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# MATH 296 GRADUATE SEMINAR

26 February 2018, Monday, 5:00 pm–6:30 pm, MB 107

## Pocket Cube Group

Perlyn Mae R. Dilla

5:00 pm

**ABSTRACT.** Pocket cube is a mechanical toy invented for recreation, but behind the leisure it provides when it is being played with, is a well-defined mathematical structure. With the help of “Permutation Puzzle: A Mathematical Perspective” of Mulholland (2016), we will show that the pocket cube can be given the structure of a group and we will define this group. To solve the cube isn’t the goal of this paper. We want to model the cube mathematically and see what mathematics has to tell about this kind of puzzle.

*Keywords:* Pocket cube, Mathematical Structure, Group

## Stability Analysis of a Triadic Interaction Model of *Lactobacillus paracasei*, *Shigella* sp., and Ciprofloxacin using Lotka-Volterra competition model and Hill equation

Thomas Herald M. Vergara

5:45 pm

**ABSTRACT.** According to the World Health Organization, there are approximately 80,000,000 cases of bloody diarrhea and around 700,000 deaths per year due to *Shigella* bacteria. Antibiotic therapy is usually given to reduce the risk of complication, avoid death, and hasten the removal of *Shigella* bacteria. Several studies show that some strains of *Shigella* sp. are resistant to antibiotics like Ciprofloxacin. Thus, other treatment including the use of probiotics are being considered in fighting the effect of the bacteria.

In this talk, we propose a mathematical model that captures a triadic interaction of *Shigella* sp., *Lactobacillus paracasei*, and Ciprofloxacin based on a system of ordinary differential equations. To model the pharmacodynamic effect of antibiotic and the competition between the bacteria, we follow the previously used  $E_{max}$  model based on Hill function and the Lotka-Volterra competition model. We then analyze the stability of the equilibrium points of the model. For the numerical simulation of the model, experimental data are used to estimate the values of the parameters of the model.

*Keywords:* Shigellosis, Hill-function, Lotka-Volterra