Contributed Talks
CombinaTexas Conference, February 25–26, 2005

Contributed Talks I, Friday, February 25, 2005			
	2:10 – 2:30	2:35– 2:55	3:00 – 3:20
Session A	Michael Reid	Nassim Sohaee	Sosina Martirosyan
Session B	Miklos Bona	Kequan Ding	Robert Ellis
Contributed Talks II, Friday, February 25, 2005			
	3:50 –4:10	4:14–4:35	4:40–5:00
Session A	Suk Jai Seo	Annela Kelly	Francisco J.Zaragoza
Session B	Emil Daniel Schwab	Art Duval	Douglas Klein
Contributed Talks III, Saturday, February 26, 2005			
	2:00 – 2:20	2:25–2:45	2:50 –3:10
Session A	Xiuzhen Huang	Lacey Huebel	Svyatoslav Trukhanov
Session B	Lucia Moura	Dimitrije Kostic	Vadim Ponomarenko
Contributed Talks IV, Saturday, February 26, 2005			
	3:40 – 4:00	4:05 – 4:25	
Session A	Rui Xu	Balabhaskar Balasundaram	
Session B	Gabor Hetyei	Catherine Yan	

I. Friday, February 25, 2005. Session A

1. Michael Reid, University of Central Florida. 2:10–2:30

   Title: *Bounding the Diameter of the Rubik's Cube Group*

   Abstract: What is the maximum distance a position of Rubik's Cube can be from the solved position? Which are those positions that maximize this distance? The answers to these questions are still unknown, largely due to the large number of positions (about $4.3 * 10^19$). We present our efforts to give upper and lower bounds for the diameter and interesting positions that have arisen. We do this for two different metrics that are commonly used to define "distance".

2. Nassim Sohaee, Southern Methodist University. 2:35–2:55

   Title: *Vertex-Edge-Face coloring of Planar Graphs.*

   Abstract: In this paper the new coloring of planar graphs, VEF-coloring, will be introduced. A VEF coloring of a simple planar graph G is a proper coloring of all elements, including vertices, edges and faces of G. We will give two conjectures for the upper bound of VEF and VEF-list coloring of a simple planar graph. However, we will prove these conjectures for planar graphs with a maximum degree of at least 12.

3. Sosina Martirosyan, Arizona State University, 3:00–3:20

   Title: *On Covering Arrays*

   Abstract: Covering arrays are well studied combinatorial structures with numerous important applications in computer sciences. They generalize orthogonal arrays by requiring that any sub-array from t columns has each t-tuple on v symbols at least once as a row. We emphasize on combinatorial constructions of covering arrays and present some new developments on the subject.

I. Friday, February 25, 2005. Session B

1. Miklos Bona, University of Florida, 2:10–2:30

   Title: *A Combinatorial Proof of the Log-concavity of a famous sequence counting permutations*

   Abstract: We provide a combinatorial proof for the fact that for any fixed n, the sequence $\{i(n,k)\}_{0\leq k\leq \binom{n}{2}}$ of the numbers of permutations of length n having k inversions is log-concave. This is the first proof of this fact that we know of that does not use generating functions. The key idea is an interesting flipping argument.

2. Kequan Ding, Chinese Academy of Sciences, 2:35–2:55

   Title: *A Combinatorial Approach to Cancer Progression*

   Abstract: A combinatorial approach in developed to model the stochastic process of cancer progression. It is interesting that the behavior of stem cells in the process coincides with that from clinical observation.

3. Robert B. Ellis, Texas A&M University, 3:00–3:20

   Title: *Random geometric graph diameter in the unit ball*

   Title: Random geometric graph diameter in the unit ball Abstract: Form the random geometric graph $G = G_p^d(\lambda, n)$ by placing n points uniformly at random in the unit ball in $\mathbb{R}^d$

and connecting two points with an edge if they are within distance λ. We give asymptotically tight bounds on the graph diameter as soon as λ is large enough so that G is connected, employing a combination of methods from probabilistic combinatorics and stochastic geometry. (Joint work with Jeremy L. Martin and Catherine Yan.)

II. Friday, February 25, 2005. Session A

1. Suk Jai Seo, Middle Tennessee State University, 3:50–4:10

   Title: *Competition-reachability of Graphs*

   Abstract: Competition parameters for a graph are those associated with two players alternately selecting elements to be included in a set S, where S is required to have a certain property such as being independent or being enclaveless. One player attempts to maximize a value, typically the order of the resulting set, while the other player attempts to minimize the value. In this paper the problem considered is for players to alternately orient edges of a given graph G, and the parameter of interest is reachability, namely, the number of ordered pairs (u, v) of vertices for which there exists a directed u-v path.

