IPCO BONN 2014

The 17th Conference on

Integer Programming and Combinatorial Optimization

Summer School:
June 20 – 22, 2014

IPCO Conference:
June 23 – 25, 2014

Bonn, Germany

Research Institute for Discrete Mathematics

hausdorff CENTER FOR MATHEMATICS

universitätbonn

ARITHMEUM
rechnen einst und heute

Mathematical Optimization Society

Contents

Greetings

As rector of the University of Bonn, it is my great pleasure to welcome you to the University as well as the City of Bonn.
The University of Bonn, founded in 1818, is an international research university; as such it offers a large spectrum of opportunities for research and studies, ranging from natural sciences and medicine to law, economics, and humanities.
Among those, our Mathematics Department is certainly one of the university's scientific beacons, probably the strongest of its kind in Germany and one of the strongest in the world. A vital part of this department is the Research Institute for Discrete Mathematics, which organizes this conference. It is well-known for its fundamental research in combinatorial optimization as well as its unrivaled success in applications, based on industrial cooperations on mathematical algorithms for chip design. It also boasts a very noteworthy collection of mechanical calculators as well as concrete art.
I am glad to see that this conference on discrete optimization attracts so many people from all parts of the world, and I wish you a prolific time in Bonn.

Jürgen Fohrmann

Welcome to Bonn! We are happy that more than 200 participants from all continents have come, a record for IPCO. Indeed, this is a great opportunity to learn about new research and make new acquaintances.
Integer programming and combinatorial optimization is a very active field. The ever-growing need for efficient algorithms to solve real-world optimization problems can only be satisfied by fundamental research and continuous advances in mathematical theory.
Since its first edition in 1990, the IPCO conference has grown and become the most important conference in this field. This year we had 143 submissions, more than ever before. The program committee, chaired by Jon Lee, had the difficult task of selecting the 34 best papers that will be presented here.
Following a more recent tradition, we have included a summer school with four prominent speakers on the weekend before IPCO, and also a poster session. I would like to thank all people who helped to make this conference possible; they are listed in this booklet. Special thanks go to Jon Lee and Stephan Held.
Our social program includes the welcome reception on Sunday, Arithmeum tours, and, on Tuesday, a boat trip on the Rhine with the conference dinner. Don't miss it, and enjoy your time in Bonn!

Jens Vygen

Organization

Program Committee

» **Flavia Bonomo**
Universidad de Buenos Aires
» **Sam Burer**
University of Iowa
» **Gérard Cornuéjols**
Carnegie Mellon University
» **Satoru Fujishige**
Kyoto University
» **Michael Jünger**
Universität zu Köln
» **Matthias Köppe**
University of California, Davis
» **Jon Lee,** *chair*
University of Michigan
» **Jeff Linderoth**
University of Wisconsin
» **Jean-Philippe Richard**
University of Florida
» **András Sebő**
CNRS, G-SCOP, Grenoble
» **Maxim Sviridenko**
University of Warwick
» **Chaitanya Swamy**
University of Waterloo
» **Jens Vygen**
Universität Bonn
» **David P. Williamson**
Cornell University
» **Laurence Wolsey**
Université catholique de Louvain

Local Organization Committee

» **Stephan Held,** *co-chair*
» **Stefan Hougardy**
» **Bernhard Korte**
» **Jens Vygen,** *chair*

With help from: Markus Ahrens, Lucius Arndt, Tilmann Bihler, Ulrich Brenner, Pascal Cremer, Mathias Gerdes, Michael Gester, Arndt Gillessen, Alexander Göke, Michael Hahmann, Nicolai Hähnle, Anna Hermann, Gita Herrmann, Britta Heymann, Nils Hoppmann, Friedrich Jahns, Nicolas Kämmerling, Dirkje Keiper, Niko Klewinghaus, Christoph Matzke, Friederike Michaelis, Lukas Miething, Dirk Müller, Bento Natura, Jakob Nussbaumer, Philipp Ochsendorf, Ina Prinz, Rabe von Randow, Daniel Romen, Daniel Rotter, Rudolf Scheifele, Jan Schneider, Ulrike Schorr, Rasmus Schroeder, Jannik Silvanus, Sophie Spirkl, Paul Stahr, Andrei Sterin, Vera Traub, Philipp Weiß, Christiane Weller

IPCO Steering Committee

» **Andrea Lodi**
Università di Bologna
» **Andreas S. Schulz,** *chair*
MIT
» **David P. Williamson**
Cornell University

Venues

Friday, Saturday, Sunday:

Research Institute for Discrete Mathematics and Arithmeum

Lennéstraße 2, 53113 Bonn

Both the Research Institute for Discrete Mathematics and the Arithmeum, a museum of calculating machines, are located in the Arithmeum building.

The welcome reception as well as the Summer School will take place here.

Monday, Tuesday, Wednesday:

University Club

Konviktstraße 9, 53113 Bonn

The University Club is located almost on the Rhine river. All IPCO lectures will be here.

See the map on page 18

History of IPCO:

Interested in the history of IPCO? Have a look at *http://www.mathopt.org/?nav=ipco* !

Summer School

Friday, June 20	
13:00 - 14:15	*Registration*
14:15 - 14:30	*Welcome*
14:30 - 16:00	Lecture by Gérard Cornuéjols
16:00 - 16:30	*Coffee break*
16:30 - 18:00	Lecture by David Shmoys
18:00 - 19:00	*Arithmeum tour*

Saturday, June 21	
09:30 - 10:00	*Coffee*
10:00 - 11:30	Lecture by András Frank
11:30 - 13:30	*Lunch break*
13:30 - 15:00	Lecture by Gérard Cornuéjols
15:00 - 15:30	Coffee break
15:30 - 17:00	Lecture by Thomas Rothvoß
17:00 - 18:00	*Arithmeum tour*

Sunday, June 22	
09:30 - 10:00	*Coffee*
10:00 - 11:30	Lecture by David Shmoys
11:30 - 13:30	*Lunch break*
13:30 - 15:00	Lecture by András Frank
15:00 - 15:30	*Coffee break*
15:30 - 17:00	Lecture by Thomas Rothvoß
18:00	*IPCO Welcome Reception (see page 10)*

Gérard Cornuéjols

Carnegie Mellon University, Pittsburgh

Cut-generating functions in integer programming

Cutting planes have become a key component of integer programming solvers. Some of the most successful cutting planes are generated from an optimal tableau of the linear programming relaxation by applying a simple „cut-generating function". Gomory's mixed-integer cuts are a classical example. In these lectures, we present our current understanding of the theory of cut-generating functions. In particular we develop their relationship to lattice-free convex sets.

András Frank

Eötvös University, Budapest

Constructive characterizations

Given a graph property P, its constructive characterization is a building procedure consisting of simple steps so that a graph has property P if and only if it can be obtained from a small starting graph by applying the given procedure. A simple and well-known example is the ear-decomposition of strongly connected digraphs. A more complicated one is described by a theorem of Dirac stating that a simple graph is chordal if and only if it can be built up from a node by adding new nodes one by one in such a way that the currently added new node is connected to a clique of the already existing subgraph. Constructive characterizations often prove to be surprisingly powerful in deriving otherwise difficult theorems. For example, a constructive characterization of $2k$-edge-connected graphs gives rise to an immediate proof of the famous orientation theorem of Nash-Williams. An analogous characterization of k-edge-connected digraphs easily implies a classic theorem of Edmonds on packing arborescences. In this mini-course, I overview the most important constructive characterizations and exhibit some of their several exciting applications.

