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A Catalogue of Neighbor Balanced Designs in Circular Blocks of Size 4

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Abstract

Neighbor balanced designs ensure that treatments comparisons will not be much affected by neighbor effects, therefore, these designs are more useful to remove the neighbor effects in experiments where the performance of a treatment is affected by the treatments applied to its adjacent plots. In this article, a catalogue of neighbor balanced designs is presented in circular blocks of size 4 for $4 \leq v \leq 100$.

Keywords: Binary blocks, circular blocks, neighbor effects, neighbor designs.

1. Introduction

Experiments in agriculture, horticulture and forestry often show neighbor effects. In such experiments neighbor balanced designs are useful to remove the neighbor effects. A design is neighbor balanced when each pair of distinct treatments appears as neighbors equally often. Rees (1967) introduced neighbor designs in serology and constructed these designs for v odd. Then Lawless (1971), Hwang (1973), Azais *et al.* (1993), Ahmed and Akhtar (2008) and Iqbal *et al*. (2009) constructed these designs for several cases. Iqbal *et al*. (2006) constructed several second order neighbor designs using cyclic shifts. Akhtar and Ahmed (2009) presented some new second and higher order neighbor designs in circular binary blocks. Ai *et al.* (2007) constructed all order neighbor balanced designs for v prime or prime power with $k \leq v$. Ahmed and Akhtar (2009) constructed all order neighbor balanced designs in circular blocks using cyclic shifts.

Neighbor designs for all v in linear blocks of size 3 are constructed by Jacroux (1998). Akhtar *et al.* (2010) presented a catalogue of neighbor designs in circular blocks of size five. Ahmed and Akhtar (2011) constructed neighbor designs in circular blocks of size six. In this article, neighbor designs are presented in circular blocks of size four for

$4 \leq v \leq 100$. This catalogue will be useful for an experimenter to choose the required design. In this list, the inclusion of some existing designs is also possible.

In this article, neighbor balanced designs are constructed in circular blocks of size four using cyclic shifts. Construction method is briefly described here, for further detail see Iqbal *et al*. (2009).

Rule I: Let $\underline{S} = [q_1, q_2, \ldots, q_{k-1}]$ be a set of shifts where $1 \leq q_i \leq v\text{-}1$, then initial block of design will be $(0, q_1, q_1+q_2, \ldots, (q_1+q_2+\ldots+q_{k-1}))$ mod v. A design is neighbor balanced if a new set of shifts contains all of 1, 2, … , v-1 an equal number of times (λ), where new set of shifts consist of (i) each shift of $\underline{S}$ along with its complement and (ii) sum of the shifts mod v along with its complement. In this rule complement of q_i is $v\text{-}q_i$ and for binary design, the sum of any two, three, …, (k-1) successive numbers of set of shifts is not zero mod v. A design is generalized neighbor design if a new set of shifts contains (i) all of 1, 2, … , v-1 and (ii) each of 1, 2, … , v-1 do not appear as the same number of time. A design will be GN_2-design if λ may take only two different non-zero values.

Rule II: Let $\underline{S} = [q_1, q_2, \ldots, q_{k-2}]$ be a set of shifts where $1 \leq q_i \leq v\text{-}2$ and $\infty = v\text{-}1$, then initial block of design will be $(0, q_1, q_1+q_2, \ldots, (q_1+q_2+\ldots+q_{k-2}), \infty)$ mod v-1. A design is neighbor balanced if a new set of shifts contains 1, 2, … , v-2 an equal number of times (λ), where new set of shifts consist of each shift of $\underline{S}$ along with its complement. In this rule, complement of q_i is $v\text{-}1\text{-}q_i$ and for binary design, the sum of any two, three, …, k-2 successive numbers of set of shifts is not zero mod v-1.

