THE WEIZMANN INSTITUTE OF SCIENCE
FACULTY OF MATHEMATICS AND COMPUTER SCIENCE

Foundations of Computer Science Seminar

Room 290C, Ziskind Building
on Monday, Dec 05, 2016
at 14:30

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Grassmann Graphs, Vertex Cover and 2-to-2 games

Abstract:

We discuss recent progress on hardness of 2-to-2 games, with applications to the inapproximability
of the Vertex-Cover problem.

A 2-to-2 game (which is a variant of Khot's well known unique games), is defined by a graph where
there is a variable in each node, and a constraint of a specific structure defined on each edge. While
in unique games each edge constraint must be a one-to-one correspondence -- i.e. for each
assignment to one node there is exactly one assignment to the other node that satisfies the constraint
-- in 2-to-2 games the correspondence has a "two-to-two" structure.

The goal is to distinguish between instances in which almost all of the edge constraints can be satisfied,
and instances in which almost none of them can be satisfied simultaneously.

We present a new combinatorial hypothesis regarding Grassmann graphs, and show that it implies
that 2-to-2 games are NP-hard *in a certain sense*. As a consequence, the hypothesis implies that it is
NP-hard to distinguish between graphs that have an independent set of fractional size (1-1/sqrt{2}),
and graphs with no independent sets of any constant fractional size. This easily implies that it is NP-hard to approximate the Vertex Cover problem within a factor \sqrt{2} - o(1).

The talk is mostly based on a joint work with Subhash Khot and Muli Safra, nevertheless, we will also
mention results from a more recent extension, which is a joint work with Irit Dinur, Subhash Khot,
Guy Kindler and Muli Safra.