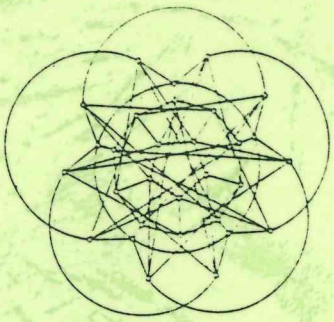

2002 組合數學新苗研討會

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15：00～15：25　郭志銘（交通大學）

The L(j,k)-Labeling Problem

Gerard Jennhwa Chang（張鎮華）
台灣大學數學系

The problem of vertex labeling with a condition at distance two, proposed by Griggs and Roberts [24], arose from a variation of the channel assignment problem introduced by Hale [12]. Suppose a number of transmitters are given. Our duty is to assign a channel to each of the given transmitters such that the interference is avoided. In order to reduce the interference, any two "close" transmitters must receive channels by at least k apart, and any two "very close" transmitters must receive channels by at least j apart, where $j \geq k$ are two given positive integers. One can construct an interference graph for this problem so that the transmitters are the vertices and there is an edge joining two "very close" transmitters. Two transmitters are defined "close" if the corresponding vertices are of distance two.

Then, for a given graph G, an *L(j,k)-labeling* is defined as a function $f: V(G) \to \{0, 1, 2, ...\}$ such that $|f(u) - f(v)| \geq j$ when $d_G(u,v) = 1$ and $|f(u) - f(v)| \geq k$ when $d_G(u,v) = 2$, where $d_G(u,v)$, the distance of u and v, is the minimum length of a path between u and v. The *L(j,k)-labeling number* $\lambda_{j,k}(G)$ of G is the smallest number m such that G has an $L(j,k)$-labeling with no label greater than m. A $\lambda_{j,k}$*-labeling* of G is an $L(j,k)$-labeling using labels not greater than $\lambda_{j,k}(G)$.

The $L(j,k)$-labeling problem, in particular the $L(2,1)$ case, has been extensively studied during the past decade (see the references). This talk is to survey the results of the problem in the past decade. These include bounds for general graphs as well as special graphs such as trees, chordal graphs, strongly chordal graphs; exact values for paths, cycles, their Cartesian products, infinite regular trees; relation between the path partition number and the Hamiltonian cycle problem; algorithmic results on trees and cographs. We will also discuss variations of the problem such as circular distance version, directed graph version, edge span version ... etc.

Keywords: Distance, labeling, graph, tree, chordal graph, path, cycle, Cartesian product, Hamiltonian cycle, algorithm, directed graph, edge span.

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Edge Spans of $L(p, q)$-Labelings on Graphs

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交通大學應用數學系

Abstract

The problem of determining the edge span of an $L(2, 1)$-labeling of a graph was first investigated by Yeh. In this thesis, we extend his notion to the $L(p, q)$-labeling. We discuss the $L(p, q)$ edge spans on cycles, trees and complete mutipartite graphs. We present results on Cartesian products of graphs in Section 3. In Section 4, we consider two operations of graphs, the union and the join of two graphs. Finally, we pay attention to triangular lattices and square lattices.

The Bandwidth Problem on Graphs

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國立交通大學應用數學系

Abstract

Suppose $G=(V,E)$ is a graph with vertex set $V=\{x_1,x_2,\ldots,x_n\}$, and $\boldsymbol{h}=(h_1,h_2,\ldots,h_n)$ is a sequence of positive integers. The multiplication of G by $\boldsymbol{h}$ is defined to be the graph $G\circ\boldsymbol{h}$ who vertex set $V(G\circ\boldsymbol{h})=\{x_i^j : 1\le i\le n, 1\le j\le h_i\}$, and edge set $E(G\circ\boldsymbol{h})=\{x_i^j x_{i'}^{j'} : x_i x_{i'}\in E,\ 1\le j\le h_i,\ 1\le j'\le h_{i'}\}$. In the case when $\boldsymbol{h}=(h, h, \ldots, h)$, we use $G\circ h$ for $G\circ\boldsymbol{h}$ and call this graph as the constant multiplication of G by h. This thesis investigates the bandwidth problem for multiplications of graphs. In particular, we solve the bandwidth problem for constant multiplications of graphs with certain conditions. We also give solution to some multiplications of paths.

