Workshop Operations Research
Bern-Fribourg

University of Bern
November 14, 2022

Time	Activity		Location
from 13:45	Welcome Coffee		Grosse Schanze
14:30 - 16:00	Presentation	Chair	Room 028, Main Building
	• Carolina Lucía Gonzalez	Norbert Trautmann	
	• Felicia Lucke	Norbert Trautmann	
	• Nicklas Klein	Bernard Ries	
	• Tamara Bigler	Bernard Ries	
16:00 - 16:20	Break		
16:20 - 17:30	Presentation	Chair	Room 028, Main Building
	• Vera Fischer	Philipp Baumann	
	• Felix Mann	Philipp Baumann	
	• Narmina Baghirova	Marino Widmer	
18:00	Dinner		Ristorante Da Bucolo

Each presentation should last 15 minutes plus 7 minutes for questions and discussion.

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Presentations - Titles and Abstracts (1/2)

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Carolina Lucía Gonzalez
Locally checkable problems

Locally checkable problems are partitioning (or, equivalently, coloring) graph problems where the solution can be verified by checking some local property for each vertex, that is, a property involving only the vertex and its neighborhood. This is the case of stable set, dominating set and k-coloring, among others. Our main focus is to study under which conditions we can efficiently solve locally checkable problems for different graph classes. In particular, we studied the complexity when parameterized by three width measures: treewidth, clique-width and mim-width.

Felicia Lucke
Variations of matching cuts

Given a connected graph G an edge cut is an edge set S such that after deletion of S the graph consists of two or more components. A matching of G is an edge set such that no two edges have a common endvertex. We define a matching cut as an edge set which is both an edge cut and a matching. We will consider variations of the matching cut problem together with an equivalent formulation which helps us to solve matching cut in special graph classes.

Nicklas Klein
Mixed-integer linear programming based solution methods for scheduling surgeries under uncertainty

We consider the problem of scheduling elective surgeries with uncertain durations in operation blocks over a fixed time horizon. The schedule has to accommodate emergency surgeries that arrive at random and must be performed on the day of their arrival. The goal is to assign a start time and an operation block to the elective surgeries to minimize the total cost for the block assignments plus the expected cost of delaying or canceling surgeries plus the expected cost of operating room idle- and overtime. We propose a two-stage mixed-integer linear programming (MILP) model that is based on sample average approximation. We further propose a matheuristic procedure to solve the problem. Computational results indicate that the matheuristic outperforms the MILP formulation solved by a standard solver.

Tamara Bigler
A binary-linear programming-based matheuristic for the obnoxious *p*-median problem

Facilities such as waste plants or wind turbines are often referred to as obnoxious facilities because they have negative side effects on their close environment. In the obnoxious p-median problem, a set of clients and a set of potential locations for obnoxious facilities are given, from which p facilities must be opened. The objective is to maximize the sum of the minimum distance between each client and the set of opened facilities. For the first time, we propose a matheuristic for this planning problem. The matheuristic covers different areas of the search space in parallel and is flexible to incorporate additional side constraints. Our computational results show that the matheuristic is competitive with the leading metaheuristics on small and medium instances and outperforms the leading metaheuristics on large instances in terms of solution quality and running times.

Presentations - Titles and Abstracts (2/2)

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Vera Fischer

A two-phased heuristic approach for a capacitated multi-vehicle covering tour problem (m-CTP) with intermediate facilities

We consider a waste collection problem which consists in identifying locations of collection sites that cover all residential buildings (set cover) and creating collection routes with intermediate facilities for a vehicle at minimum total cost. We propose a mixed-integer linear programming (MILP) formulation that exploits the sparsity of the road network. To efficiently solve practical instances, we decompose the problem as follows: we solve a minimum clique covering problem on chordal graphs to identify the set covers and develop a column generation approach to build the routes for a given set cover.

Felix Mann

Measuring complexity of graphs

Most interesting problems on graphs are hard to solve. However, there are some graphs, even large ones, for which we can quickly solve many different problems. This is why there has been considerable research trying to measure how complicated a graph is. I will roughly outline the main ideas of parameterized complexity and why it is so complicated to describe how complicated graphs are.

Narmina Baghirova

On k-community structures in special graph classes

For a fixed integer $k \geq 2$, a k-community structure in an undirected graph is a partition of its vertex set into k sets (called communities), each of size at least two, such that every vertex of the graph has proportionally at least as many neighbors in its own community as in any other community. We study the existence of a k-community structure in different graph classes and introduce a polynomial-time algorithm for finding such structure in certain graph classes. We also consider a variant of the problem, where communities are allowed to have size one. Moreover, we introduce a new infinite family of connected graphs that do not admit any 2-community structure.