Locating arrays, disjoint spread systems, and error correction

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(joint work with Masakazu Jimbo, Chubu University)

Let A be an $N \times k$ s-ary array, that is an array A with N rows, k columns, and s symbols chosen from an alphabet S. A *t-way interaction* in A is a choice of a set K of t columns, and $\sigma_\ell \in S$ for $\ell \in K$, represented by $T = \{(\ell, \sigma_\ell) \mid \ell \in K\}$. For each array $A = (a_{ij})$ and any interaction T, let $\rho_A(T)$ be the number of rows of A in which the interaction T is covered, namely $\rho_A(T) = \{r \mid a_{r\ell} = \sigma_\ell \text{ for each } \ell \in K\}$. Let $\mathcal{T}_1$ and $\mathcal{T}_2$ be two sets, each consisting of d t-way interactions, and $\bigcup_{T\in\mathcal{T}_1} \rho_A(T) = \bigcup_{T\in\mathcal{T}_2} \rho_A(T)$ if and only if $\mathcal{T}_1 = \mathcal{T}_2$. Then A is called a *(d,t)-locating array.* An locating array is used for designs of experiments for identifying interaction faults in a component-based system.

In this talk, I will focus on $(1,1)$-locating array, and study the cases when error-correction is taken in mind. In terms of combinatorics, a $(1,1)$-locating array is equivalent to a disjoint spread system, that is a set system consisting of partitions of a finite set, in which no two subsets coincide. When an error is tolerated, a similar consideration to error-correcting codes is required. This talk also involves an approach related to codes for 1-error-correcting $(1,1)$-locating arrays.

References

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[2] C. J. Colbourn and D. W. McClary. Locating and detecting arrays for interaction faults. *Journal of Combinatorial Optimization*, 15(1):17–48, 2008.

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