

On the Existence of Simple BIBDs with Number of Elements a Prime Power

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摘 要：

Let V be a finite set of symbols, and suppose B is a collection of subsets of V . Then (V, B) is called a *BIBD* (balanced incomplete block design) if there are parameters r , k , and λ with the following properties:

- (1) every *block* in B has exactly k symbols;
- (2) every symbol appears in exactly r blocks;
- (3) every pair of distinct symbols appears in exactly λ blocks.

A design without repeated blocks is called *simple*.

We show that, when the number of elements is a prime power q , in many situations the necessary conditions

- (1) $\lambda(q-1) \equiv 0 \pmod{k-1}$,
- (2) $\lambda q(q-1) \equiv 0 \pmod{k(k-1)}$, and

$$(3) \lambda \leq \binom{q-2}{k-2}$$

are also sufficient for the existence of a (q, k, λ) simple BIBD.