Talks by Robert Beeler

Intersection Graphs Generated By An Edge Decomposition
1-7-07 AMS-MAA Joint Meeting, New Orleans

Abstract:

A *decomposition* $\mathcal{D}$ of a graph H by a graph G is a partition of the edge set of H such that the subgraph induced by the edges in each part of the partition is isomorphic to G. The *intersection graph* generated by the decomposition, denoted $I(\mathcal{D})$ has a vertex for each part of the partition, and an edge if the parts of the partition share a common vertex in H. We will discuss several results and open questions regarding the structure of $I(\mathcal{D})$.

The $\{K_{1,s}, K_{1,t}\}$-Spectrum of Stars and Caterpillars
12-2-06 ACES Workshop, Emory University

Abstract:

Let $\mathcal{K}$ be a collection of graphs. We say that $\mathcal{D}$ is a $\mathcal{K}$-*decomposition* of H if the edges of H can partitioned such that the subgraph induced by each part of the partition is isomorphic to an element of $\mathcal{K}$. In this case, we refer to H as the *host* of the decomposition and the elements of $\mathcal{K}$ as *blocks* or *prototypes*.

The *chromatic index* of the decomposition, denoted $\chi'(\mathcal{D})$ is the minimum number of colors required to color the blocks of a decomposition, such that if two blocks share a common vertex in H then those blocks receive different colors. The $\mathcal{K}$-*spectrum* of H, denoted $Spec_{\mathcal{K}}(H)$, is the set of all possible values of $\chi'(\mathcal{D})$.

Mendelsohn and Jamison showed that every n element set of positive integers is the $\mathcal{K}$-spectrum of a tree when $\mathcal{K}$ is a family of n trees. In this presentation, we will look at ways of improving this result. In particular, we examine the problem of whether any n element subset of the natural numbers is the spectrum of a star when decomposing into other stars, as well as whether any n element subset of the natural numbers is the spectrum of a tree when decomposing into a family of $k < n$ trees.

Simple Automorphic Decompositions of Graphs
9-28-06 Algebra and Discrete Math Seminar, Clemson University

Abstract:

A *decomposition* $\mathcal{D}$ of a graph H by a graph G is a partition of the edge set of H such that the subgraph induced by the edges in each part of the partition is isomorphic to G. The intersection graph generated by the decomposition, denoted $I(\mathcal{D})$ has a vertex for each part of the partition, and an edge if the parts of the partition share a common vertex in H. A decomposition is defined to be *simple* if any two parts of the partition share at most one common vertex in H. A decomposition is said to be *automorphic* if $I(\mathcal{D}) \cong H$. We will show that if G is a d-regular graph of order p and H admits a simple automorphic G-decomposition, then H is $p(p-1)$-regular and $G \cong K_p$.

Mathematical Resources on the Web
9-11-06 Graduate Student Seminar, Clemson University

Abstract:

In recent years, the internet has grown to contain a wealth of information. In this talk, we will survey some of the resources that the web has to offer. Some of the topics to be discussed include:

1. What resources are available for teaching, research, etc.

2. Where to find free math books.

3. What fun stuff is available.

Decompositions of Graphs
3-7-06 Thirty-Seventh Southeastern International Conference on Combinatorics, Graph Theory, and Computing, Florida Atlantic University

Abstract:

A decomposition of a graph H (called the *host*) by a graph G (called the *block prototype*) is a partition of the edge set of H such that each part of the partition (called the blocks of the decomposition) is isomorphic to G. In this talk, we will discuss several necessary conditions for a G-decomposition of H as well as discuss the relationship between graceful labelings of a graph G and G-decompositions. We will also discuss several other applicable labeling schemes as well as methods for constructing new labelings.

Fully Automorphic Decompositions of Graphs
2-27-06 Graduate Student Seminar, Clemson University

Abstract:

Given a graphs H and G, we say that H has a G-Decomposition if we are to partition the edge set of H so that for each part $\mathcal{D}$ of the partition, the subgraph of H induced by $\mathcal{D}$ is isomorphic to G. We then define a new graph, $I(\mathcal{D})$ as follows: the vertices of $I(\mathcal{D})$ represent the parts of the partition, and two vertices in $I(\mathcal{D})$ share an edge if and only if there corresponding blocks share a common node in H. We say that $\mathcal{D}$ is an *automorphic decomposition* of H with respect to G if $I(\mathcal{D}) \cong H$. In a previous talk, we gave several necessary conditions for the existence of such a decomposition, in particular we required that the chromatic number of H, $\chi(H)$, be greater than or equal to the number of verices in G, $n(G)$. We say that $\mathcal{D}$ is a *fully automorphic decomposition* of H with respect to G if $n(G) = \chi(H)$ and $\mathcal{D}$ is an automorphic decomposition of H with respect to G. In this talk, we will state several necessary conditions for the existence of a fully automorphic decomposition as well as give some of their implications.

