Generation of Association Schemes

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Abstract

We are interested in the exhaustive generation (up to isomorphism) by computer of all association schemes [1] (strongly regular graphs, distance regular graphs, ...) with a given parameter set. The generation algorithms require a recursive traversal of a tree-like search space. We use various pruning methods and heuristics to limit the size of the search space. The developed pruning techniques use criteria that exploit the inherent symmetries and the mathematical properties of the objects.

On the one hand we try to design, improve and study such generation algorithms in general, but on the other hand we also apply these algorithms to specific parameter sets, hoping to obtain new mathematical results [2, 3, 4, 5] in combinatorial theory.

References

[1] COLBOURN CH. J., DINITZ J.H., *The CRC handbook of combinatorial designs, CRC Press*, 229-233, 1996.

[2] COOLSAET K., DEGRAER J., *A computer assisted proof of the uniqueness of the Perkel graph*, Designs, Codes and Cryptography, Vol 34, No. 2-3, pp. 155-171, 2005.

[3] COOLSAET K., DEGRAER J., SPENCE E., *The Strongly Regular (45,12,3,3) Graphs*, submitted to The Electronic Journal of Combinatorics 2005.

[4] DEGRAER J., COOLSAET K., *Classification of three-class association schemes using dynamic variable ordering*, Discrete Mathematics, Vol 300, No. 1-3, pp. 71-81, 2005. 2004.

[5] DEGRAER J., COOLSAET K., *Classification of some strongly regular subgraphs of the McLaughlin graph*, to appear in Discrete Mathematics.