A ROOM DESIGN OF ORDER 10

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(received January 16, 1964)

A Room design of order $2n$, where n is a positive integer, is an arrangement of $2n$ objects in a square of side $2n - 1$, so that each of the $(2n - 1)^2$ cells of the array is either empty or contains just two distinct objects; each of the $2n$ objects occurs just once in each row and in each column; and each (unordered) pair of objects occurs in just one cell.

It is known that Room designs of orders 4 and 6 do not exist [4], but that Room designs of orders 2.4^m $(m = 0, 1, \ldots)$ do exist [2], [3, p. 88]. Hence the question has been raised [3, p. 88] as to whether a Room design of order 10 exists.

The accompanying figure answers this question in the affirmative. It is, moreover, a cyclic Room design [1]: the entries in the $(i + 1)$th row are obtained by moving the entries in the ith row one column to the right, the last one being placed in the first column, and increasing the entries in each occupied cell by 1 (mod 9), except that the digit 9 remains unaltered. The figure is thus determined by the first row.

09		57		16	34		28	
	19		68		27	45		30
41		29		70		38	56	
	52		39		81		40	67
78		63		49		02		51
62	80		74		59		13	
	73	01		85		69		24
35		84	12		06		79	
	46		05	23		17		89

Canad. Math. Bull. vol. 7, no. 3, July 1964.

REFERENCES

1. J. W. Archbold, A Combinatorial Problem of T. G. Room, Mathematika 7, 50-55 (1960).

2. J. W. Archbold and N. L. Johnson, A Construction for Room's Squares and an Application in Experimental Design, Annals of Mathematical Statistics 29, 219-225 (1959).

3. R. H. Bruck, What is a Loop? Studies in Modern Algebra, A. A. Albert (editor), Prentice-Hall (1963).

4. T. G. Room, A New Type of Magic Square, Mathematical Gazette 39, 307 (1955).

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