Automorphic Decompositions of Graphs
10-20-05 Algebra and Discrete Math Seminar, Clemson University
4-25-05 Graduate Student Seminar, Clemson University

Abstract:

Given graphs H and G, we say that H has a G-Decomposition if we are to partition the edge set of H so that for each part $\mathcal{P}$ of the partition, the subgraph of H induced by $\mathcal{P}$ is isomorphic to G. Let $I(\mathcal{D})$ be the intersection generated by such a decomposition. We say that $\mathcal{D}$ is an automorphic decomposition of H with respect to G if $I(\mathcal{D}) \cong H$. In this talk, we will show several examples of such a decomposition as well as give necessary conditions for their existence. These necessary conditions will be used to completely classify all bipartite graphs that have an automorphic decomposition.

Problems Relating to the Chromatic Decomposition of Graphs
11-11-04 Algebra and Discrete Math Seminar, Clemson University
11-8-04 Graduate Student Seminar, Clemson University

Abstract:

Building on the recent work by Robert Jamison and Eric Mendelsohn, we will investigate the particular case of decomposing a graph, $H = (V, E)$, into a family of graphs $\mathcal{K}$. Such a decomposition exists if we are able to partition the edge set E of H so that for each part P of the partition, the subgraph of H induced by P is isomorphic to a graph in $\mathcal{K}$. In particular, if $H = K_{1,N}$ and $\mathcal{K} = \{K_{1,s_1}, K_{1,s_2}\}$ with $s_1 \neq s_2$ then such a decomposition is possible if and only if there exist a non-negative integer solution (x_1, x_2) to the associated Frobenius Problem:

$$s_1x_1 + s_2x_2 = N$$

We will also show that if $I(\mathcal{D})$ is the intersection graph generated by such a decomposition, then the chromatic index, $\chi'(\mathcal{D})$ of $I(\mathcal{D})$ is equal to the sum $x_1 + x_2$. The range of all chromatic indices generated in this way is the chromatic spectrum. We will also discuss questions such as:

1. The structure of the decomposition of a tree into two trees.

2. When is a set of two positive integers the spectrum of a star when decomposing into two stars?

3. When is a set of three positive integers the spectrum of a caterpillar, when decomposing into two stars?

4. The spectrum of a fat cycle and a cube when decomposing into isomorphic copies of P_3

The History of e
9-13-04,10-7-02 Graduate Student Seminar, Clemson University

Abstract:

While e is not as famous as its geometric cousin, π, it has an interesting history of its own. The acceptance of the infinite which allowed for the development of calculus also allowed for the discovery of e, the first number defined by a limiting process. The importance of the constant was emphasized by Jakob Bernoulli, who showed why it should be considered as the "natural" base for the logarithms, and Leonard Euler, who showed the relationship between the trigonometric and the exponential. The impact of other mathematicians such as Napier, Briggs, DeMoivre, Hermite, and Cantor may also be discussed with regard to their contributions to the history of e.

Pascal's Wager - The Search for God in a Mathematical World
10-6-03 Graduate Student Seminar, Clemson University

Abstract:

In 1656, Blaise Pascal began writing his most famous philosophical work, the Penses. Included in this is the following arguement for the belief in God: "If God does not exist, one will lose nothing by believing in him, while if he does exist, one will lose everything by not believing." This arguement, known as Pascal's wager, uses mathematical probability, in particular the expected value of a random variable, to support his belief in God. In this talk, we will examine the short comings of Pascal's wager, as well as posssible ways to rectify. Other mathematical arguements for the existence of God may be discussed as time permits.

"...we are compelled to gamble..." - Blaise Pascal, 1656

Transcental Numbers
4-22-03 Informal Number Theory Seminar, Clemson University

Abstract:

In this talk we give a short history of transcendental numbers as well as the construction of Liouville.

Mental Illness and the Mathematician
3-10-03 Graduate Student Seminar, Clemson University

Abstract:

It is said that there is a thin line between genius and insanity. In this talk, we will take a brief look at mathematicians who stepped over this line and were plagued by schizophrenia, paranoia, and emotional imbalance. Tragically, the lives and careers of several great mathematicians were diminished due to their struggle with menal illness. Mathematicians to be included are Blaise Pascal, Isaac Newton, Georg Cantor, Kurt Godel, John Nash, and the infamous Unabomber, Theodore Kaczynski. Other mathematicians may be discussed if time permits.