Packing Graphs with Cycles

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摘 要

A *k-cycle packing* of a graph G is a set of edge-disjoint k-cycles in G. A k-cycle packing C is *maximum* if $|C| \geq |C'|$ for all other k-cycle packings C' of G. The *leave* L of a packing C is the subgraph induced by the set of edges of G that does not occur in any k-cycle of the packing C. Therefore a maximum packing has a minimum leave.

A *k-cycle covering* of G is a set of edge-disjoint k-cycles $\mathcal{C}$ such that each edge of $E(G)$ occurs in at least one k-cycle in $\mathcal{C}$. A k-cycle covering $\mathcal{C}$ is *minimum* if $|\mathcal{C}| \leq |\mathcal{C}'|$ for all other k-cycle coverings of G. The graph induced by the set of edges which are added to G in the covering is called the padding of the covering. Clearly, a minimum padding can be obtained in a minimum covering.

In this thesis, we shall focus on the study of 5-cycle and 6-cycle packings (respectively, coverings). By considering G as the balanced complete multipartite graphs $K_{m(n)}$ and the Cartesian product of two complete graphs $K_m \times K_n$.

The Study of Decomposing a Complete Multipartite Graph into Pentagons

學生：廖威絢　　指導教授：高金美

淡江大學數學系

Abstract

A complete k-partite graph is a graph whose vertices can be partitioned into k disjoint nonempty sets, and there are no edges within two vertices which are in the same set, and every edge joins two vertices which are in the different partite sets. A complete four-partite graph with n vertices in each partite set, then we will denote it by $K_{4(n)}$.

In this thesis we will prove that the necessary and sufficient conditions for decomposing $K_{4(n)}$ into pentagons are $n \equiv 0 \pmod{10}$, and prove that $K_{2n,2n,2n,8n}$ can be decomposed into pentagons. In the last section, we obtain the remaining graphs of packing $K_{4(n)}$ into pentagons when $n<10$ as follows:

	$K_{4(1)}$	$K_{4(2)}$	$K_{4(3)}$	$K_{4(4)}$	$K_{4(5)}$	$K_{4(6)}$	$K_{4(7)}$	$K_{4(8)}$	$K_{4(9)}$
remaining graph	K_6	C_4	$3K_{1,3}$	$2C_8$	$7K_2 \cup K_{1,3} \cup P_5$	$4C_4$	$14K_2$	$4C_6$	$18K_2 \cup C_{18}$

On the H-decomposition of graphs with H of size 3

學生：陳捻君*

靜宜大學應用數學系

老師：黃國卿

靜宜大學應用數學系

學生：蔡智祥

東海大學數學系

Abstract

Only simple graphs are considered in this talk. A graph G is said to be H-decomposable, denoted by H | G, if E(G) can be partitioned into subgraphs such that each subgraph is isomorphic to H. In this talk, we study the H-decomposition of complete multipartite graphs with size three. Moreover, we give a characterization for the M_3-decomposability of graphs. As a byproduct, we obtain the sufficicent and neccessary conditions for the M_3-decomposability of complete multipartite graphs.

On the * connectivity of some n-regular Cayley graphs

研 究 生：林政寬　　指導教授：黃華民 博士

中央大學數學系

摘要：

A graph is Hamiltonian if and only if for any two vertices exists two internal vertex disjoint paths between them which contain all vertex of this graph. Menger's theorem states that in a n-connected graph, any two vertices are joined by n internal vertex disjoint paths. Two vertices p and q are k-* connected if and only if there are k internal disjoint paths from x to y which contain all vertices of this graph.

In this paper, we shall discuss the k-* connectivity of some families of n-regular Cayley graphs.

Some remarks on the cycle connected graphs

研究生： 林容新　　指導老師： 黃華民

中央大學數學系

摘要：

Let S be a subset of a finite group G such that

1. $S=S^{-1}$ ， 2. S is a generating set of G .

Let $E=\{\{x,xh\}：x\in G, h\in S\}$.

Cayley graph Cay(G,S) is the graph defined by the vertex, edge order pair (G,E) .

