Abstracts of Australasian PhD theses

Concerning the existence and

construction of orthogonal designs

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This thesis is concerned with the existence problem for orthogonal designs, amicable orthogonal designs, and product designs.

In order to give a basis for attacking the existence problem of orthogonal designs, the problem is solved completely for the case of orthogonal designs of order 16 . The ideas developed here are extended to prove that there is no orthogonal design of order n , $n > 40$, and type $(1, 1, 1, 1, 1, n-5)$.

Some properties of amicable orthogonal designs are investigated, especially from the point of view of non-existence. We prove, for example, that there are no amicable orthogonal designs of order $n \equiv 0 \pmod 8$ and types $\big((1); (1, a, n-a-1)\big)$, $a = 2, 3, 4$, or 5 .

Product designs are defined and various properties of these designs are given. It is shown how these designs may be combined with amicable orthogonal designs to produce new orthogonal designs. Examples are given of how these designs may be used to produce orthogonal designs of orders $32, 64$, and 128 . An orthogonal design of order 2^t and type $\big(1, 1, 1, 1, 2, 2, 4, 4, \ldots, 2^{t-2}, 2^{t-2}\big)$ is constructed. This design often meets the Radon bound for the number of variables.

Some properties of Turyn sequences are investigated, and it is shown how these sequences may be used to construct orthogonal designs.