2. Catalogue of Neighbor Balanced Designs For K = 4

v	**Initial Blocks**
4	[1,1]t
5	[1,2,4]
6	[1,2,4] + [1,2]t(2)
7	[1,5,3](2) + [1,3,6]
8	[1,2,6] + [4,4]t
9	[3,2,8]
10	[1,2,8](2) + [3,4,6] + [3,4]t(2)
11	[1,2,10](2) + [3,7,5](2) + [3,5,8]
12	[1,2,10] + [3,4,8] + [6,6]t
13	[3,2,12](2) + [5,6,8]
14	[1,2,12](2) + [3,4,10](2) + [5,6,8] + [5,6]t(2)
15	[1,2,14](2) + [3,4,12](2) + [5,9,7](2) + [5,7,10]
16	[1,2,14] + [3,4,12] + [5,6,10] + [8,8]t
17	[3,2,16] + [7,6,12]
18	[1,2,16](2) + [3,4,14](2) + [5,6,12](2) + [7,8,10] + [7,8]t(2)
19	[1,2,18](2) + [3,4,16](2) + [5,6,14](2) + [7,11,9](2) + [7,9,12]
20	[1,2,18] + [3,4,16] + [5,6,14] + [7,8,12] + [10,10]t
21	[3,2,20](2) + [7,6,16](2) + [9,10,12]
22	[1,2,20](2) + [3,4,18](2) + [5,6,16](2) + [7,8,14](2) + [9,10,12]+ [9,10]t(2)
23	[1,2,22](2) + [3,4,20](2) + [5,6,18](2) + [7,8,16](2) + [9,13,11](2) + [9,11,14]

24	[1,2,22] + [3,4,20] + [5,6,18] + [7,8,16] + [9,10,14] + [12,12]t
v	**Initial Blocks**
25	[3,2,24] + [7,6,20] + [11,10,16]
26	[1,2,24](2) + [3,4,22](2) + [5,6,20](2) + [7,8,18](2) + [9,10,16](2) + [11,12,14] + [11,12]t(2)
27	[1,2,26](2) + [3,4,24](2) + [5,6,22](2) + [7,8,20](2) + [9,10,18](2) + [11,15,13](2) + [11,13,16]
28	[1,2,26] + [3,4,24] + [5,6,22] + [7,8,20] + [9,10,18] + [11,12,16] + [14,14]t
29	[3,2,28](2) + [7,6,24](2) + [11,10,20](2) + [13,14,16]
30	[1,2,28](2) + [3,4,26](2) + [5,6,24](2) + [7,8,22](2) + [9,10,20](2) + [11,12,18](2) + [13,14,16] + [13,14]t(2)
31	[1,2,30](2) + [3,4,28](2) + [5,6,26](2) + [7,8,24](2) + [9,10,22](2) + [11,12,20](2) + [13,17,15](2) + [13,15,18]
32	[1,2,30]+[3,4,28]+[5,6,26]+[7,8,24]+[9,10,22]+[11,12,20]+[13,14,18]+[16,16]t
33	[3,2,32] + [7,6,28] + [11,10,24] + [15,14,20]
34	[1,2,32](2) + [3,4,30](2) + [5,6,28](2) + [7,8,26](2) + [9,10,24](2) + [11,12,22](2) + [13,14,20](2) + [15,16,18] + [15,16]t(2)
35	[1,2,34](2) + [3,4,32](2) + [5,6,30](2) + [7,8,28](2) + [9,10,26](2) + [11,12,24](2) + [13,14,22](2) + [15,19,17](2) + [15,17,20]
36	[1,2,34] + [3,4,32] + [5,6,30] + [7,8,28] + [9,10,26] + [11,12,24] + [13,14,22] + [15,16,20] + [18,18]t
37	[3,2,36](2) + [7,6,32](2) + [11,10,28](2) + [15,14,24](2) + [17,18,20]
38	[1,2,36](2) + [3,4,34](2) + [5,6,32](2) + [7,8,30](2) + [9,10,28](2) + [11,12,26](2) + [13,14,24](2) + [15,16,22](2) + [17,18,20] + [17,18]t(2)
39	[1,2,38](2) + [3,4,36](2) + [5,6,34](2) + [7,8,32](2) + [9,10,30](2) + [11,12,28](2) + [13,14,26](2) + [15,16,24](2) + [17,21,19](2) + [17,19,22]
40	[1,2,38] + [3,4,36] + [5,6,34] + [7,8,32] + [9,10,30] + [11,12,28] + [13,14,26]+ [15,16,24] + [17,18,22] + [20,20]t
41	[3,2,40] + [7,6,36] + [11,10,32] + [15,14,28] + [19,18,24]
42	[1,2,40](2)+[3,4,38](2)+[5,6,36](2)+[7,8,34](2)+[9,10,32](2)+[11,12,30](2)+ [13,14,28](2) + [15,16,26](2) + [17,18,24](2) + [19,20,22] + [19,20]t(2)
43	[1,2,42](2)+[3,4,40](2)+[5,6,38](2)+[7,8,36](2)+[9,10,34](2)+[11,12,32](2)+ [13,14,30](2)+[15,16,28](2)+[17,18,26](2)+[19,23,21](2)+[19,21,24]
44	[1,2,42] + [3,4,40] + [5,6,38] + [7,8,36] + [9,10,34] + [11,12,32] + [13,14,30]+ [15,16,28] + [17,18,26] + [19,20,24] + [22,22]t
45	[3,2,44](2)+[7,6,40](2)+[11,10,36](2)+[15,14,32](2)+[19,18,28](2)+[21,22,24]
46	[1,2,44](2)+[3,4,42](2)+[5,6,40](2)+[7,8,38](2)+[9,10,36](2)+[11,12,34](2) + [13,14,32](2)+[15,16,30](2)+[17,18,28](2)+[19,20,26](2)+[21,22,24]+ [21,22]t(2)
47	[1,2,46](2)+[3,4,44](2)+[5,6,42](2)+[7,8,40](2)+[9,10,38](2)+[11,12,36](2)+ [13,14,34](2)+[15,16,32](2)+[17,18,30](2)+[19,20,28](2)+[21,25,23](2)+ [21,23,26]
48	[1,2,46] + [3,4,44] + [5,6,42] + [7,8,40] + [9,10,38] + [11,12,36] + [13,14,34]+ [15,16,32] + [17,18,30] + [19,20,28] + [21,22,26] + [24,24]t
49	[3,2,48] + [7,6,44] + [11,10,40] + [15,14,36] + [19,18,32] + [23,22,28]
50	[1,2,48](2)+[3,4,46](2)+[5,6,44](2)+[7,8,42](2) + [9,10,40](2) + [11,12,38](2)+ [13,14,36](2) + [15,16,34](2) + [17,18,32](2) + [19,20,30](2) + [21,22,28](2)+