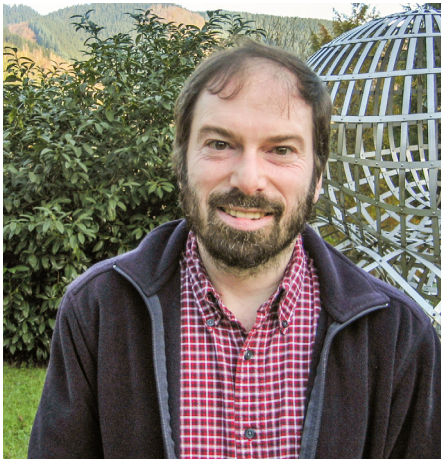
Thomas Rothvoß

University of Washington, Seattle

Extended formulations

A popular method in combinatorial optimization is to express polytopes P, which may potentially have exponentially many facets, as solutions of linear programs that use few extra variables to reduce the number of constraints down to a polynomial. We will review the basic definitions and concepts in the field of extended formulations and see several examples of compact extended formulations. Then we will discuss Yannakakis' Theorem and the award-winning result of Fiorini, Massar, Pokutta, Tiwary and de Wolf that the TSP polytope requires exponential size LPs. Afterwards, we discuss a recent exponential lower bound on the matching polytope.

David Shmoys
Cornell University, Ithaca



Improving Christofides' algorithm with randomization and LP

We will survey a number of recent results that yield improved approximation algorithms for variants of the traveling salesman problem (TSP); an r-approximation algorithm for an optimization is a polynomial-time algorithm that is guaranteed to find a feasible solution of objective function value within a factor of r of optimal. We shall briefly discuss recent results of Oveis Gharan, Saberi, & Singh and Mömke & Svensson for the graphical TSP, Asadpour, Goemans, Mądry, Oveis Gharan, & Saberi for the asymmetric TSP, but we shall focus instead on results for the s-t path traveling salesman problem.

In the *s-t* path TSP, we are given pairwise distances among n points that satisfy the triangle inequality, and two specified endpoints *s* and *t*; the problem is to find a shortest Hamiltonian path between *s* and *t*. Hoogeveen showed that the natural variant of the classic TSP algorithm of Christofides is a *5/3*-approximation algorithm for this problem, and this asymptotically tight bound in fact has been the best approximation ratio known until now. We shall present a result of An, Kleinberg, and Shmoys, which provides an approximation algorithm that is guaranteed to find a solution of cost within a factor of the golden ratio of optimal in polynomial time for any metric input. This result is based on modifying Christofides' algorithm so that it randomly chooses the initial spanning tree based on an optimal solution to a natural linear programming relaxation, rather than a minimum spanning tree; this simple but crucial modification leads to an improved approximation ratio, surpassing the 20-year-old barrier set by the natural Christofides' algorithm variant. We shall discuss a subsequent improvement by Sebő, which gives a refinement of this approach that yields a *1.6*-approximation algorithm. Finally, we present an elegant result of Gao, that provides a much simpler approach to match a result of Sebő and Vygen that gives a *1.5*-approximation algorithm for the graphical metric case of this problem.

All photos from the Archives of the Mathematisches Forschungsinstitut Oberwolfach

Welcome Reception

Sunday, June 22, 18:00 - 21:00

The welcome reception takes place on Sunday, June 22 at 18:00 in the Arithmeum building, Lennéstraße 2. Snacks and drinks will be served.

Arithmeum Tour

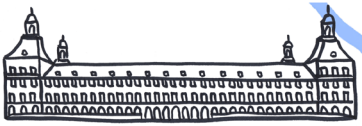
Friday, Saturday, Monday

The exhibition spans an immense period of time: from the beginnings of digits and number systems in ancient Mesopotamia 6 000 years ago, to the reckoning boards of classical antiquity and the middle ages, and on to the first mechanical calculating machines in the 17 th century that were conceived by such famous mathematicians and scientists as Leibniz, Pascal, Schickard, Poleni, Leupold, and Stanhope.
During the baroque era there was neither a scientific nor a commercial need for calculating machines. They were collected by kings and potentates and kept in cabinets, and were admired and marvelled at because they, like androids, were able to perform human feats mechanically. Series production of mechanical calculating machines did not commence until the middle of the 19 th century.

Additionally, a special exhibition on the history of the slide rule is presented. The current art exhibition shows the graphic work of Jo Niemeyer. This artist developed different design variants for the golden section and presents the most beautiful results in the primary colors, white, grey and black.

Boat Trip with Conference Dinner

Tuesday, June 24 , 18:00 - 23:00



Bonn

Filia Rheni

The conference dinner will take place on Tuesday, June 24 on the boat ***Filia Rheni***. We meet at 18:00 on the boat, which will be waiting for us at Brassertufer below Alter Zoll. (see the map on page 18).

UN and DHL Tower

Please wear your badge and make sure to be on time: **the boat will leave at 18:15!**

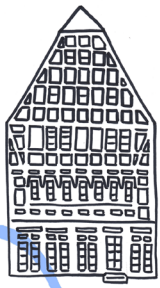
We will travel in the southern direction. From the boat we will see

» the Regierungsviertel
» the Rheinaue park
» Königswinter and the Siebengebirge
» Rolandseck and the Arp museum
» Linz am Rhein

Siebengebirge

On board, the ***Trio Mayence*** will entertain us with jazz music.

Rolandseck



Linz

Conference Program

Monday, June 23

08:30 - 08:50	*Registration*
08:50 - 09:00	Jens Vygen: *Welcome*
	chair: Jon Lee
09:00 - 09:30	Ilan Adler, Christos Papadimitriou, and Aviad Rubinstein: *On simplex pivoting rules and complexity theory*
09:30 - 10:00	Volker Kaibel and Matthias Walter: *Simple extensions of polytopes*
10:00 - 10:30	Zachary Friggstad, Jochen Könemann, Young Kun Ko, Anand Louis, Mohammad Shadravan, and Madhur Tulsiani: *Linear programming hierarchies suffice for directed Steiner tree*
10:30 - 11:00	*Coffee break*
	chair: Anke van Zuylen
11:00 - 11:30	Chandra Chekuri and Alina Ene: *The all-or-nothing flow problem in directed graphs with symmetric demand pairs*
11:30 - 12:00	Lap Chi Lau and Hong Zhou: *A unified algorithm for degree bounded survivable network design*
12:00 - 12:30	Sylvia Boyd, Yao Fu, and Yu Sun: *A 5/4-approximation for subcubic 2EC using circulations*

