



The Mathematical Association of America

Math Club/MAA Student Chapter presents

The Theorem of Grundy **Matthieu Dufour (University of Quebec)**

Wednesday, May 16, 2007
3 – 4 pm, Simpson Tower 213
Refreshments 2:30 - 3

The game of Nim is played with heaps of chips by two players who alternately remove as many chips as they want from one heap of their choice. The first player unable to make a move loses the game.

We are interested in finding a winning strategy for the game of Nim. To do so, we need to define two concepts, the Minimum Excluded Value function and the Digital Sum of two integers. Together they give us the Grundy Theorem, the most powerful theorem of combinatorial game theory.

The "Minimum Excluded Value" function (MEX) associates to each proper subset A of \mathbb{N} the minimum integer belonging to A^c , i.e., the smallest integer that is missing from the set A . For instance, if $A = \{0, 1, 2, 3, 5, 7, 8, 9, 10, 13, \dots\}$, then $\text{MEX}(A) = 4$.

The DIGITAL SUM of two integers x and y is the integer resulting when computing the sum of x and y in base two, and carry over is not done. For example, the digital sum of 45 and 39 is $101101_2 + 100111_2 = 001010_2$, or 10 (when converted back to base 10).

$$\begin{array}{rcccccc} & 1 & 0 & 1 & 1 & 0 & 1 \\ + & 1 & 0 & 0 & 1 & 1 & 1 \\ \hline & 0 & 0 & 1 & 0 & 1 & 0 \end{array}$$

No previous knowledge of game theory is assumed. If enough time is left, we will see other related solved and open problems of combinatorial game theory.

Topic B: Professor Dufour has been kind enough to offer us another topic for his talk if student interest is great enough:

(Open inversion of birational morphisms) We will show that the Holder-Erdős automorphism group is absolutely useless with regard to the utterly unimportant and difficult task of performing an open inversion of a birational morphism, whatever that means.

The very scarce definitions given in this talk will be buried under lots of gibberish. An impressive amount of illegible equations will scroll across the screen, together with proofs that will be given without any justification. In addition, the speaker will try to conceal his total lack of mastery of the topic by moving hands frenetically and looking sternly at anybody who dares to ask a question showing s/he did not follow the convoluted presentation.

For more information, contact Mike "Quimby" Krebs at mkrebs@calstatela.edu or Tony Shaheen at ashahee@calstatela.edu.
Math Club website: http://www.calstatela.edu/academic/math/Math_Club/mathClub.htm