	[23,24,26] + [23,24]t(2)
v	**Initial Blocks**
51	[1,2,50](2) + [3,4,48](2) + [5,6,46](2) + [7,8,44](2) + [9,10,42](2) + [11,12,40](2) + [13,14,38](2) + [15,16,36](2) + [17,18,34](2) + [19,20,32](2) + [21,22,30](2) + [23,27,25](2) + [23,25,28]
52	[1,2,50] + [3,4,48] + [5,6,46] + [7,8,44] + [9,10,42] + [11,12,40] + [13,14,38] + [15,16,36] + [17,18,34] + [19,20,32] + [21,22,30] + [23,24,28] + [26,26]t
53	[3,2,52](2) + [7,6,48](2) + [11,10,44](2) + [15,14,40](2) + [19,18,36](2) + [23,22,32](2) + [25,26,28]
54	[1,2,52](2) + [3,4,50](2) + [5,6,48](2) + [7,8,46](2) + [9,10,44](2) + [11,12,42](2) + [13,14,40](2) + [15,16,38](2) + [17,18,36](2) + [19,20,34](2) + [21,22,32](2) + [23,24,30](2) + [25,26,28] + [25,26]t(2)
55	[1,2,54](2) + [3,4,52](2) + [5,6,50](2) + [7,8,48](2) + [9,10,46](2) + [11,12,44](2) + [13,14,42](2) + [15,16,40](2) + [17,18,38](2) + [19,20,36](2) + [21,22,34](2) + [23,24,32](2) + [25,29,27](2) + [25,27,30]
56	[1,2,54]+[3,4,52]+[5,6,50]+[7,8,48]+[9,10,46]+[11,12,44]+[13,14,42] + [15,16,40]+[17,18,38]+[19,20,36]+[21,22,34]+[23,24,32]+[25,26,30]+[28,28]t
57	[3,2,56]+[7,6,52]+[11,10,48]+[15,14,44]+[19,18,40]+[23,22,36]+[27,26,32]
58	[1,2,56](2)+[3,4,54](2)+[5,6,52](2)+[7,8,50](2)+[9,10,48](2)+[11,12,46](2)+ [13,14,44](2)+[15,16,42](2)+[17,18,40](2)+[19,20,38](2)+[21,22,36](2)+ [23,24,34](2)+[25,26,32](2)+[27,28,30]+[27,28]t(2)
59	[1,2,58](2) + [3,4,56](2) + [5,6,54](2) + [7,8,52](2) + [9,10,50](2) + [11,12,48](2) + [13,14,46](2) + [15,16,44](2) + [17,18,42](2) + [19,20,40](2) + [21,22,38](2) + [23,24,36](2) + [25,26,34](2) + [27,31,29](2) + [27,29,32]
60	[1,2,58] + [3,4,56] + [5,6,54] + [7,8,52] + [9,10,50] + [11,12,48] + [13,14,46] + [15,16,44] + [17,18,42] + [19,20,40] + [21,22,38] + [23,24,36] + [25,26,34] + [27,28,32] + [30,30]t
61	[3,2,60](2) + [7,6,56](2) + [11,10,52](2) + [15,14,48](2) + [19,18,44](2) + [23,22,40](2) + [27,26,36](2) + [29,30,32]
62	[1,2,60](2) + [3,4,58](2) + [5,6,56](2) + [7,8,54](2) + [9,10,52](2) + [11,12,50](2) + [13,14,48](2) + [15,16,46](2) + [17,18,44](2) + [19,20,42](2) + [21,22,40](2) + [23,24,38](2) + [25,26,36](2) + [27,28,34](2) + [29,30,32] + [29,30]t(2)
63	[1,2,62](2)+[3,4,60](2)+[5,6,58](2)+[7,8,56](2)+[9,10,54](2)+[11,12,52](2)+ [13,14,50](2)+[15,16,48](2)+[17,18,46](2) + [19,20,44](2) + [21,22,42](2)+ [23,24,40](2) + [25,26,38](2) + [27,28,36](2) + [29,33,31](2) + [29,31,34]
64	[1,2,62] + [3,4,60] + [5,6,58] + [7,8,56] + [9,10,54] + [11,12,52] + [13,14,50] + [15,16,48] + [17,18,46] + [19,20,44] + [21,22,42] + [23,24,40] + [25,26,38] + [27,28,36] + [29,30,34] + [32,32]t
65	[3,2,64] + [7,6,60] + [11,10,56] + [15,14,52] + [19,18,48] + [23,22,44] + [27,26,40] + [31,30,44]
66	[1,2,64](2) + [3,4,62](2) + [5,6,60](2) + [7,8,58](2) + [9,10,56](2) + [11,12,54](2) + [13,14,52](2) + [15,16,50](2) + [17,18,48](2) + [19,20,46](2) + [21,22,44](2) + [23,24,42](2) + [25,26,40](2) + [27,28,38](2) + [29,30,36](2) + [31,32,34] + [31,32]t(2)
67	[1,2,66](2)+[3,4,64](2)+[5,6,62](2)+[7,8,60](2)+[9,10,58](2)+[11,12,56](2)+ [13,14,54](2)+[15,16,52](2)+[17,18,50](2)+[19,20,48](2)+[21,22,46](2)+

