UNIVERSITÄT SALZBURG

Workshop on Distance Geometry
2nd – 6th July 2012

Programme

Monday 2nd July 2012

12.00, lunch

1.00 pm, group photo

1.30 pm, lecture hall 411

Christian BUCHTA
Salzburg University
Austria

60 minutes

Random polytopes

The talk starts with a classical result by Rényi and Sulanke from the early sixties: Assume that *n* points are chosen independently and uniformly from the interior of a convex polygon with *r* vertices. Then the expected number of vertices of the convex hull is of order log *n* as *n* tends to infinity. Furthermore, it is asymptotically proportional to *r*. Various lines of research from the past fifty years are considered, including
- refinements of the original result,
- extension to dimension three,
- extension to higher dimensions,
- variance,
- higher moments,
- exact distribution.

The emphasis is put on recent results and current developments.

Monday 2nd July 2012

2.30 pm, coffee break

3.00 pm, lecture hall 411

Bettina SEREINIG
Salzburg University
Austria

60 minutes

Poisson polygons

A Poisson polygon is the convex hull of the intersection of a Poisson point process with a fixed convex set. Approximating the convex hull of a uniform sample from the interior of a convex polygon by a Poisson polygon, Groeneboom (1988) derived a limit theorem for the number of vertices of the convex hull. Cabo and Groeneboom (1994) obtained a limit theorem for the area of the convex hull applying the same method. The most intricate part in both papers is the computation of the variance of the random variables associated with the Poisson polygon. Due to the complexity of these computations, the extension of the method to dimensions $d \geq 3$ is out of reach. Therefore simplifying the approach is a main concern.

Tuesday 3rd July 2012

12.00, lunch

1.30 pm, lecture hall 411

Szilárd RÉVÉSZ
Hungarian Academy of Sciences, Budapest /
Kuwait University

60 minutes

A potential theoretic approach to distance geometry

It was proved by O. Gross that for a compact, connected metric space X there exists a unique number $r = r(X)$ - the *rendezvous number* of X - such that for every (finite) system of points there exists some further point, to which the average distance of the selected points is exactly the given number r. Rendezvous numbers have been generalized in many directions, including rendezvous numbers of unit spheres in Banach spaces. We investigate rendezvous numbers involving general potential theoretic quantities like *energy, Chebyshev constant, transfinite diameter*.
We further analyze notions which have already gained recognition in the field of distance geometry, such as *invariant measures* and *maximal energy* (Björck, Wolf), in the framework of abstract potential theory. It turns out that general potential theoretical principles such as existence of *capacitary measures* or *Frostman's equilibrium theorem* are accounted for the existence of invariant measures. Several results of distance geometry can be obtained, and sometimes even sharpened, in the context of abstract potential spaces (X, k). An interesting example of interest is the notion of *hypermetric spaces*, which is very closely connected, in the potential theoretic setting, to *positive definiteness* of the kernel function k on X.

Tuesday 3rd July 2012

2.30 pm, coffee break

3.00 pm, lecture hall 411

Aicke HINRICHS
Friedrich-Schiller-University, Jena
Germany

60 minutes

Johnson-Lindenstrauss Embeddings - Efficient Computation and Applications

The Johnson-Lindenstrauss lemma is a central result about the embedding of large finite point sets in a high-dimensional Euclidean space into a low-dimensional Euclidean space with almost unchanged distances of all pairs of points. The corresponding embeddings have applications in such diverse areas as compressed sensing, dimensionality reduction, graph embedding and data storage. We will review some of these applications and comment on recent work about efficient computation of Johnson-Lindenstrauss embeddings. The talk is partly based on joint work with Jan Vybiral.

Wednesday 4th July 2012

leisure time

A sightseeing tour in Salzburg or its surroundings will be arranged.

Detailed information will be given during the first days of the workshop.

We look forward to welcoming you to Salzburg
and hope you have a fruitful time at the workshop.