If $S=\{s_0,s_1,\ldots,s_{k-1}\}$ then the cycle connected graph of Cay(G,S) is a graph with vertex set $\{(s,g)：s\in S, g\in G\}$ such that $(s_i,g_1),(s_j,g_2)$ are adjacent if and only if either i=j, $g_1\sim g_2$ in Cay(G,S) or $|i-j|=1 \bmod(k)$, $g_1=g_2$.

In this paper, we shall discuss some interesting properties of cycle connected graphs.

Dissemination of Information in Network

學生 ： 張定邦　　指導教授 ： 張鎮華

國立交通大學應用數學系

Abstract

The purpose of this thesis is to investigate the problem of dissemination of information among processors of interconnection networks under the communication mode in which communications are via vertex-disjoint or edge-disjoint paths. In this communication mode, in one communication step, one or two processors send their information to all other processors via a path. Several processors can send information at a same step if the paths used one vertex/edge-disjoint. The complexity of a communication algorithm is measured by the number of communication steps.

In this thesis we design linear-time broadcast algorithms for trees in one-way listen-in vertex-disjoint mode and one-way listen-in edge-disjoint mode. We also design optimal broadcast, accumulation and gossip algorithms for complete k-ary trees and n-dimensional grid in two-way listen-in vertex-disjoint mode.

Construction of graphs with given circular flow number

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May, 2000

Keywords: graph, flow, circular flow number, pseudo-flow, series join, parallel join, two-terminal graph

Abstract

Suppose $r \geq 2$ is a real number. A proper r-flow of a directed multi-graph $\vec{G} = (V, E)$ is a mapping $f : E \to R$ such that (i) for every edge $e \in E$, $1 \leq |f(e)| \leq r - 1$; (ii) for every vertex $v \in V$, $\sum_{e \in E^+(v)} f(e) - \sum_{e \in E^-(v)} f(e) = 0$. The circular flow number of a graph G is the least r for which an orientation of G admits a proper r-flow. The well-known 5-flow conjecture is equivalent to the statement that every bridgeless graph has circular flow number at most 5. In this paper, we prove that for any rational number r between 2 and 5, there exists a graph G with circular flow number r.

Game chromatic number of Halin graphs

學生：吳佼佼　　指導教授：朱緒鼎

國立中山大學應用數學系

論文摘要:

This thesis discusses the game chromatic number of Halin graphs. We shall prove that with a few exceptions,all Halin graphs have game chromatic number 4.

Extensions of Gauss Codes

學生: 賴欣豪
指導教授: 李國偉
Student: Hsin-Hao Lai
Advisor: Dr. Ko-Wei Lih
Department of Mathematics
National Taiwan University

June, 11, 2002

Abstract

A knot is a piecewise-linear closed curve in the 3-dimensional Euclidean space. We may represent its shadow on the 2-dimensional Euclidean plane by a 4-regular plane graph. This graph has a unique straight Eulerian tour. We may record this tour by writing down the crossing points in the order in which they are visited by the tour. The resulting string of symbols representing the vertices is called the Gauss code of the shadow. In this paper, we discuss extensions of Gauss codes in two different ways. In the first version, we allow two edges of a drawing to have at most one crossing point in common. In the second version, we allow some vertices not to be an overpass so that the Eulerian tour is not entirely straight, and give a method to find all such codes, including a method to find all Gauss codes. Finally, we explain why it is sufficient to assume the 4-regularity of graphs in this investigation.

Keywords: double occurrence word, Gauss code, Harborth code, straight circuit, overpass

A Fast Parallel Coloring Algorithm for Cographs

學生姓名: 江 耀 軒　　指導教授: 阮 夙 姿

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Abstract

The cographs is P_4-free graph. A graph is P_k-free if and only if it contains no induced path of length k-1.

The coloring problem is researched by many researchers. It is important and basic issue in graph theorem and computer science.

Since there are many well-known characters on cographs, so that many savants study the cographs in mathematics and computer theory region. We are interested in the cographs, so we want to analyze how to apply parallel algorithm for solving the coloring problem of the cographs. Because the cographs is contained by distance-hereditary graph, it implies that the cographs possesses the properties of distance-hereditary graphs. When we analyse and solve the coloring problem of the cographs latter, we will utilize the properties of distance-hereditary graphs. The main goal of this thesis is that we propose a parallel coloring algorithm to find a $\chi(G)$-coloring for a given cograph G. Our algorithm can be implemented in $O(\log n)$ time complexity and uses $O(n/\log n)$ processors on the *EREW PRAM* model.

