SESSION 2A

GRAPHS AND GEOMETRY

Session Moderator: Werner Stuetzle, Statistics
085 MGH
3:45 PM to 5:15 PM

* Note: Titles in order of presentation.

Generalized Ramsey Numbers for Near-Diagonal Pan Graphs and Relatively Prime Tadpole Graphs

Timothy Perisho, Fifth Year, Mathematics, Philosophy, Seattle Pacific University
Mentor: Steve Johnson, Mathematics, Seattle Pacific University

Ramsey Theory is an intricate field of pure mathematics, but it also has applications in computer science, where graphs are commonlu used as data structures. Every pair of "forbidden" graphs has a Ramsey number, which indicates when one of those graphs must occur. A Ramsey number for a pair of forbidden graphs is the smallest number of points R for which every edge-coloring of the complete graph on R points includes one of the forbidden graphs in its respective color. In this paper we use two original methods to find and prove new Ramsey number formulas for certain tadpole graphs based upon known Ramsey number formulas for arbitrary cycle graphs. A tadpole graph Qn,t is formed by connecting one end of a path graph on t points (called the "tail") to a cycle of size n (called the "head"). A pan graph Qn is defined as a tadpole graph with t=1. We first use an intuitive counting method to prove exact Ramsey number formulas for all "near-diagonal" pan graphs, i.e. those pairs of pan graphs where the maximum cycle size of the pair is no more than 5/2 times the minimum cycle size. Then, we demonstrate a number-theoretic method to find exact Ramsey numbers for arbitrarily far-from-diagonal tadpole pairs with arbitrarily long tails. However, the second method requires that the tadpoles meet number-theoretic constraints (rather than size constraints). For example, in the diagonal cases, n-1 must be relatively prime to n+t, where either n-1 has an odd order (mod n+t) or the additive inverse of n-1 has an even index relative to n-1 (mod n+t). These "scattered" on- and off-diagonal results provide upper bounds on the Ramsey numbers for other tadpole pairs that fail to meet the number-theoretic constraints.

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A Political Redistricting Tool for the Rest of Us

Evan Kleiner, Junior, Mathematics, Whitman College
Mentor: Albert Schueller, Mathematics, Whitman College

For our research project, we asked the question: 'Is there some way to automate the redrawing of district lines in each state mandated by the constitution after every decennial census?' This presentation will consist of a brief overview of the factors considered in redistricting (population, compactness, alignment with city and county lines, etc.) followed by a demonstration and discussion of the software application that we developed to address this problem. The presentation will conclude with a mention of potential political and social drawbacks of automated redistricting.

POSTER SESSION 4

Commons East, Easel 62
4:15 PM to 5:45 PM

An Algorithm for Finding Hamiltonian Cycle

Thanh Dang, Sophomore, Mathematics, Seattle Central College
Mentor: Steve Kangas, Mathematics, Seattle Central Community College

A Hamiltonian cycle is a path that goes through all vertices exactly one and comes back at the starting vertex. Finding Hamiltonian cycles is a well-known problem in graph theory. While necessary and sufficient conditions for Hamiltonian cycles remain unknown, we have developed an algorithm for finding Hamiltonian cycles in polynomial time in certain types of graphs presented in the paper. The algorithm involves finding k cyclic subgraphs within the original graph by deleting edges and then reconstructing some specific edges to create one single Hamiltonian cycle. Along with several algorithms developed earlier, this can contribute to a more general solution, or solutions of the classic Travelling Salesman

Problem.