Thursday 5th July 2012

12.00, lunch

1.30 pm, lecture hall 411

Reinhard WOLF
Salzburg University
Austria

60 minutes

A norm-inequality related to affine regular hexagons

Let $(E, \|.\|)$ be a two-dimensional real normed space with unit sphere $S = \{x \in E, \|x\| = 1\}$. We discuss the following result:

Consider an affine regular hexagon with vertex set

$$H = \{\pm v_1, \pm v_2, \pm v_3\} \subseteq S$$

inscribed to *S*. Then we have

$$\min_i \max_{x \in S} \|x - v_i\| + \|x + v_i\| \leq 3.$$

From this result we obtain

$$\min_{y \in S} \max_{x \in S} \|x - y\| + \|x + y\| \leq 3,$$

and equality if and only if *S* is a parallelogram or an affine regular hexagon.

Thursday 5th July 2012

2.30 pm, coffee break

3.00 pm, lecture hall 411

Open problem session

- discussions
- remarks
- open questions
- conjectures
- …

Friday 6th July 2012

12.00, lunch

1.30 pm, lecture hall 411

Ian DOUST
University of New South Wales, Sydney
Australia

60 minutes

Metric trees of generalized roundness one

Every finite metric tree has generalized roundness strictly greater than one. On the other hand, some countable metric trees have generalized roundness precisely one. In this talk we discuss some large classes of countable metric trees that have generalized roundness precisely one. At the outset we consider spherically symmetric trees endowed with the usual combinatorial metric (SSTs). Using a simple geometric argument we show how to determine decent upper bounds on the generalized roundness of finite SSTs that depend only on the 'downward degree sequence' of the tree in question. Our discussion will include are all complete n-ary trees of depth ω ($n \geq 2$), all k-regular trees ($k \geq 3$) and inductive limits of Cantor trees. The second part of the talk we shall deal with two classes of countable metric trees of generalized roundness one whose members are not, in general, spherically symmetric. The first such class of trees are merely required to spread out at a sufficient rate (with a restriction on the number of leaves). The second such class of trees resemble infinite combs.
This is joint work with Elena Caffarelli (Rutgers) and Anthony Weston (Canisius College).

Friday 6th July 2012

2.30 pm, coffee break

3.00 pm, lecture hall 411

Stephen SÁNCHEZ
University of New South Wales, Sydney
Australia

60 minutes

Supremal p-negative type qualities of finite metric spaces

We study the supremal p-negative type of finite metric spaces. We show how recent work by Wolf and Li and Weston can be used together to (theoretically) calculate the supremal *p*-negative type of any finite metric space, and detail some simple results that follow. A formula for the supremal 1-negative type gap of additively combined metric spaces will be discussed, which can be seen a generalization of the recent work on finite metric trees by Doust and Weston.

7.00 pm, joint dinner

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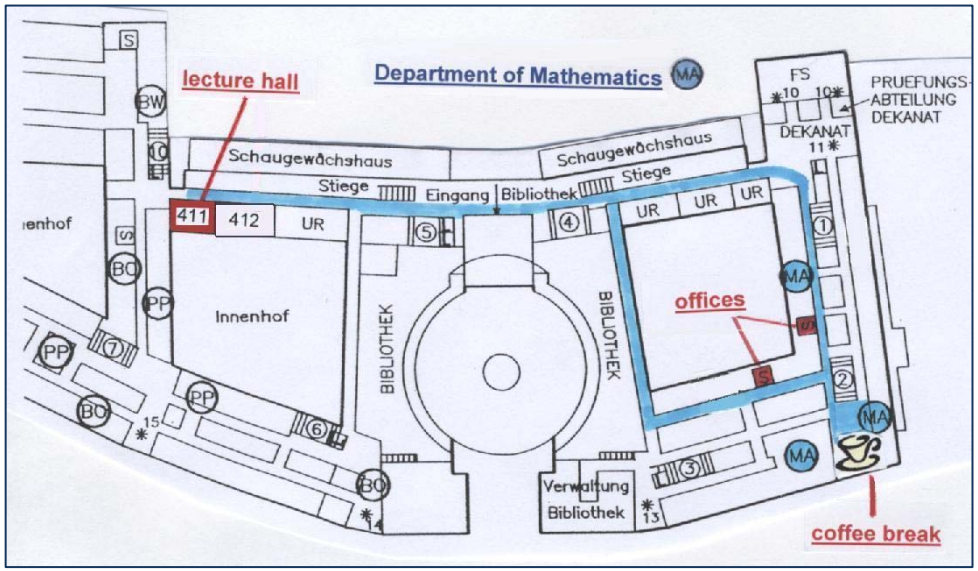

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