Annual status workshop

29.01.2010 TU Berlin, 13-17h, MA 212 and
01.02.2010 TU Berlin, 13-17h, MA 212

13:00-13:30	Roman Glebov
13:30-14:00	Daniel Werner
14:00-14:30	Caesar Ceballos
14:30-15:00	Jens M. Schmidt
15:00-15:30	Coffee
15:30-16:00	Veronica Albanese
16:00-16:30	Christina Puhl
16:30-17:00	Max Klimm

13:00-13:30	Bastian Laubner
13:30-14:00	Berit Grußien
14:00-14:30	Holger Dell
14:30-15:00	Kolja Knauer
15:00-15:30	Coffee
15:30-16:00	Hans Raj Tiwary
16:00-16:30	Daria Schymura
16:30-17:00	Lena Schlipf

29.01.2010 (Friday)

Roman Glebov
Title: Turàn-type Problems for Nonbipartite Graphs

Abstract:
In this talk we deal with Turan-type problems: given a positive integer n and a forbidden graph H, how many edges can there be in a graph on n vertices without a subgraph H? And how does a graph look like if it has this extremal edge number?

We look at special classes of forbidden nonbipartite graphs, although the asymptotics is determined by the Erdös-Stone theorem. Furtheremore, we see a conjecture that reduces the extremal number of any graph to the extremal number of a set of bipartite graphs.

Daniel Werner
Title: Discrepancy Problems

Abstract:
Geometric discrepancy has significant applications in optimization, statistics, combinatorics, and computer graphics. It describes how close a distribution of a (finite) point set in R^d is to the uniform distribution,

by comparing the continuous and the discrete volume of certain sets, e.g., boxes. There are several notions of discrepancy, depending on the sets that we are allowed to consider.
Computation of the Box-Discrepancy is known to be NP-hard, and the best known algorithms run in time O(n^d). We show that computing the Star- and Box-Discrepancy is W[1]-hard and thus that, under standard complexity theoretic assumptions, this exponential dependence on d cannot be removed. Our construction also indicates NP-hardness of both problems and is considerably easier than the previous approaches.

Caesar Ceballos
Title: Three non affinely equivalent realizations of the associahedron.

Abstract:
We present three different constructions of the associahedron using fiber polytopes, cluster algebras and Minkowski sums of simplices, and show that they are not affinely equivalent.

Jens M. Schmidt
Title: Planar, Cubic Graphs on Point Sets and Contractible Edges in 3-connected Graphs

Abstract:
We give a short sketch of the problem of finding a planar (straight-line) embedding of a cubic, connected graph with vertices mapped to points of a given point set. In addition, we strengthen Tutte's result that every 3-connected graph G contains a contractible edge to hold even when being restricted to an arbitrary DFS-tree of G (an edge is called contractible if its contraction leaves a 3-connected graph).

Veronica Albanese
Title: A Railway Track Allocation Problem

Abstract:
I will present the problem of routing a maximum number of trains in a conflict-free way thought a track network. The integer program is difficult and the size is not small.
The particular problem we have concern a specific corridor. A possible way, still on work in porogres, consists on creating a macroscopy model from tha microscopy one.

Christina Puhl
Title: Recoverable Robust Combinatorial Optimization

Abstract:

In many real-world applications parts of a given optimization problem underlie significant uncertainties. We expect uncertainty to be given via a set of scenarios. Recoverable robustness is a two stage concept to avoid over-conservatism in robust optimization by allowing a limited recovery after the full data is revealed. In the first stage a decision has to be taken. This decision leads to first stage decision costs and limitations of the feasible solutions in the second stage. We call those the recovery set of a decision. In the second stage, when the scenario is known, from the recovery set any solution might be taken. For this solution the scenario costs have to be paid. An optimal recoverable robust solution is a first stage decision that minimizes the first stage costs and the maximal scenario
costs by taking the best solution from its recovery set.

In this framework I will introduce several recoverable robust settings for combinatorial optimization problems and give a broad overview of their complexity status according to different scenario sets.

Max Klimm
Title: Strong Nash Equilibria in Bottleneck congestion games

Abstract:
In recent years lexicographic arguments have been applied fruitfully to various classes of games in order to prove existence of Nash equilibria. We provide an axiomatic framework for this important technique and derive new results on the existence of strong Nash equilibria for a very general class of congestion games with bottleneck objectives. This includes extensions of classical load-based models, routing games with splittable demands, scheduling games with malleable jobs, and more.

