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Generalized Heffter arrays and near alternating sign matrices

In this talk, we present a generalization of Heffter arrays [1] by allowing that:

- the number of nonzero entries in each row (resp. column) of the array be not constant, and
- the entries of the array, *in absolute value*, belong to an arbitrarily chosen subset S of a group G , not necessarily abelian.

We show that *generalized Heffter arrays* (GHA) can be used to construct orthogonal path or cycle decompositions and biembeddings of Cayley graphs onto orientable surfaces. The structural properties of the latter depend on the sum of the entries in each row and column of the GHA (with respect to a given ordering). Preferable are those satisfying the further strong property of being *simple*: for each row and each column, the partial sums (of the non-zero entries) are pairwise distinct, and only the total sum is possibly zero. We show that simple GHAs over cyclic groups can be easily built by means of *near alternating sign matrices* [2]. Further results and future works will be discussed.

This is joint work with Lorenzo Mella.

References

- [1] L. Mella and T. Traetta. *Constructing generalized Heffter arrays via near alternating sign matrices*, submitted.
[2] R.A. Brualdi and H.K. Kim. *A Generalization of Alternating Sign Matrices*, J. Combin. Des. 23 (2015), 204-215.