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## Low discrepancy colorings and semidefinite programming (7.5 hours)

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Discrepancy theory deals with the following type of question. Given a set-system, find a red-blue coloring of the elements such that each set is colored as evenly as possible. Perhaps surprisingly, this notion has a wide variety of applications both in computer science and mathematics, and several techniques (many of them non-constructive) have been developed to understand the discrepancy of various set-systems.

Recently, there have been several new developments in discrepancy based on connections to semidefinite programming. This connection is useful in various ways. It gives efficient polynomial time algorithms for several problems for which only non-constructive results were previously known. It also leads to several new structural results, such as tightness of the so-called determinant lower bound, and bounds on the discrepancy of union of set systems. In these lectures, we will study these results in detail and visit various concepts such as correlated brownian motion, non-constructive entropy method, gaussian roundings, sdp duality, Cauchy-Binet formula and so on. Time permitting, we will also see some surprising applications of discrepancy.

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