We made a contribution of following three points:

(1) Reduce the number of processors

(2) Our time complexity is less than the time complexity on *CRCW PRAM* model even if our working model is more inflexible.

(3) Given an arbitrary cograph G, we could find a $\chi(G)$-coloring for given cograph G successfully.

Kneser Graphs are Hamiltonian for $n > 2.62k$

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Abstract

The Kneser graph $K(n,k)$ is the graph whose vertices are the k-subsets of an n-set, with vertices adjacent when the corresponding sets are disjoint. The Petersen graph is $K(5,2)$ and is not Hamiltonian. It is conjectured that $K(n,k)$ is Hamiltonian for all other Kneser graphs with n at least $2k+1$. Heinrich and Wallis proved this for $K(n,2)$ and $K(n,3)$. A theorem of Bor-Liang Chen and Ko-Wei Lih implies the conjecture for n exceeding $k^2/logk$. Ya-Chen Chen proved the conjecture for n at least $3k$ in 1998.

Suppose $n \geq 2k+1$. The bipartite Kneser graph $H(n,k)$ has as its partite sets the k- and $n-k$-subsets of $[n]$. Two vertices A and B from different partite sets are adjacent if the k-subset A is contained in the $n-k$-subset B. Erdős' revolving door conjecture states that $H(2k+1,k)$ is Hamiltonian. It is also known as the middle levels problem. Simpson proved that $H(n,k)$ is Hamiltonian for $n \geq (3k^2+k+2)/2$. Hurlbert showed that $H(n,k)$ is Hamiltonian for $n > ck^2+k$, with $c < 1.5$ when k is large. We now show that $K(n,k)$ and $H(n,k)$ are Hamiltonian when n is at least $(3k+1+\sqrt{5k^2-2k+1})/2$. The main tool used in our inductive proof is Baranyai's theorem. Note that $(3k+1+\sqrt{5k^2-2k+1})/2 < 2.62k+1$.

A Study of Total Relative Displacement of Permutations in Graphs

學生: 曾建國　　指導教授: 江南波

大同大學應用數學系

Abstract

Let $G = (V, E)$ be a connected graph and let ϕ be a permutation of V. The total relative displacement of the permutation ϕ in G is

$$\delta_\phi(G) = \sum_{x,y \in V} |d(x,y) - d(\phi(x), \phi(y))|,$$

where the sum is over all the $\binom{n}{2}$ unordered pairs of distinct vertices of G and $d(x,y)$ means the distance between x and y in G, i.e., the length of a shortest path between x and y. It is clear that a permutation ϕ is an automorphism of G if and only if $\delta_\phi(G) = 0$. Let $\pi(G)$ denote the smallest positive value of $\delta_\phi(G)$ among the $n!$ permutations ϕ of the vertices of G. A permutation ϕ for which $\pi(G) = \delta_\phi(G)$ has been called a near-automorphism of G. Let $\pi^*(G)$ be the maximum value of $\delta_\phi(G)$ among all permutations of $V(G)$ and the permutation which realizes $\pi^*(G)$ is called a chaotic mapping of G. In this thesis, we will study the $\pi(G)$ and $\pi^*(G)$ for some graphs.

點不同著色數之上下界的研究

學生: 黃茂峰　　指導教授: 江南波

應用數學所

大同大學

摘要

一個圖 $G = (V, E)$ 爲點不同著色，是指在 G 的邊上著色，使得對 G 中任意兩點所對應的顏色集合不會相同；而 G 之點不同著色數是指 G 的點不同著色中所用顏色最少之顏色個數。 我們討論在圖的一些運算下，它的點不同著色數的上下界， 而且我們強調這些上下界都是最好可能或者可能達到的。 接著我們討論在一些特定的圖，它的點不同著色數的上下界。

Extended 7-Cycle Systems

研究生　黃國斌　　指導老師　黃文中

東吳大學數學系

摘要

An extended 7-cycle system of the order n is an ordered pair (V, B), where B is a collection of edge-disjoint 7-cycles, 3-tadpoles and loops which partition the edge of the graph K_n^+ whose vertex set is n-set V.

