**Discrete & Computational Geometry Day***
**Thursday, July 11, 2019**
**Ben-Gurion University, Building 37, Room 201**

We are happy to invite you to a day of talks in Discrete and Computational Geometry, revolving around four distinguished researchers from India and Canada, who will be visiting BGU and the Technion between July 9 and July 18.

For additional details please contact: Matya Katz (matya@cs.bgu.ac.il) or Paz Carmi (carmip@gmail.com)

**10:00-10:15 Gathering**

**10:15-10:55 Subhas Nandy**, Indian Statistical Institute, Kolkata, India
Color spanning Localized query
**Abstract**: Let P be a set of n points and each of the points is colored with one of the k possible colors. We present efficient algorithms to pre-process P such that for a given query point q, we can quickly identify the smallest color spanning object of the desired type containing q. In this talk, we focus on (i) interval, (ii) axis-parallel square, (iii) axis-parallel rectangle, (iv) equilateral triangle of fixed orientation and (v) circle, as our desired type of objects.
For problems with object type (i) - (iv), we propose optimal algorithms, and for the problem with object type (v), we propose a (1+epsilon)-factor approximation algorithm.

**11:00-11:40 Paz Carmi**, Ben-Gurion University
Stabbing Pairwise Intersecting Disks by Four Points
**Abstract**: Following the seminal works of Danzer (1956, 1986) and Stachó (1965,1981), and the recent result of Har-Peled et al. (2018), in this talk we consider the problem of stabbing disks by points. We prove that any set of pairwise intersecting disks in the plane can be stabbed by four points. Our proof is constructive and yields a simple linear-time algorithm for finding the points.

**11:40-12:00 Coffee**

**12:00-12:40 Minati De**, Indian Institute of Technology, Delhi, India
Approximation Schemes for Geometric Coverage Problems
**Abstract**: Mustafa and Ray [DCG 10] showed that a wide class of geometric set cover (SC) problems admit a PTAS via local search – this is one of the most general approaches known for such problems. Their result applies if a naturally defined "exchange graph" for two feasible solutions is planar and is based on subdividing this graph via a planar separator theorem due to Frederickson [SIAM J. Comput. 87]. Obtaining similar results for the related maximum coverage problem (MC) seems non-trivial due to the hard cardinality constraint.
In this talk, we provide a way to address the above-mentioned issue. First, we propose a color-balanced version of the planar separator theorem. The resulting subdivision approximates locally in each part the global distribution of the colors. Second, we show how this roughly balanced subdivision can be employed in a more careful analysis to strictly obey the hard cardinality constraint. More specifically, we obtain a PTAS for any "planarizable" instance of MC and thus

essentially for all cases where the corresponding SC instance can be tackled via the approach of Mustafa and Ray.
This is based on a joint work with Steven Chaplick, Alexander Ravsky, and Joachim Spoerhase.

**12:40-14:00 Lunch**

**14:00-14:40 Gill Barequet**, Technion – Israel Institute of Technology
Polycubes with Small Perimeter Defect
**Abstract**: A polycube is a face-connected set of cubical cells on $\mathbb{Z}^3$. To-date, no formulae enumerating polycubes by volume (number of cubes) or perimeter (number of empty cubes neighboring the polycube) are known. We present a few formulae enumerating polycubes with a fixed deviation from the maximum possible perimeter, and prove the general form of these formulae.
Joint work with Andrei Asinowski (Vienna University of Technology, now at Univ. of Klagenfurt) and Yufei Zheng (Technion, now at Princeton).

**14:40-15:00 Coffee**

**15:00-15:40 Aritra Banik**, National Institute of Science Education and Research, India
Tracking Paths
**Abstract**: Consider a secure environment (say an airport) that has a unique entry and a unique exit point with multiple inter-crossing paths between them. We want to place (minimum number of) trackers (or checkpoints) at some specific intersections so that based on the sequence of trackers a person has encountered, we can identify the exact path traversed by the person. Motivated by such applications, recently Banik et al. have considered the Tracking Paths problem which can be defined as follows. Given an undirected graph with a source s, a destination t, and a non-negative integer k, the goal is to find a set of at most k vertices, a tracking set, that intersects each s-t path in a unique sequence. Such a set enables a central controller to track all the paths from s to t. In this talk, we will discuss the known results about the problem and some related open problems.

**15:45-16:25 Anil Maheshwari**, Carleton University, Canada
Scheduling trains in a geometric network
**Abstract:** A (d-dimensional) train line consists of a track, which is a line segment in d-dimensions, with distinct endpoints distinguished between a departure point and an arrival point, of a car length and of a velocity, which are positive real numbers. A set of train lines with non-overlapping tracks is called a train network. A (collision-free) schedule for a train network is an assignment of a departure time, which is a non-negative real number, to each of its lines with the property that every pair of cars (on lines whose tracks cross) do not collide. The optimization problem is to find a collision-free schedule so that the maximum departure time is minimized. We will discuss some special cases of this problem and provide some visually entertaining simulations.

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