# Construction techniques for incidence structures

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**Abstract**

A *balanced incomplete block design* (BIBD) [1] is a pair $(V, B)$ where $V$ is a $v$-set and $B$ is a collection of $b$ $k$-subsets of $V$ (blocks) such that each element of $V$ is contained in exactly $r$ blocks and any 2-subset of $V$ is contained in exactly $\lambda$ blocks.

The *partial geometry* with parameters $PG(s, t, \alpha)$ is defined as a set $S = (P, B, I)$ with points $P$ and lines $B$ disjoint (nonempty) sets of objects, and $I$ is a symmetric point-line incidence relation $I \subseteq (P \times B) \cup (B \times P)$. Each point (line) is incident with $1 + t$ $(1 + s)$ lines and two different points (lines) are incident with at most one line (point). If $x$ is a point not incident with line $L$, then exactly $\alpha$ $(\alpha \geq 1)$ points $y_1, y_2, \ldots, y_\alpha$ and $\alpha$ lines $M_1, M_2, \ldots, M_\alpha$ exist such that $xIM_i$, $M_iIy_i$, $y_iIL$ $(\forall i : 1 \leq i \leq \alpha)$

We combine a standard orderly algorithm with techniques from the field of Constraint Satisfaction Problems (CSP).

We present some results, for instance we found that there is no $PG(6, 6, 4)$ when assuming an automorphism of order 3 with 7 fixed points and 7 fixed blocks. When assuming a fixed automorphism, an orbit matrix generation phase which precedes the actual incidence structure generation phase is used.

## References

[1] Colbourn C. and Dinitz J. eds., *The CRC Handbook of Combinatorial Designs*, Boca Raton, FL., CRC Press **7** (1996), pp. 3-41.