2022 Workshop on Algebraic Combinatorics
Institute of Mathematics, Academia Sinica, Taipei, Taiwan
Jan. 24-26, 2022

Semidefinite programming bounds for equiangular lines and binary codes

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Abstract

The three-points semidefinite programming(SDP) method has been successfully applied on estimating the upper bounds for equiangular lines. We generalize it to the four-points semidefinite programming method and solve the optimization problems symbolically, then we improve the upper bounds on the cardinality of equiangular lines in $\mathbb{R}^n$ for infinitely many dimensions n with described angles. This part is the joint work with Wei-Jiun Kao. Additionally, Schrijver used SDP to improve the upper bound of the $A(n,d)$ problem which is the maximum size of binary codes with length n and minimum distance d. We use the splitting Terwilliger algebra to derive the semidefinite programming bounds improving the bounds of $A(n,d)$. In particular, we show that $A(18,4) \leq 6537$, and $A(19,4) \leq 12804$, $A(20,4) \leq 25608$. This part is the joint work with Pin-Chieh Tseng and Chin-Yi Lai.