12:30 - 14:00	*Lunch break*

chair: Michael Jünger

14:00 - 14:30	Michele Conforti, Alberto Del Pia, Marco Di Summa, and Yuri Faenza: *Reverse split rank*
14:30 - 15:00	Gennadiy Averkov and Amitabh Basu: *On the unique-lifting property*
15:00 - 15:30	Santanu S. Dey, Marco Molinaro, and Qianyi Wang: *How good are sparse cutting-planes?*
15:30 - 15:35	*Photo*
15:35 - 16:00	*Coffee break*

chair: Uwe Zimmermann

16:00 - 16:30	José R. Correa, Alberto Marchetti-Spaccamela, Jannik Matuschke, Leen Stougie, Ola Svensson, Víctor Verdugo, and José Verschae: *Strong LP formulations for scheduling splittable jobs on unrelated machines*
16:30 - 17:00	Matthias Mnich and Andreas Wiese: *Scheduling and fixed-parameter tractability*
17:00 - 17:30	Chien-Chung Huang and Telikepalli Kavitha: *An improved approximation algorithm for the stable marriage problem with one-sided ties*
18:00 - 19:00	*Arithmeum Tour*

Proceedings:

All extended abstracts presented here are included in the proceedings:

J. Lee, J. Vygen (eds.) : Integer Programming and Combinatorial Optimization. LNCS 8494. Springer, Berlin 2014.

All participants receive a copy.

Tuesday, June 24

chair: András Sebő

09:00 - 09:30 Ahmad Abdi and Bertrand Guenin:
The cycling property for odd st-walk clutters

09:30 - 10:00 Henning Bruhn and Oliver Schaudt:
Claw-free t-perfect graphs can be recognised in polynomial time

10:00 - 10:30 Uriel Feige, R. Ravi, and Mohit Singh:
Short tours through large linear forests

10:30 - 11:00 *Coffee break*

chair: Karen Aardal

11:00 - 11:30 Pierre Bonami and François Margot:
Cut generation through binarization

11:30 - 12:00 Manish Bansal and Kiavash Kianfar:
n-step cycle inequalities: facets for continuous n-mixing set and strong cuts for multi-module capacitated lot-sizing problem

12:00 - 12:30 Alejandro Angulo, Daniel Espinoza, and Rodrigo Palma:
Sequence independent, simultaneous and multidimensional lifting of generalized flow covers for the semi-continuous knapsack problem with generalized upper bounds constraints

12:30 - 13:00 *Poster session (see page 20)*

12:30 - 14:00	*Lunch break*

chair: Bruce Shepherd

14:00 - 14:30 Christos Kalaitzis, Aleksander Mądry, Alantha Newman, Lukáš Poláček, and Ola Svensson:
On the configuration LP for maximum budgeted allocation

14:30 - 15:00 Madhukar Korupolu, Adam Meyerson, Rajmohan Rajaraman, and Brian Tagiku:
Coupled and k-sided placements: generalizing generalized assignment

15:00 - 15:30 Hyung-Chan An, Aditya Bhaskara, Chandra Chekuri, Shalmoli Gupta, Vivek Madan, and Ola Svensson:
Centrality of trees for capacitated k-center

15:30 - 16:00	*Coffee break*

chair: Matthias Köppe

16:00 - 16:30 Volker Kaibel and Stefan Weltge:
Lower bounds on the sizes of integer programs without additional variables

16:30 - 17:00 Iskander Aliev, Jesús A. De Loera, and Quentin Louveaux:
Integer programs with prescribed number of solutions and a weighted version of Doignon-Bell-Scarf's theorem

17:00 - 17:30	*Poster session (see page 20)*
18:00 - 23:00	*Boat trip with conference dinner (see page 11)*

Wednesday, June 25

chair: Gérard Cornuéjols

09:00 - 09:30 Fatma Kılınç Karzan and Sercan Yıldız:
Two-term disjunctions on the second-order cone

09:30 - 10:00 Christoph Buchheim and Claudia D'Ambrosio:
Box-constrained mixed-integer polynomial optimization using separable underestimators

10:00 - 10:30 Diego Pecin, Artur Pessoa, Marcus Poggi, and Eduardo Uchoa:
Improved branch-cut-and-price for capacitated vehicle routing

10:30 - 11:00 *Coffee break*

chair: Satoru Fujishige

11:00 - 11:30 Mourad Baïou and Francisco Barahona:
Maximum weighted induced bipartite subgraphs and acyclic subgraphs of planar cubic graphs

11:30 - 12:00 Adrian Bock, Karthekeyan Chandrasekaran, Jochen Könemann, Britta Peis, and Laura Sanità:
Finding small stabilizers for unstable graphs

12:00 - 12:30 Amit Chakrabarti and Sagar Kale:
Submodular maximization meets streaming: matchings, matroids, and more

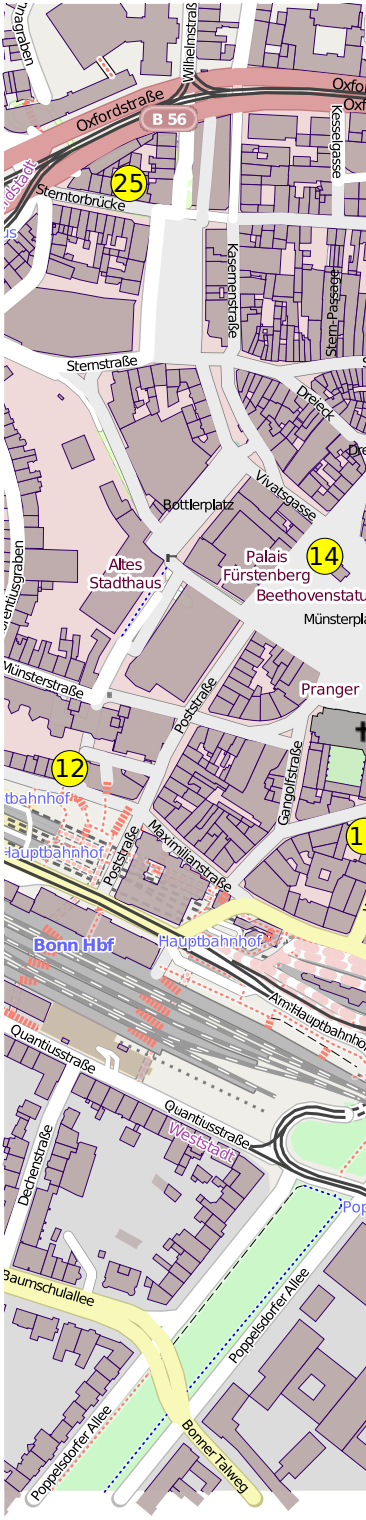
12:30 - 14:00	*Lunch break*
	chair: Chaitanya Swamy
14:00 - 14:30	Nikhil Bansal and Viswanath Nagarajan: *On the adaptivity gap of stochastic orienteering*
14:30 - 15:00	Anand Bhalgat and Sanjeev Khanna: *A utility equivalence theorem for concave functions*
15:00 - 15:30	Umang Bhaskar, Katrina Ligett, and Leonard J. Schulman: *Network improvement for equilibrium routing*
15:30 - 16:00	*Coffee break*
	chair: William Cook
16:00 - 16:30	Natashia Boland, Hadi Charkhgard, and Martin Savelsbergh: *The triangle splitting method for biobjective mixed integer programming*
16:30 - 17:00	Hassene Aissi, A. Ridha Mahjoub, S. Thomas McCormick, and Maurice Queyranne: *A strongly polynomial time algorithm for multicriteria global minimum cuts*