	[23,24,44](2)+[25,26,42](2)+[27,28,40](2)+[29,30,38](2)+[31,35,33](2)+ [31,33,36]
v	**Initial Blocks**
68	[1,2,66] + [3,4,64] + [5,6,62] + [7,8,60] + [9,10,58] + [11,12,56] + [13,14,54] + [15,16,52] + [17,18,50] + [19,20,48] + [21,22,46] + [23,24,44] + [25,26,42] + [27,28,40] + [29,30,38] + [31,32,36] + [34,34]t
69	[3,2,68](2) + [7,6,64](2) + [11,10,60](2) + [15,14,56](2) + [19,18,52](2) + [23,22,48](2) + [27,26,44](2) + [31,30,40](2) + [33,34,36]
70	[1,2,68](2) + [3,4,66](2) + [5,6,64](2) + [7,8,62](2) + [9,10,60](2) + [11,12,58](2) + [13,14,56](2) + [15,16,54](2) + [17,18,52](2) + [19,20,50](2) + [21,22,48](2) + [23,24,46](2) + [25,26,44](2) + [27,28,42](2) + [29,30,40](2) + [31,32,38](2) + [33,34,36] + [33,34]t(2)
71	[1,2,70](2) + [3,4,68](2) + [5,6,66](2) + [7,8,64](2) + [9,10,62](2) + [11,12,60](2) + [13,14,58](2) + [15,16,56](2) + [17,18,54](2) + [19,20,52](2) + [21,22,50](2) + [23,24,48](2) + [25,26,46](2) + [27,28,44](2) + [29,30,42](2) + [31,32,40](2) + [33,37,35](2) + [33,35,38]
72	[1,2,70] + [3,4,68] + [5,6,66] + [7,8,64] + [9,10,62] + [11,12,60] + [13,14,58] + [15,16,56] + [17,18,54] + [19,20,52] + [21,22,50] + [23,24,48] + [25,26,46] + [27,28,44] + [29,30,42] + [31,32,40] + [33,34,38] + [36,36]t
73	[3,2,72] + [7,6,68] + [11,10,64] + [15,14,60] + [19,18,56] + [23,22,52] + [27,26,48] + [31,30,44] + [35,34,40]
74	[1,2,72](2) + [3,4,70](2) + [5,6,68](2) + [7,8,66](2) + [9,10,64](2) + [11,12,62](2) + [13,14,60](2) + [15,16,58](2) + [17,18,56](2) + [19,20,54](2) + [21,22,52](2) + [23,24,50](2) + [25,26,48](2) + [27,28,46](2) + [29,30,44](2) + [31,32,42](2) + [33,34,40](2) + [35,36,38] + [35,36]t(2)
75	[1,2,74](2) + [3,4,72](2) + [5,6,70](2) + [7,8,68](2) + [9,10,66](2) + [11,12,64](2) + [13,14,62](2) + [15,16,60](2) + [17,18,58](2) + [19,20,56](2) + [21,22,54](2) + [23,24,52](2) + [25,26,50](2) + [27,28,48](2) + [29,30,46](2) + [31,32,44](2) + [33,34,42](2) + [35,39,37](2) + [35,37,40]
76	[1,2,74] + [3,4,72] + [5,6,70] + [7,8,68] + [9,10,66] + [11,12,64] + [13,14,62] + [15,16,60] + [17,18,58] + [19,20,56] + [21,22,54] + [23,24,52] + [25,26,50] + [27,28,48] + [29,30,46] + [31,32,44] + [33,34,42] + [35,36,40] + [38,38]t
77	[3,2,76](2) + [7,6,72](2) + [11,10,68](2) + [15,14,64](2) + [19,18,60](2) + [23,22,56](2) + [27,26,52](2) + [31,30,48](2) + [35,34,44](2) + [37,38,40]
78	[1,2,76](2) + [3,4,74](2) + [5,6,72](2) + [7,8,70](2) + [9,10,68](2) + [11,12,66](2) + [13,14,64](2) + [15,16,62](2) + [17,18,60](2) + [19,20,58](2) + [21,22,56](2) + [23,24,54](2) + [25,26,52](2) + [27,28,50](2) + [29,30,48](2) + [31,32,46](2) + [33,34,44](2) + [35,36,42](2) + [37,38,40] + [37,38]t(2)
79	[1,2,78](2) + [3,4,76](2) + [5,6,74](2) + [7,8,72](2) + [9,10,70](2) + [11,12,68](2) + [13,14,66](2) + [15,16,64](2) + [17,18,62](2) + [19,20,60](2) + [21,22,58](2) + [23,24,56](2) + [25,26,54](2) + [27,28,52](2) + [29,30,50](2) + [31,32,48](2) + [33,34,46](2) + [35,36,44](2) + [37,41,39](2) + [37,39,42]
80	[1,2,78]+[3,4,76]+[5,6,74]+[7,8,72]+[9,10,70]+[11,12,68]+[13,14,66]+ [15,16,64] + [17,18,62] + [19,20,60] + [21,22,58] + [23,24,56] + [25,26,54] + [27,28,52]+[29,30,50]+[31,32,48]+[33,34,46]+[35,36,44]+[37,38,42]+[40,40]t
81	[3,2,80] + [7,6,76] + [11,10,72] + [15,14,68] + [19,18,64] + [23,22,60] + [27,26,56] + [31,30,52] + [35,34,48] + [39,38,44]

