Department Problem of the Week. Numbered consecutively, the last problem posted during the fall semester of 2010 was number 150. We will look at a few of my favorite problems from that span and talk about their solutions. Here are some of them (feel free to try and solve them before coming!):

13. Alice: Here I have a penny and a quarter. You get to make a statement and if it is true I will give you one of the coins. If it is false, I give you nothing.

Bob: That is generous of you. Which coin will you give me if my statement is true?

Alice: I'm not telling.

What statement should Bob make to maximize the amount of money Alice gives him?

23. Roll two ordinary dice and look at the sum of the numbers rolled. The number of ways of getting a sum equal to 2 is 1 (only 1+1). The number of ways of rolling a sum equal to 3 is two (1+2 and 2+1). The number of ways of rolling a sum equal to 4 is three (1+3, 3+1, 2+2), and so forth until you reach the largest possible sum, 12, which can only occur in one way (6+6).

Find another pair of 6-sided dice such that...

1. Every side has a positive number of dots.
2. The set of dots on each die is not a permutation of an ordinary die, i.e., is not {1,2,3,4,5,6} in a different order.
3. The number of ways of rolling a sum with the new pair of dice is the same as the number of ways of rolling a sum with the ordinary dice, as explained above.

31. Al, Bob and Carl are prisoners under the supervision of the warden. One day the warden takes the ID cards from each prisoner and places them in different lockers in a locker room. The locker room consists of three numbered lockers that are marked 1, 2 and 3. On the next day each prisoner will be taken into the locker room, where he can choose a locker and look in it. If he sees his own ID card, he is said to be successful. Otherwise, he gets to open a second locker and again, if he sees his own ID card, he is successful; otherwise he has failed. If all three prisoners are successful, then they will all be

released. Otherwise, all three go back to their cells. As each prisoner laves the locker room he cannot communicate with the others, and as each enters the locker room he has no way of telling if a previous prisoner was successful or has looked into any specific locker.

The prisoners know the procedure and can get together in advance to decide on a strategy. What should they do to maximize their chances of release?

67. Suppose A, B, C and D are four distinct points in a plane. There are six line segments connecting these four points. Consider the lengths of these segments, denoted AB, AC, AD, BC, BD and CD. For certain configurations of these points, some of these segments are the same length. For example, if the four points are the vertices of a square, we have AB=BC=CD=AD and AC=BD, so there are only two distinct lengths for the six segments.

There are five more configurations of four points in which the six segments have only two different lengths. Including the square, these configurations are non-congruent and non-similar - that is, you can't obtain one configuration simply by rotating, reflecting, scaling, or sliding another configuration.

Find the five remaining configurations.

135. A goat is tethered to a circular silo with a rope that is 20 feet long. The circumference of the silo is 40 feet. Find the area of the region the goat can graze.

146. A 6 x 6 checkerboard is covered by 18 dominoes (that is, rectangles of size 1 x 2). Prove that at least one vertical or horizontal line cuts the board into two parts without cutting through any dominoes.

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