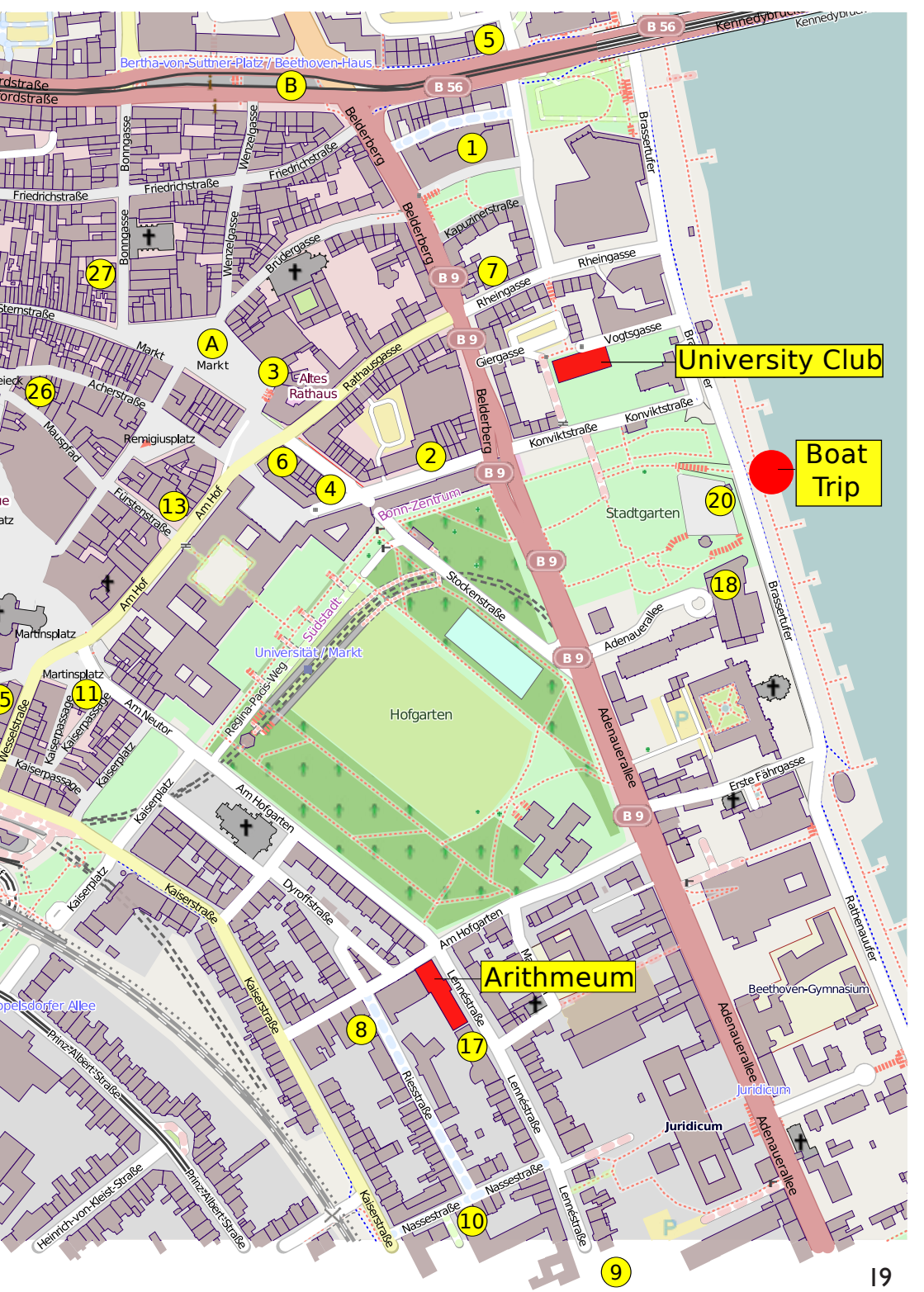
Trimester Program on Combinatorial Optimization

at the Hausdorff Research Institute for Mathematics, Bonn
September – December 2015

Organizers: András Frank, Satoru Iwata, Jochen Könemann, Jens Vygen

Interested? Write us an e-mail or have a look at
http://www.him.uni-bonn.de/combinatorial-optimization-2015/




University Club
Boat Trip
Arithmeum
Bertha-von-Suttner-Platz / Beethoven-Haus
Belderberg
Rheingasse
Vogtsgasse
Giergasse
Konviktstraße
Brassertufer
Stadtgarten
Hofgarten
Bonn-Zentrum
Altes Rathaus
Markt
Remigiusplatz
Am Hof
Martinsplatz
Universität / Markt
Südstadt
Stockenstraße
Adenauerallee
Erste Fährgasse
Am Hofgarten
Kaiserstraße
Kaiserplatz
Lennéstraße
Nassestraße
Juridicum
Beethoven-Gymnasium
Rathenauufer
Prinz-Albert-Straße
Heinrich-von-Kleist-Straße
B 56
B 9

Poster Session

Tuesday, June 24, 12:30 - 13:00 and 17:00 - 17:30

» Iskander Aliev, Robert Bassett, Jesús A. De Loera, and Quentin Louveaux:
Lower Bounds in an Extension of Doignon-Bell-Scarf Theorem

» Enrico Angelelli, Martin W. P. Savelsbergh, Reena Kapoor, and Thomas Kalinowski:
Complexity and Algorithms for Reclaimer Scheduling Problems

» Paulina Alejandra Ávila Torres, Fernando López Irarragorri, and Rafael Caballero Fernández:
A mathematical model for the urban transport problem with uncertain demand and travel time

» Michael Bastubbe, Martin Bergner, Alberto Ceselli, and Marco E. Lübbecke:
A branch-and-price algorithm for re-arranging a matrix into singly-bordered block-diagonal form

» Umang Bhaskar, Katrina Ligett, Leonard J. Schulman, and Chaitanya Swamy:
Achieving Target Equilibria in Network Routing Games without Knowing the Latency Functions

» Natashia Boland, Thomas Kalinowski, and Simranjit Kaur:
Scheduling Network Maintenance Jobs with Release Dates and Deadlines to Maximize Total Flow Over Time: Bounds and Solution Strategies

» Austin Buchanan, Jose L. Walteros, Sergiy Butenko, and Panos M. Pardalos:
Solving 0-1 programs with dense conflict graphs

» Margarida Carvalho, Andrea Lodi, João Pedro Pedroso, and Ana Viana:
Two-Player Kidney Exchange Game

» Lin Chen, Nicole Megow, Roman Rischke, and Leen Stougie:
Approximation Algorithms for Two-Stage Stochastic Scheduling with Time-Slot Cost

» Stefano Coniglio and Stefano Gualandi:
On the exact separation of rank inequalities for the stable set problem

» Andrew Conn, Claudia D'Ambrosio, Leo Liberti, Claire Lizon, and Ky Vu:
A trust region method for solving grey-box MINLP

» Ante Ćustić and Bettina Klinz:
On the constant objective value property for combinatorial optimization problems

