

Supplementary Material for “Constructing near-Hadamard designs with (almost) D -optimality by General Supplementary Difference Sets”

Yuan-Lung Lin and Frederick Kin Hing Phoa

Institute of Statistical Science, Academia Sinica, Taiwan, R.O.C.

This supplementary material provides a catalog of near-Hadamard designs. Table 1 lists the base blocks of GSDSs for constructing near-Hadamard designs when $N = 4t + 2$. The first and second columns are the N and t of the designs. The third column indicates the type of the near-Hadamard design and the classification is referred to Theorem 2 in the main paper. The fourth column lists the GSDS base blocks and the last column is the D -efficiencies of the designs. The designs with (*) are conjectured to be D -optimal. Although near-Hadamard designs cover cases in which Ehlich’s upper bound is not achievable, an exception is $N = 58$. In this case neither a near-Hadamard design of Type I exists by exhaustive search nor that of Type II because of an even t . Thus, a near-Hadamard design of Type G of order 58 is listed in Table 1. However, a design of order 58 is listed on the website (<http://www.indiana.edu/~maxdet>) with a larger determinant than that of a near-Hadamard design of Type G . On the other hand, we have confirmed that its determinant is less than the determinant value of a Type I design of order 58.

Institute of Statistical Science, Academia Sinica, Taiwan, R.O.C.

E-mail: gaussla@stat.sinica.edu.tw

E-mail: fredphoa@stat.sinica.edu.tw

Table 1: Base Blocks of GSDSs for Constructing near-Hadamard designs.

N	t	Type	GSDS	D -efficiency
6	1	I	$\{1\}$ $\{1\}$	92.83
10	2	I	$\{1,3\}$ $\{1,2\}$	97.67
14	3	G	$\{1,2,4\}$ $\{1,2,3\}$	97.79
18	4	I	$\{1,2,4,6\}$ $\{1,2,3,5\}$	99.34
22(*)	5	I	$\{1,2,4,6,8\}$ $\{1,2,3,4,7\}$	99.56
26	6	G	$\{1,2,3,5,8,9\}$ $\{1,2,3,4,6,9\}$	99.10
30	7	G	$\{1,2,3,5,8,10,11\}$ $\{1,2,3,4,5,7,11\}$	98.89
34(*)	8	I	$\{1,2,3,5,6,9,10,12\}$ $\{1,3,7,9,11,12,13,14\}$	99.82
38	9	G	$\{1,2,3,5,7,9,10,14,15\}$ $\{1,2,3,4,5,6,9,12,15\}$	99.16
42	10	I	$\{1,3,5,8,9,10,11,12,15,17\}$ $\{1,5,8,9,10,11,12,15,17,20\}$	99.88
46	11	G	$\{1,2,4,6,9,10,11,12,13,16,22\}$ $\{1,3,4,5,6,9,10,12,13,18,21\}$	99.36
50	12	G	$\{1,3,6,8,10,11,12,13,14,18,21,24\}$ $\{1,4,5,6,9,10,11,12,13,18,20,24\}$	99.62
54	13	I	$\{1,4,6,11,12,13,14,15,17,20,22,23,26\}$ $\{1,5,6,8,10,12,13,14,16,17,18,20,26\}$	99.93
58	14	G	$\{1,2,3,4,5,10,13,15,18,19,22,23,24,25\}$ $\{1,3,4,8,10,12,13,14,15,16,18,20,25,28\}$	99.50
62	15	G	$\{1,2,4,6,7,11,13,14,15,16,17,19,23,24,30\}$ $\{1,2,4,5,7,8,9,12,13,14,16,18,23,26,28\}$	99.38
66	16	G	$\{1,2,3,4,5,8,10,14,15,16,17,18,22,24,27,32\}$ $\{1,2,3,4,5,8,9,12,15,17,20,24,26,28,29,30\}$	99.43
70(*)	17	I	$\{1,2,3,4,7,9,11,15,16,17,20,23,25,26,31,32,33\}$ $\{1,3,5,7,15,16,17,18,20,21,23,24,27,28,30,31,32\}$	99.50
74	18	G	$\{1,2,3,4,6,7,9,10,15,17,18,19,22,26,27,29,32,36\}$ $\{1,2,3,4,6,8,10,12,13,16,17,18,19,23,24,28,31,36\}$	99.50
78(*)	19	II	$\{1,2,3,5,9,12,13,16,18,19,21,22,23,24,26,27,31,32,34\}$ $\{1,5,6,7,9,11,12,13,15,18,19,21,23,30,32,33,34,35,37,38\}$	99.91
82	20	G	$\{1,2,3,4,6,8,10,13,14,17,18,19,20,21,26,27,30,35,38,40\}$ $\{1,2,3,4,5,8,11,14,15,19,20,21,26,29,31,33,34,35,38,40\}$	99.73
86	21	G	$\{1,2,6,7,8,9,11,12,14,17,18,21,25,28,30,33,34,35,36,40,42\}$ $\{1,2,7,10,11,12,13,14,18,20,22,24,25,27,28,29,30,31,32,35,40\}$	99.69
90	22	G	$\{1,2,3,4,6,7,10,11,13,16,21,22,23,26,31,33,34,37,38,40,42,44\}$ $\{1,2,3,4,6,7,8,12,14,16,19,20,21,22,23,25,28,30,33,37,38,44\}$	99.61
94(*)	23	II	$\{1,2,3,6,10,11,12,16,18,19,21,22,23,24,25,28,30,32,33,35,36,38,39\}$ $\{1,3,4,6,7,10,11,12,14,19,22,24,26,28,30,31,32,34,35,36,37,38,42,43\}$	99.93
98	24	G	$\{1,2,3,4,7,8,12,13,15,17,18,20,21,23,24,25,27,28,30,33,34,36,41,48\}$ $\{1,2,3,4,6,7,8,12,14,15,19,23,24,25,26,29,33,34,36,38,40,42,43,48\}$	99.60