2. Annela Kelly, University of Louisiana at Monroe, 4:15–4:35

   Title: *Analysis of one pile misere Nim for* $2n + 1$ *players*

   Abstract: We will consider a one-pile misere Nim for $2n + 1$ players. In this case the combinatorial game theory results about impartial games do not apply. We will give a complete analysis of misere Nim game if alliances are formed by any n and $n + 1$ players.

3. Francisco J. Zaragoza Martinez, Universidad Autonoma Metropolitana Azcapotzalco, 4:40–5:00

   Title: *Approximation Algorithms for a Restricted Mixed Postman Problem*

   Abstract: The Mixed Postman Problem is that of finding the minimum cost of a closed route that traverses all edges and arcs of a mixed graph. Veerasamy (PhD 1999, U. of Texas at Dallas) introduced a variant of this problem, which we call the Edges Postman Problem, where all arcs must be traversed exactly once and he gave an approximation algorithm for this problem with approximation guarantee between 2 and 5/2. We give two other approximation algorithms for this problem with tight guarantees of 3/2 and 4/3, respectively.

II. Friday, February 25, 2005. Session B

1. Emil Daniel Schwab, The University of Texas at El Paso, 3:50–4:10

   Title: *A Combinatorial Research ib Inverses Monoids via the Theory of Mobius*

   Abstract: A reduced standard division category of an inverse monoid S is a Mbius category if and only if S is combinatorial and the partially ordered set of all idempotents is locally finite. We explore combinatorial results arising from special combinatorial inverse monoids.

2. Art Duval, University of Texas at El Paso, 4:15–4:35

   Title: *A Relative Laplacian Spectral Recursion*

   Abstract: The Laplacian spectral recursion, satisfied by matroid complexes and shifted complexes, expresses the eigenvalues of the combinatorial Laplacian of a simplicial complex K in terms of the eigenvalues of $K - e$, K/e, and $(K - e, K/e)$, which are, respectively, the

deletion with respect to a ground element e, the contraction with respect to e, and the relative simplicial complex of the deletion modulo the contraction. We generalize this recursion to relative pairs of matroid complexes and shifted complexes. This recursion expresses the eigenvalues of a relative pair R in terms of $R-e$, R/e, $(R-e, R/e)$, and $(R/e, R-e)$, once these expressions are suitably defined for relative pairs.

3. Douglas Klein, Texas A&M University at Galveston, 4:40–5:00.

   Title: *Substitution-Reaction Posets*

   Abstract: A mathematical representation of a chemical reaction placing substitutents at different locations of a molecular skeleton is described. Let G be a permutation group acting on the members of a finite set S, and consider the minimal G-invariant subsets (or orbits) $\xi \Box S$. Then the substitution partial ordering $P(S,G)$ of these orbits is such that $\xi > \zeta$ if there are $C0\xi$ and $C'0\zeta$ with $C\delta C'$. In chemistry the $\zeta \Box P(S,G)$ represent substitutional isomers on a molecular skeleton S with "symmetry" G, and the associated Hasse diagram represents a substitution-reaction network. The posets P(S,G): have unique maximum and minimum elements; are self dual; and are ranked. Let $G(s)$ & $G(u)$ be full permutation groups on two sets $S(s)$ & $S(u)$ bipartitioning S. Several characteristics for $P(S,G)$ are cast in a group-theoretic framework involving $(G, G(u) \times G(o))$-double cosets in the full permutation group acting on S.

III. Saturday, February 26, 2005. Session A

1. Xiuzhen Huang, Arkansas State University, 2:00–2:20

   Title: *Finding Maximum Common Subgraph*

   Abstract: The problem of finding maximum common subgraph of two graphs or a set of graphs has very important practical applications in pattern recognition, imagine processing, computational biology and many other areas. This problem is a famous combinatorial intractable problem. I first talk about the approaches for addressing this problem. Basically, this problem is reduced to find a maximum clique in the product graph of two given graphs. Then I will talk about some intractable analysis of this problem.

2. Lacey Huebel, Texas State University, 2:25–2:45

   Title: *Global Alliance Numbers*

   Abstract: Given a graph $G = (V, E)$, a global alliance is a subset of V, say S, satisfying two criteria: first, that every vertex in V is connected to at least one vertex in S, and second, that every vertex in S is connected to at least as many vertices in S than in $V - S$. The global alliance number is the minimum cardinality for a global alliance set. I will be presenting and describing the global alliance number for complete n-partite graphs.