» Claudia D'Ambrosio, Angelo Di Zio, Silvano Martello, and Luca Mencarelli:
A heuristic algorithm for general multiple nonlinear knapsack problems

» Claudia D'Ambrosio and Raouia Taktak:
Optimality for Tough Combinatorial Hydro Valley Problems

» Gustavo Dias and Leo Liberti:
Exploiting symmetries of MILP feasible sets

» Anja Fischer, Frank Fischer, and S. Thomas McCormick:
Matroid optimisation problems with a special polynomial objective function

» Andreas Gebauer, Sarah Kirchner, and Marco E. Lübbecke:
Row-and-Column Generation for the Jobshop Scheduling Problem with min-sum Objective

» Ruben Hoeksma, Bodo Manthey, and Marc Uetz:
Decomposition Algorithm for the Single Machine Scheduling Polytope

» Marco E. Lübbecke and Christian Puchert:
Primal Heuristic for Multi-Stage Mixed Integer Programs

» Marco E. Lübbecke and Jonas T. Witt:
Separation of Generic Cutting Planes in Branch-and-Price Using a Basis

» Alejandro Marcos Alvarez, Quentin Louveaux, and Louis Wehenkel:
A Machine Learning-Based Approximation of Strong Branching

» Nancy Maribel Arratia Martínez, and Fernando López Irarragorri:
A Mixed Integer Linear Mathematical Model to R&D Project Portfolio Selection in Public Sector

» Daniel Porumbel:
Optimizing column generation programs using an intersection sub-problem instead of a separation sub-problem

» Richard Sieg:
Scheduling Sport Tournaments and Monoids

» Arnaud Vandaele:
A refined rectangle covering number as lower bound for extended formulations

» Matthias Walter and Nils Wegmann:
Computational Study of Graphic TSP Approximation Algorithms

» Umar Waqas, Marc Geilen, Joost van Pinxten, Sander Stuijk, and Henk Corporaal
Combinatorial optimization challenges in scheduling Print Shops

» Andreas Wierz, Britta Peis, and S. Thomas McCormick:
Primal-Dual Algorithms for Precedence Constrained Covering Problems

Restaurants

Price categories:
You can get a main course with drink for...
- » < 8 euros €
- » 8-15 euros €€
- » 16-25 euros €€€
- » > 25 euros €€€€

English?
In general, you can assume that waiters are able to speak English. Most restaurants even have an English menu.

Credit Card?
In Germany it is not very common to pay small amounts by credit card. In a lot of restaurants you have to pay cash or by EC-Card.

You find many opportunities for snacks like French fries, sausages („Bratwurst“ or „Currywurst“), and Döner on the market place and near Bertha-von-Suttner-Platz. Germany is also famous for its bakeries which can be found all around the city.

See also the map on page 18, where you can find the market place marked by A and Bertha-von-Suttner-Platz marked by B.

Near University Club

Bühne 1
» Cuisine: Turkish
» €€
» Kapuzinerstraße 13, 53111 Bonn
» +49 228 608 894 43
» great variety of appetizers
» 4 min. walk from University Club
10 min. walk from Arithmeum

Café Blau 2
» Cuisine: International
» €
» Franziskanerstraße 9, 53113 Bonn
» +49 228 650717
» students‘ restaurant
» 3 min. walk from University Club
7 min. walk from Arithmeum

Mandu 2
» Cuisine: Korean
» €
» Franziskanerstraße 5, 53111 Bonn
» +49 228 55523953
» 3 min. walk from University Club
7 min. walk from Arithmeum

Em Höttche 3
» Cuisine: Traditional German
» €€
» Markt 4, 53111 Bonn
» +49 228 690009
» 6 min. walk from University Club
8 min. walk from Arithmeum

First Flush Tea Room 3

» Cuisine: Syrian / International
» €€
» Markt 6, 53111 Bonn
» +49 228 68477951
» 6 min. walk from University Club
8 min. walk from Arithmeum

Ichiban Sushi Bar 4

» Cuisine: Japanese
» €€
» Stockenstraße 14, 53113 Bonn
» +49 228 4109789
» 6 min. walk from University Club
7 min. walk from Arithmeum

Rüen Thai 5

» Cuisine: Thai
» €€
» Berliner Freiheit 14, 53111 Bonn
» +49 228 651576
» 6 min. walk from University Club
13 min. walk from Arithmeum

Ruland 6

» Cuisine: Italian
» €€
» Bischofsplatz 1, 53111 Bonn
» +49 228 41027670
» 6 min. walk from University Club
8 min. walk from Arithmeum

Pastis 7

» Cuisine: French
» €€€
» Rheingasse 5, 53111 Bonn
» +49 228 9694270
» 3 min. walk from University Club
9 min. walk from Arithmeum

Near Arithmeum

KostBar 8

» Cuisine: Soups
» €
» Riesstraße 2, 53113 Bonn
» +49 228 3388888
» Quick lunch only
» 2 min. walk from Arithmeum,
9 min. walk from University Club

Lenné Snack 9

» French Fries, Schnitzel, Burger, etc.
» €
» Lennéstraße 57, 53113 Bonn
» +49 228 224328
» 4 min. walk from Arithmeum,
12 min. walk from University Club

Mensa Nassestraße 10

» Cuisine: Mixed
» €
» Nassestraße 11, 53113 Bonn
» +49 228 737135
» students‘ cafeteria, self service,
different offers each day
» 3 min. walk from Arithmeum,
11 min. walk from University Club

Roses 11

» Cuisine: International
» €€
» Martinsplatz 2a, 53113 Bonn
» +49 228 4330653
» 5 min. walk from Arithmeum,
8 min. walk from University Club

Not far away

Cassius Garten 12

» Cuisine: Vegetarian and Vegan
» €€
» Maximilianstraße 28d, 53111 Bonn
» +49 228 652429
» 12 min. walk from University Club
9 min. walk from Arithmeum

Dehly & deSander 13

» Cuisine: Soups, Salads, etc.
» €
» Am Hof 26, 53111 Bonn
» +49 228 945914
» Quick lunch only
» 7 min. walk from University Club
7 min. walk from Arithmeum

Midi 14

» Cuisine: International
» €€
» Münsterplatz 11, 53111 Bonn
» +49 228 96963821
» 10 min. walk from University Club
8 min. walk from Arithmeum

Tuscolo 15

» Cuisine: Italian
» €€
» Gerhard-von-Are-Straße 8,
53111 Bonn
» +49 228 42976605
» Huge and very good pizza.
Special offers for lunch.
» 9 min. walk from University Club
6 min. walk from Arithmeum

Top-of-the-range

Matthieu's 16

» Cuisine: French / International
» €€€
» Argelanderstraße 103, 53115 Bonn
» +49 228 2891229
» reservation recommended

Il Punto 17

» Cuisine: Italian
» €€€€
» Lennéstraße 6, 53113 Bonn
» +49 228 263833
» reservation recommended

Oliveto 18

» Cuisine: Italian
» €€€€
» Adenauerallee 9, 53111 Bonn
» +49 228 2601
» in Hotel Königshof
reservation recommended
great view from the terrace

Strandhaus 19

» Cuisine: German / International
» €€€€
» Georgstraße 28, 53111 Bonn
» +49 228 3694949
» dinner only
reservation required