01.02.2010 (Monday)

Bastian Laubner
Title: Capturing Polynomial Time on Unordered Structures

Abstract:
In the area of descriptive complexity, arguably the most important open question asks whether there exists a (nice) logic which characterizes precisely all those queries that are computable in polynomial time. A negative answer to this question would immediately entail that PTIME does not equal NP, since there is a logic known to capture NP on arbitrary structures. A positive answer, on the other hand, would enable the comparison of the two complexity classes using methods from finite model theory.

I will start this status talk by giving background information about the foundational results in the area. From these results, there are two main strands of research towards an answer to the above question: Capturing

results for restricted classes of structures, and new logics with new expressive powers. I will briefly survey the main results here and highlight my own contributions to both directions of research.

Berit Grußien
Title: Capturing Polynomial Time on Graphs of Bounded Rank-Width

Abstract:
A problem on a class of graphs of bounded tree-width is computable in polynomial time if, and only if, it is definable in fixed-point logic with counting. Whereas the treewidth of a graph measures the similarity of the graph to a tree, rank-width is a more general measure to describe the structure of a graph. We are interested in generalizing the result above to the class of
graphs of bounded rank-width. In my talk I will give an overview on this problem.

Holger Dell
Title: Satisfiability Allows No Nontrivial Sparsification Unless The Polynomial-Time Hierarchy Collapses

Abstract:
It is well-known that no deterministic polynomial-time machine can solve the satisfiability problem of Boolean formulas unless P=NP. In this talk, we will allow the polynomial-time machine to communicate with a computationally arbitrarily powerful oracle. Now the machine can trivially solve the satisfiability problem by sending its whole input to the oracle. We will see that, if the machine could solve the satisfiability problem by sending the oracle a number of bits of order strictly less than the number of bits in the input, the polynomial-time hierarchy would collapse to its third level, a complexity event considered unlikely.

Kolja Knauer
Title: Cubic Time Recognition of Cocircuit Graphs of Uniform Oriented Matroids

Abstract:
Rank 3 uniform oriented matroids correspond to simple spherical pseudoline arrangements. Generally, every uniform oriented matroid can be seen as a simple pseudosphere arrangement of some dimension. The cocircuit graph is the 1-skeleton of such an arrangement. It can also be defined in terms of sign vectors associated to the oriented matroid.

We present an algorithm which takes a graph as input and decides in cubic time if the graph is the cocircuit graph of a uniform

oriented matroid. In the affirmative case the algorithm returns the set of signed cocircuits of the oriented matroid.

This improves the running time of an algorithm described by Babson, Finschi and Fukuda.

Hans Raj Tiwary
Title: Convex Subsets of Minkowski Sums of Planar Points

Abstract:
Given two sets of n points P, Q in the plane, the Minkowski sum P+Q has n^2 points. How many points from P+Q can be chosen that are convexly independent? In this talk I will overview the known results for this problem and discuss the case when P and Q themselves are convex. This complements the other known results by Pach and Eisenbrand, and Toth et. al.

Daria Schymura
Title: Three Problems Involving Shapes

Abstract:
I will introduce three problems that I worked on and shortly present the results.

First, I present a shape matching problem. Shapes are finite sets of d-dimensional simplices in R^d with pairwise disjoint interiors. Given two shapes A and B, find a transformation t such that, with high probability, the volume of the intersection of t(A) and B is at least as large as the volume of intersection of r(A) and B (minus an error of size epsilon) for any other transformation r.

Second, I introduce the optimal shape of a town. Given a natural number n, compute a subset S of size n (a town) of the plane integer grid that minimizes the sum of the Manhattan distances. This is joint work with Erik Demaine, S´andor Fekete, Günter Rote, Nils Schweer and Mariano Zelke. We give a O(n^7.5) algorithm that solves the problem.

The third problem is to measure the similarity of geometric graphs. Together with Otfried Cheong, Joachim Gudmundsson, Hyo-Sil Kim and Fabian Stehn, our aim was to define a reasonable distance measure for geometric graphs. We also defined a heuristic distance that we tested with the matching and retrieval of Chinese characters.

Lena Schlipf
Title: Geometric Shape Matching and Inner Approximation

Abstract:

In shape matching, we are given two geometric objects and we compute their distance according to some geometric
similarity measure. A similar problem is to replace a complex geometric shape by a simpler one. First, I will talk about some similarity measures, computing them, and impreciseness in input.
Then, I will talk about inner approximation of convex polygons by rectangles.

