

Abstracts
Senior Seminar and Honors
Spring 2009 Simpson College
Mathematics Department

A Look at Homomorphisms through Computer Programming and the Edge Reconstruction Conjecture by Chelsy Croson, Honors Thesis

In this paper homomorphic relationships between any two simple graphs, G and H , are examined. We will begin with describing several homomorphic relationships between cycles and wheels, followed with explaining a computer program for checking for homomorphisms between graphs. From here we will define injective, surjective, and bijective homomorphisms to explain a proven case of the Edge Reconstruction Conjecture. This project begins to answer questions raised by Nesetril and Nigussie.

Mathematical Modeling of Infectious Diseases by Kendra Frush, Honors Thesis

Infectious diseases are a common part of human life. An infectious disease is caused by a pathogen and is contagious from one person to another. Transmission can occur in many different ways, for example, through direct contact, food, blood, and water. Mathematically, two common approaches are taken to model an infectious disease concerning humans. One can model the disease within a human body or within the general population. These models may consider the course of the disease, the rate of different aspects of the disease, and the impact of various other factors, both external and internal. I have chosen to focus my research on developing an adaptable model for the course of an infectious disease within a fixed population.

Elements of Bioinformatics by Emily Lundt

Bioinformatics employs a wide range of techniques in order to obtain information related to molecular biology. Using graphs of desire and reality and a little graph theory, we will examine how to model a series of rearrangements to DNA. These transformations show the edit distance, or evolutionary distance, between two DNA sequences or genes. The graph of desire and reality helps identify where rearrangement steps are needed and ultimately finds the shortest and thus most evolutionarily probable relationship. The last section introduces common problems encountered in the bioinformatics world, as well as some solutions. Finally included is a descriptive analysis of an algorithm created to solve the spliced alignment problem.

MLB Free Agent Market with a Two-Stage Auction by Dillon McKelvey

MLB free agent's salaries have been increasing dramatically for many years now. However, this increase isn't constant among all players. The top free agents have been exhausting the market while the marginal players have only been receiving contracts set at the minimum salary level. This has created a large gap that is continuing to grow. The current free agent auction promotes this gap and needs to be adjusted. A two-stage sealed bid auction should be implemented in order to reduce this gap and clean up the entire MLB free agent market.

Financial Mathematics Exam Study Guide by Erin Vinnedge

This paper is to be used as a study guide for the second Actuary Exam in Financial Mathematics sponsored by the Society of Actuaries. The concepts for this paper were taken from the first seven of the ten chapters in “The Theory of Interest” by Stephen Kellison. There are several practice and example problems taken from the text as well as the review sections that are presented as well as solved. It presents the reader with basic concepts of interest as well as simple investment tools and ways in which to calculate their worth.

Instant Insanity by Stephanie Zeorlin

Instant Insanity is a game created in 1967 that involves stacking four cubes into a rectangular prism so that every color appears once on every side of the rectangular prism. I will show how graph theory can be used to find a solution to the original puzzle and the variation of adding a fifth cube and color to the game.