Bars, Beer Gardens, Breweries

Beer Gardens on the Rhine (outdoors):

Alter Zoll 20

» Many students
» Brassertufer, 53113 Bonn
» +49 228 241243

Bahnhöfchen 21

» Beer garden and restaurant
» Rheinaustr. 116, 53225 Bonn
» +49 228 463436

Rheinlust 22

» Students' pub
» Rheinaustraße 134, 53225 Bonn
» +49 228 467091

Schänzchen 23

» Bavarian food, self-service
» Rosental 105, 53111 Bonn
» +49 228 9636529

Pubs and Bars (indoors)

Bierhaus Machold 24

» German beer
» Heerstraße 52, 53111 Bonn
» +49 228 9637877

Bönnsch 25

» Home-brewed beer
» Typical brewery food, huge plates but expensive
» Sterntorbrücke 4, 53111 Bonn
» +49 228 650610

James Joyce 26

» Irish Pub with irish food, beer, cider
» Mauspfad 6, 53111 Bonn
» +49 228 3695671

Tacos 27

» Cocktail bar with mexican food
» Bonngasse 7, 53111 Bonn
» +49 228 65518

Many bars can also be found in the Altstadt, Südstadt, and Poppelsdorf. Many will show soccer worldcup games. See also the map on page 18.

In particular, there are many bars in and around the following streets:

» Maxstraße (Altstadt) 24
» Ermekeilstraße (Südstadt) 16
» Clemens-August-Straße (Poppelsdorf) C

List of Participants

» **Aardal, Karen**
Delft Institute of Technology

» **Abdi, Ahmad**
University of Waterloo

» **Ahmadian, Sara**
University of Waterloo

» **Ahrens, Markus**
University of Bonn

» **Aissi, Hassene**
Université Paris-Dauphine

» **An, Hyung-Chan**
EPFL, Lausanne

» **Aouida, Lamia**
USTHB, Algiers & LIP6, Paris

» **Apke, Alexander**
Universität zu Köln

» **Arratia Martínez, Nancy Maribel**
Universidad Autónoma de Nuevo León

» **Averkov, Gennadiy**
Universität Magdeburg

» **Ávila Torres, Paulina Alejandra**
Universidad Autónoma de Nuevo León

» **Bader, Jörg**
ETH Zürich

» **Baïou, Mourad**
CNRS (LIMOS)

