## General supplementary difference sets (GSDS): A key to the construction of (near)-Hadamard designs.

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## Abstract

We propose a new and unified construction method, namely general supplementary difference sets (GSDS), for near-Hadamard designs when the run sizes are  $n \equiv 2 \pmod{4}$ . These designs possess high *D*-efficiencies. Ehlich (1964) derived an upper bound for the determinant of matrices of order  $n \equiv 2 \pmod{4}$  achievable only if 2n - 2 is a sum of two squares. Even in a small range from 1 to 100, there are 6 parameters, 22; 34; 58; 70; 78 and 94, that do not fulfill this condition. We construct these designs for many values of n and formulate a new class of near-Hadamard designs whose determinants are very close to Ehlich's upper bound.