3. Svyatoslav Trukhanov, Texas A&M University, 2:50–3:10

   Title: *Using Critical Sets for the Maximum Independent Set Problem*

   Abstract: The problem of finding a maximum independent set in an undirected graph is a well known NP-hard problem. At the same time, the critical independent set problem is polynomially solvable. The relationship between these two problems was studied and a method that utilizes a nonempty critical independent set for solving the maximum independent set problem was developed. The theoretical results were confirmed by extensive numerical experiments on large-scale graphs with large independence number.

III. Saturday, February 26, 2005. Session B

1. Lucia Moura,University of Ottawa, 2:00–2:20

   Title: *Erdos-Ko-Rado theorems for uniform set-partition systems*

   Abstract: In this talk, we show a higher order generalization of the Erdos-Ko-Rado theorem, in which we substitute a k-subset of an n-set by a k-partition of an n-set. A k-partition is a partition with k classes. A partition is said to be uniform if each of its classes have the same cardinality. Two partitions are said to t-intersect if they have t classes in common. Our theorem states that, when n is large enough, the maximum t-intersecting family of uniform k-partitions of an n-set is the one having all uniform k-partitions of an n-set that contain a common set of t classes. In addition, we show the surprising fact that when $t = 1$ the result holds for all n.

2. Dimitrije Kostic, Texas A&M University, 2:25–2:45

   Title: *An Algorithmic Bijection Between G-Parking Functions and Spanning Trees on G*

   Abstract: G-parking functions, where G is a loopless graph, are an intriguing generalization of ordinary parking functions. Unfortunately, little is known about them, except for several bijections to spanning trees of G. In this talk, we introduce G-parking functions, establish some useful and powerful facts about them, and formulate a simple and elegant algorithm establishing one such bijection.

3. Vadim Ponomarenko, Trinity University, 2:50–3:10

   Title: *Images of $Z[x]$*

   Abstract: Given a polynomial $f(x)$ with integer coefficients, we consider the set $f(Z)$, that is the set of values f takes on as x varies over all integers. If $f(Z) = g(Z)$ for polynomials f,g, the polynomials must be related in certain ways, to be described.

IV. Saturday, February 26, 2005. Session A

1. Rui Xu, The State University of West Georgia, 3:40–4:00

   Title: *On integer flows of bidirected graphs*

   Abstract: The map coloring problem is considered one of the major catalysts of the tremendous development of graph theory. It was observed by Tutte that the problem of the face-coloring of an embedded (planar) graph can be formulated in terms of integer flows of the graph. Since then the topic of integer flow has been one of the most attractive in graph theory.

   Tutte had three famous fascinating flow conjectures: 3-flow conjecture, 4-flow conjecture and 5-flow conjecture. There are a lot of partial results for these three conjectures. But in general, all these 3 conjectures are open.

   In this talk, we will talk about a generalization of integer flow problems: integer flows of bidirected graphs. We proved that Bouchet's bidirected flow conjecture is true for 6-edge connected graphs. This is a joint work with C-Q Zhang.

2. Balabhaskar Balasundaram, Texas A&M University, 4:05–4:25

   Title: *Graph Theoretic Relaxations of Clique Models in Social Network Analysis*

Abstract: Cliques and their relaxations are used to model "cohesive subgroups" in social network analysis. Some of these relaxations that are distance based, diameter based and degree based will be introduced in this talk. Complexity results, integer programming models and computational performance of exact algorithms and heuristics for selected models will be presented.

IV. Saturday, February 26, 2005. Session B

1. Gabor Hetyei,UNC Charlotte, 3:40–4:00

   Title: *The s-vector of a simplicial complex*

   Abstract: The s-vector encodes the face numbers of a simplicial complex, using generalized binomial coefficients. In terms of this vector, expressing the face numbers of the barycentric subdivision of the free join of two CW-complexes may be found by multiplying polynomials. The s-vector of the order complex of any simplicial poset and of certain graded planar posets is non-negative. By calculating the s-vector of the barycentric subdivision of n-cube in two ways, we provide a combinatorial proof for the an intriguing identity of Bernoulli polynomials.

2. Catherine Yan, Texas A&M University, 4:05–4:25

   Title: *Crossings and nestings of matchings and partitions*

   Abstract: We present results on the enumeration of crossings and nestings for matchings and set partitions. Using a bijection between partitions and vacillating tableaux, we show that if we fix the sets of minimal block elements and maximal block elements, the crossing number and the nesting number of partitions have a symmetric joint distribution. It follows that the crossing numbers and the nesting numbers distributed symmetrically over all partitions of $[n]$, as well as over all matchings on $[2n]$.

   This is a joint work with W.Y.C. Chen, E. Deng, R. Du, and R. Stanley.