» **Barahona, Francisco**
IBM Research

» **Bassett, Robert**
UC Davis

» **Bastubbe, Michael**
RWTH Aachen

» **Bhalgat, Anand**
Facebook

» **Bhaskar, Umang**
Caltech

» **Bihler, Tilmann**
University of Bonn

» **Bindewald, Viktor**
TU Dortmund

» **Bock, Adrian**
EPFL, Lausanne

» **Bolzoni, Paolo**
FU Bozen-Bolzano

» **Bonami, Pierre**
IBM

» **Manon, Bondouy**
Airbus & Université Paul Sabatier

» **Boyd, Sylvia**
University of Ottawa

» **Brenner, Ulrich**
University of Bonn

» **Buchanan, Austin**
Texas A&M University

» **Buchheim, Christoph**
TU Dortmund

» **Carvalho, Margarida**
Universidade do Porto & INESC

» **Chandrasekaran, Karthekeyan**
Harvard University

» **Charkhgard, Hadi**
University of Newcastle

» **Christophel, Philipp**
SAS Institute

» **Conforti, Michele**
University of Padova

» **Coniglio, Stefano**
RWTH Aachen

» **Cook, William**
University of Waterloo

» **Cornuéjols, Gérard**
Carnegie Mellon University

» **Cremer, Pascal**
University of Bonn

» **Csehi, Csongor György**
BME, Budapest

» **Ćustić, Ante**
TU Graz

» **D'Ambrosio, Claudia**
LIX, École Polytechnique, Paris

» **Dal Sasso, Veronica**
University of Padova

» **Di Summa, Marco**
University of Padova

» **Dias, Gustavo**
LIX, École Polytechnique, Paris

» **Dreyer, Lukas**
University of Bonn

» **van Ee, Martijn**
Vrije Universiteit Amsterdam

» **Ene, Alina**
Princeton & University of Warwick

» **Espinoza, Daniel**
Universidad de Chile

» **Etscheid, Michael**
University of Bonn

» **Faenza, Yuri**
EPFL, Lausanne

» **Feldmann, Andreas**
University of Waterloo

» **Filipecki, Bartosz**
UCL, Louvain

» **Fischer, Anja**
TU Dortmund

» **Fischer, Frank**
University of Kassel

» **Fischer, Tobias**
TU Darmstadt

» **Frank, András**
Eötvös University, Budapest

» **Friggstad, Zac**
University of Alberta

» **Fujishige, Satoru**
Kyoto University

» **Gester, Michael**
University of Bonn

» **Gijswijt, Dion**
Delft Institute of Technology

» **Göke, Alexander**
University of Bonn

» **Gottschalk, Corinna**
RWTH Aachen

» **Günneç, Dilek**
Özyeğin University, Istanbul

» **Gutman, Yaron**
Tel Aviv

» **Haddadan, Arash**
University of Waterloo

» **Hähnle, Nicolai**
University of Bonn

» **Halász, Veronika**
University of Debrecen

» **Hansknecht, Christoph**
TU Berlin

» **Haupt, Andreas**
University of Bonn

» **Held, Stephan**
University of Bonn

» **Henneke, Fabian**
University of Bonn

» **Hermann, Anna**
University of Bonn

» **Heymann, Britta**
University of Bonn

» **von Heymann, Frederik**
Universität zu Köln

» **Hoeksma, Ruben**
University of Twente

» **Hojny, Christopher**
TU Darmstadt

» **Holm, Eugenia**
University of Konstanz

» **Hoppmann, Nils**
University of Bonn

» **Hougardy, Stefan**
University of Bonn

» **Huang, Chien-Chung**
Chalmers University of Technology

» **Ilyina, Anna**
TU Dortmund

» **Jünger, Michael**
Universität zu Köln

» **Kaibel, Volker**
Universität Magdeburg

» **Kalaitzis, Christos**
EPFL, Lausanne

» **Kale, Sagar**
Dartmouth College

» **Kämmerling, Nicolas**
University of Bonn

» **Kapoor, Reena**
University of Newcastle

» **Karpinski, Marek**
University of Bonn

» **Karrenbauer, Andreas**
MPI, Saarbrücken

» **Kaur, Simranjit**
University of Newcastle

» **Kianfar, Kiavash**
Texas A&M University

» **Kılınç-Karzan, Fatma**
Carnegie Mellon University

» **Kirchner, Sarah**
RWTH Aachen

» **Klewinghaus, Niko**
University of Bonn

» **Könemann, Jochen**
University of Waterloo

» **Köppe, Matthias**
UC Davis

» **Korte, Bernhard**
University of Bonn

» **Kurtz, Jannis**
TU Dortmund

» **Lee, Geun-Cheol**
Konkuk University, Seoul

» **Lee, Jon**
University of Michigan

» **Lips, Madeline**
TU Darmstadt

» **Louveaux, Quentin**
Université de Liège

» **Lübbecke, Marco**
RWTH Aachen

» **Lüthen, Hendrik**
TU Darmstadt

» **Maher, Stephen**
Zuse Institut Berlin

» **Mahjoub, Ali Ridha**
Université Paris-Dauphine

» **Mainka, Roland**
Universität zu Köln

» **Mallach, Sven**
Universität zu Köln

» **Mambelli, Francesco**
Universität zu Köln

» **Marcos Alvarez, Alejandro**
Université de Liège

» **Matuschke, Jannik**
TU Berlin

» **Matzke, Christoph**
University of Bonn

» **McCormick, Tom**
University of British Columbia

» **Megow, Nicole**
TU Berlin

» **Mencarelli, Luca**
LIX, École Polytechnique, Paris

» **Michaelis, Friederike**
University of Bonn

» **Miething, Lukas**
University of Bonn

» **Mnich, Matthias**
University of Bonn

» **Molinaro, Marco**
Georgia Tech

» **Montenegro, Maribel**
TU Dortmund

» **Müller, Dirk**
University of Bonn

» **Muuss, Karsten**
IBM

» **Nagarajan, Viswanath**
IBM Research

» **Narasimhan, Sridharakumar**
IIT Madras

» **Natura, Bento**
University of Bonn

» **Nussbaumer, Jakob**
University of Bonn

» **Ochsendorf, Philipp**
University of Bonn

» **Olver, Neil**
VU University & CWI, Amsterdam

» **Pashkovich, Kanstantsin**
Free University of Brussels

» **Pecin, Diego**
PUC-Rio, Rio de Janeiro

» **Peis, Britta**
RWTH Aachen

» **Peters, Martin**
Springer, Heidelberg

» **Pfetsch, Marc**
TU Darmstadt

» **van Pinxten, Joost**
Technische Universiteit Eindhoven

» **Platz, Alexander**
University of Bonn

» **Poggi, Marcus**
PUC-Rio, Rio de Janeiro

» **Porumbel, Daniel**
Artois University

» **Preuß, Michael**
Universität der Bundeswehr, München

» **Puchert, Christian**
RWTH Aachen

» **Rajaraman, Rajmohan**
Northeastern University

» **von Randow, Rabe**
University of Bonn

» **Richter, Alexander**
TU Berlin

» **Rischke, Roman**
TU Berlin

» **Romen, Daniel**
University of Bonn

» **Rösner, Clemens**
University of Bonn

» **Rothvoß, Thomas**
University of Washington

» **Rotter, Daniel**
University of Bonn

» **Rubinstein, Aviad**
UC Berkeley

» **Salami, Maryam**
IASI-CNR, Rome

» **Salehi Sadaghiani, Farnaz**
Sharif University of Technology, Tehran

» **Sanità, Laura**
University of Waterloo

» **Sarto Basso, Rebecca**
University of Greenwich

» **Schalekamp, Frans**
College of William & Mary

» **Schaudt, Oliver**
Universität zu Köln

» **Scheifele, Rudolf**
University of Bonn

» **Schmand, Daniel**
RWTH Aachen

» **Schmidt, Daniel**
Universität zu Köln

» **Schneider, Jan**
University of Bonn

» **Schorr, Ulrike**
University of Bonn

» **Sebő, András**
CNRS, Grenoble

» **Schroeder, Rasmus**
University of Bonn

» **Seminaroti, Matteo**
CWI, Amsterdam

» **Shadravan, Mohammad**
University of Waterloo

» **Shepherd, Bruce**
McGill University, Montréal

» **Shina, Ron**
Hebrew University of Jerusalem

» **Shioura, Akiyoshi**
Tohoku University

» **Shmoys, David**
Cornell University

» **Sieg, Richard**
Universität Osnabrück

» **Silvanus, Jannik**
University of Bonn

» **Silvestri, Francesco**
Heidelberg University

» **Singh, Mohit**
Microsoft Research

» **Spacey, Simon**
University of Waikato, Hamilton

» **Spirkl, Sophie**
University of Bonn

» **Spisla, Christiane**
Universität zu Köln

» **Stahr, Paul**
University of Bonn

» **Sterin, Andrei**
University of Bonn

» **Swamy, Chaitanya**
University of Waterloo

» **Taktak, Raouia**
LIX, École Polytechnique, Paris

» **Telha, Claudio**
Université Catholique de Louvain

» **Traub, Vera**
University of Bonn

» **Trieu, Long**
TU Dortmund

» **Uetz, Marc**
University of Twente

» **Van Vyve, Mathieu**
University of Louvain

» **Vandaele, Arnaud**
University of Mons

» **Verdugo, Víctor**
Universidad de Chile

» **Verschae, José**
Universidad de Chile

» **de Vries, Sven**
Universität Trier

» **Vu, Khac Ky**
LIX, École Polytechnique, Paris

» **Vygen, Jens**
University of Bonn

» **Walter, Matthias**
Universität Magdeburg

» **Waqas, Umar**
Technische Universiteit Eindhoven

» **Weiß, Christian**
University of Leeds

» **Weiß, Philipp**
University of Bonn

» **Weltge, Stefan**
Universität Magdeburg

» **Wierz, Andreas**
RWTH Aachen

» **Wiese, Andreas**
MPI for Informatics, Saarbrücken

» **Wiese, Sven**
University of Bologna

» **Wissner, Heinz**
Berlin

» **Witt, Jonas**
RWTH Aachen

» **Yıldız, Sercan**
Carnegie Mellon University

» **Zhong, Xianghui**
University of Bonn

» **Zhou, Hong**
Chinese University of Hong Kong

» **Zimmermann, Uwe**
TU Braunschweig

» **van Zuylen, Anke**
College of William & Mary

Sightseeing

Beethoven's birth place

The Beethovenhaus was the birth place of Ludwig van Beethoven and contains the largest private Beethoven collection in the world. In addition to instruments and portraits, original manuscripts can be found there.

» Bonngasse 18-26, 53111 Bonn
» Entrance 6 euros
» Open Mon - Sun 10:00 - 18:00
» www.beethoven-haus-bonn.de

Münster

Since the 13th century, the Bonner Münster is the landmark of the city and a significant example of medieval church architecture of the Rhineland.

» Gerhard-von-Are-Str. 5, 53111 Bonn
» Free Entrance

Rheinufer

The bank of the river Rhine is the ideal place for walking, running, and cycling. You will also find a planet trail in scale 1:1 000 000 000. There are many beer gardens along the river (see page 25).

