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Generalized packing designs

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Generalized t -designs, which form a common generalization of objects such as t -designs, resolvable designs and orthogonal arrays, were defined by Cameron [P.J. Cameron, A generalisation of t -designs, *Discrete Math.* **309** (2009), 4835--4842]. In this paper, we define a related class of combinatorial designs which simultaneously generalize packing designs and packing arrays. We describe the sometimes surprising connections which these generalized designs have with various known classes of combinatorial designs, including Howell designs, partial Latin squares and several classes of triple systems, and also concepts such as resolvability and block colouring of ordinary designs and packings, and orthogonal resolutions and colourings. Moreover, we derive bounds on the size of a generalized packing design and construct optimal generalized packings in certain cases. In particular, we provide methods for constructing maximum generalized packings with $t=2$ and block size $k=3$ or 4.

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