In this talk, we show that an extended 7-cycle system of the order n exists for all n except n = 2, 3 and 5.

Extended Directed Triple Systems

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摘要

An extended directed triple system of the order v is a pair (V, B), where B is a collection of ordered triples from a v-set V (each ordered triple may have repeated elements) such that every ordered pair of elements of V, not necessarily distinct, is contained in exactly one ordered triple of B.

The elements of B are called blocks. There are five types of blocks: (1) [a, b, c], (2)[a,b,a], (3)[a,a,b],(4)[b,a,a], (5) [a,a,a] (in which it is the set of ordered pairs {ab,bc,ac}, {ab,ba,aa}, {aa,ab}, {ba,aa} and {aa}, respectively). Let {v; b_2,b_1} denote the class of extended directed triple systems of the order v in which the number of blocks of the form [a,b,a] is b_2 and the number of blocks of the form [b,a,a] or [a,a,b] is b_1.

In this talk, the classes {v; b_2,0} and {v; 0,b_1} will be constructed.

Intersection Problem for some class of Extended Directed Triple Systems

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摘要

An extended directed triple system of the order v is a pair (V, B), where B is a collection of ordered triples from a v-set V (each ordered triple may have repeated elements) such that every ordered pair of elements of V, not necessarily distinct, is contained in exactly one ordered triple of B.

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In this talk, we consider the intersection problem for the classes EDTS(v).

A Fault-Tolerant Two Terminals Routing Algorithm of Double-Loop Networks

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Abstract

Delivering messages between two terminals is a very important function of a network. Fault-tolerant is an important criteria to ensure the quality of a network. Under this circumstance that there is at most one edge (or node) fault in the double-loop network and the fault can not be detected before a message is sent, we propose a routing algorithm which simultaneously sends two messages to the destination along two node-disjoint routes among which at least one route is optimal. At each vertex, our algorithm spends only constant time and space to determine which vertex is the next vertex that the message should be sent.

The Study of Hyper-L Tiles of Triple-Loop Networks

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Abstract

In this thesis, we first survey the current results of hyper-L tiles of triple-loop networks, which were proposed by Aguiló, Fiol and Garcia. Then, we survey the current results of hyper-L H_1 and H_2, which were proposed by Aguiló-Gost. Finally, we propose our main results — necessary and sufficient conditions for the existence of hyper-L triple-loop networks.

Minimal Diameter Double-Loop Networks

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Abstract

Double-loop networks have become one of the most popular architectures in the design of Local Area Networks and distributed memory multiprocessor systems. This is due to its characters of minimal diameter, easy routing, expandability and regularity. The switching mechanism at each node can easily be implemented using building blocks of the same specification. Therefore, double-loop networks have a high degree of reliability and hence very low vulnerability. Let N denote the number of nodes in a double-loop network and $d(N)$ be the best possible diameter with N vertices. Given an N, Bermond *et al.* [5], Boesch and Wang [7], and Yebra *et al.* [23] have shown that $d(N) \geq \left\lceil \frac{\sqrt{2N-1}-1}{2} \right\rceil$. This is a well-known lower bound for $d(N)$ and is usually denoted as $lb(N)$. In this paper, what we discuss is finding an optimal topology such that $d(N)= lb(N)$ for any given value of N. We provide a simple formula to find optimal topologies of double-loop networks with N nodes.

Prime Labeling Conjecture

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Abstract

In 1980, Roger Entringer conjecture: Every tree has prime labelinging. So far, this conjecture is still unsolved. It has been verified for some special type of trees.

In this paper we first verify the conjecture by S. M. Lee. et al : the amalgamation of m copies of the wheel W_n that share common center, $W_{m,n}$, is prime provided that n is even.

Then, in section 2.2 we show the main theorem: every tree with order $n(n \leqq 16)$ has a prime labelinging by using consecutive n integers. Using this theorem we are able to show that some conditional trees are prime. We believe that the idea developed can be applied to take the conjecture by Roger Entringer.