Museum mile

The Museum mile is a collection of five museums including

» **Haus der Geschichte**
- Museum of the history of post-war Germany
- Willy-Brandt-Allee 14, 53113 Bonn
- Open Tue - Fri 09:00 - 19:00
  Sat - Sun 10:00 - 18:00
- Free entrance
- www.hdg.de

» **Kunstmuseum Bonn** and **Bundeskunsthalle**
- Museum of modern and contemporary art; and exhibition hall
- Friedrich-Ebert-Allee 2 - 4, 53113 Bonn
- the Bundeskunsthalle is open Tue - Sun 10:00 - 19:00, until 21:00 on Tue and Wed
- the Kunstmuseum is open Tue - Sun 11:00 - 18:00 until 21:00 on Wed
- www.kunstmuseum-bonn.de www.bundeskunsthalle.de

Old City Hall

The old city hall of Bonn is located on the market square. In Bonn's era as federal capital, numerous crowned heads and state guests were received here and entered their names in the Golden Book of the City's Guests of Honour.
» Markt 2, 53111 Bonn
» Open Mon - Fri 08:00 - 13:00

Cologne Cathedral

With its 157 meters the "Kölner Dom" is the second largest Gothic church in northern Europe. With an average of around 20000 visitors per day it is Germany's most visited landmark. Cologne can easily be reached by train (around 25 minutes from Bonn central station). Cologne cathedral is located next to Cologne central station.

Brühl Palaces

The baroque Augustusburg and Falkenlust palaces form a historical building complex which has been listed as a UNESCO cultural World Heritage Site since 1984. They are connected by the spacious gardens and trees of the Schlosspark. The Max Ernst Museum is located nearby.

Siebengebirge and Drachenfels

The Siebengebirge ("seven hills" in German) is a range of more than forty hills along the river Rhine. It is a popular tourist destination for hiking because of its natural beauty. The highest peak is the Ölberg with 460 metres. The most famous hill is the Drachenfels ("dragon's rock" in German). Several legends surround the Drachenfels, most famously that Siegfried – the hero of the Nibelungenlied – killed the dragon Fafnir, who lived in a cave in the hill, then bathed in its blood to become (unfortunately only nearly) invulnerable. The Siebengebirge can be seen on our boat trip on Tuesday.

Regierungsviertel

From 1949 to 1991 Bonn was the seat of the German government.
Of course, the former ministry and parliament buildings, the Villa Hammerschmidt, former residence of the German federal president, and the "Langer Eugen", the skyscraper containing UN organizations, are all still there. We will also see them from the boat.

B Basics of German Language

Hello!	Hallo
good morning	guten Morgen
good evening	guten Abend
How are you?	Wie geht es dir? (informal) Wie geht es Ihnen? (formal)
I'm fine	mir geht es gut
yes / no / maybe	ja / nein / vielleicht
What's your name?	Wie heißt du? (informal) Wie heißen Sie? (formal)
my name is ...	ich heiße ...
do you speak English?	Sprichst du Englisch? (informal) Sprechen Sie Englisch? (formal)
thank you / thank you very much	Danke / vielen Dank
you are welcome	gern geschehen
please	bitte
sorry / excuse me	Entschuldigung
1 / 2 / 3 / 4 / 5	eins, zwei, drei, vier, fünf
6 / 7 / 8 / 9 / 10	sechs, sieben, acht, neun, zehn
11 / 12 / 13 / 14 / 15	elf, zwölf, dreizehn, vierzehn, fünfzehn

16 / 17 / 18 / 19 / 20	sechzehn, siebzehn, achtzehn, neunzehn, zwanzig
I / you / he / she	ich / du (informal), Sie (formal) / er / sie
we / you / they	wir / ihr (informal), Sie (formal) / sie
good bye	tschüss! (informal) auf Wiedersehen (formal)
how much is ...?	wie viel kostet ...?
Please bring the bill.	Die Rechnung bitte.
breakfast / lunch / dinner	Frühstück / Mittagessen / Abendessen
I am a vegetarian	ich bin Vegetarier
Cheers!	Prost!
yesterday / today / tomorrow	gestern / heute / morgen
... o'clock am / ... o' clock pm	... Uhr Morgens / ... Uhr Nachmittags
buy / rent / order	kaufen / mieten / bestellen
Does this bus go to ...?	Fährt dieser Bus nach ...?
railway station / airport	Bahnhof / Flughafen
Can you help me?	Kannst du mir helfen? (informal) Können Sie mir helfen? (formal)
Where are you from?	Wo kommst du her? (informal) Wo kommen Sie her? (formal)
Where is ...?	Wo ist ...?
Who is ...?	Wer ist ...?
I'm lost	ich habe mich verlaufen

Important Information

WiFi in the Arithmeum

ssid: arithmeum-gast
password: IPCO2014Bonn

WiFi at the University Club

You can connect using EDUROAM or with the account that you received with a separate leaflet.

Library in the Arithmeum buildung (1st floor)

» Opening hours:
Monday - Friday 09:00 - 17:00
» Contact:
+49 228 738731

Important telephone numbers

Emergency	112
Police	110
Taxi	+49 228 555555

How to tip in Germany

In restaurants and cafés it is common to give around 5 % and round up, depending on quality of food and service. Same for taxis. In self-service restaurants and supermarkets, it is not necessary to tip.

Opening hours of shops

Most shops are open Monday to Saturday from 10am - 8pm. For smaller shops, the opening hours can vary. Supermarkets usually open at 7 or 8am and close at 8 or 10pm.
On Sundays only a very limited number of (touristic) shops are open.

Some shops

» **Galeria Kaufhof**
department store and food
Remigiusstraße 20-24, 53111 Bonn
» **Thalia (**books)
Markt 24, 53111 Bonn
» **Deutsche Post** (post office)
Münsterplatz 17, 53111 Bonn
» **Haribo** (local sweets)
Am Neutor 3, 53113 Bonn

ATMs

Near University Club

» **Santander Bank**
Berliner Freiheit 36, 53111 Bonn
» **Sparkasse Köln/Bonn**
Bertha-von-Suttner-Platz 17,
53111 Bonn
» **Western Union Bank**
Wenzelgasse 35-39, 53111 Bonn

Near Arithmeum

» **Deutsche Bank**
Kaiserplatz 7, 53113 Bonn

Near Münsterplatz or Central Station

» **Postbank**
Münsterplatz 17, 53111 Bonn
» **ReiseBank AG**
Am Hauptbahnhof 1, 53111 Bonn
» **Commerzbank**
Maximilianstraße 12, 53111 Bonn

Time	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Time
08:50				Welcome			08:50
09:00				IPCO Session	IPCO Session	IPCO Session	09:00
09:30		Coffee	Coffee				09:30
10:00		Lecture by András Frank	Lecture by David Shmoys				10:00
10:30				Coffee break	Coffee break	Coffee break	10:30
11:00				IPCO Session	IPCO Session	IPCO Session	11:00
11:30		Lunch break	Lunch break				11:30
12:00							12:00
12:30				Lunch break	Poster Session	Lunch break	12:30
13:00					Lunch break		13:00
13:30		Lecture by Gérard Cornuéjols	Lecture by András Frank				13:30
14:00	Welcome			IPCO Session	IPCO Session	IPCO Session	14:00
14:30	Lecture by Gérard Cornuéjols						14:30
15:00		Coffee break	Coffee break				15:00
15:30		Lecture by Thomas Rothvoß	Lecture by Thomas Rothvoß	Coffee break	Coffee break	Coffee break	15:30
16:00	Coffee break			IPCO Session	IPCO Session	IPCO Session	16:00
16:30	Lecture by David Shmoys						16:30
17:00		Arithmeum Tour			Poster Session		17:00
17:30							17:30
18:00	Arithmeum Tour		Welcome Reception	Arithmeum Tour	Boat Trip with Conf. Dinner		18:00