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Enumeration of all simple t-$(t+7,t+1,2)$ designs. (English. English summary)

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A t-(v,k,λ) design is a family of k-subsets, called blocks, of a v-set of points such that each t-subset of points is contained in exactly λ blocks. This paper reports on a computer enumeration of certain t-$(t+7,t+1,\lambda)$ designs with $t \le 5$. Such designs with $\lambda = 1$ are called Witt designs, and have been well studied in the literature. Also, any such design with $\lambda \ge 4$ is the complement of one with $\lambda \le 3$, and consequently only those designs with $\lambda \le 3$ are studied. The 1-$(8,2,\lambda)$ designs are the regular graphs of valency λ on 8 points. The designs with $t \ge 2$ were enumerated as consecutive 1-point extensions of these 1-designs using "natural algorithms". The designs with $\lambda = 1$, $t \le 5$, and their uniqueness, were discussed by T. Beth, D. Jungnickel and H. Lenz [Design theory, Cambridge Univ. Press, Cambridge, 1986; MR 88b:05021], those with $\lambda = t = 2$ were enumerated by P. B. Gibbons ["Computing techniques for the construction and analysis of block designs", Ph.D. Thesis, Univ. Toronto, Toronto, ON, 1976], and those with $\lambda = 3$, $t = 2$, by J. J. Harms, C. J. Colbourn and A. V. Ivanov [Congr. Numer. 57 (1987), 147–170; MR 88c:05024]. Also, the existence of designs with all allowable parameters was known from work of A. E. Brouwer ["The t-designs with $v < 18$", 76/77, Stichting Math. Centrum, Centrum Wisk. Inform., Amsterdam, 1977; per bibl.]. The author's enumeration shows that, for $\lambda = 2$, there are 27, 1, and 1 designs for $t = 3$, 4, and 5, respectively. For $\lambda = 3$, $t \ge 3$, all designs with an automorphism of order 3 not fixing any block were found.

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