v	**Initial Blocks**
82	[1,2,80](2) + [3,4,78](2) + [5,6,76](2) + [7,8,74](2) + [9,10,72](2) + [11,12,70](2) + [13,14,68](2) + [15,16,66](2) + [17,18,64](2) + [19,20,62](2) + [21,22,60](2) + [23,24,58](2) + [25,26,56](2) + [27,28,54](2) + [29,30,52](2) + [31,32,50](2)+[33,34,48](2)+[35,36,46](2)+[37,38,44](2)+[39,40,42]+ [39,40]t(2)
83	[1,2,82](2) + [3,4,80](2) + [5,6,78](2) + [7,8,76](2) + [9,10,74](2) + [11,12,72](2) + [13,14,70](2) + [15,16,68](2) + [17,18,66](2) + [19,20,64](2) + [21,22,62](2) + [23,24,60](2) + [25,26,58](2) + [27,28,56](2) + [29,30,54](2) + [31,32,52](2) + [33,34,50](2) + [35,36,48](2) + [37,38,46](2) +[39,43,41](2) + [39,41,44]
84	[1,2,82] + [3,4,80] + [5,6,78] + [7,8,76] + [9,10,74] + [11,12,72] + [13,14,70] + [15,16,68] + [17,18,66] + [19,20,64] + [21,22,62] + [23,24,60] + [25,26,58] + [27,28,56] + [29,30,54] + [31,32,52] + [33,34,50] + [35,36,48] + [37,38,46] + [39,40,44] + [42,42]t
85	[3,2,84](2) + [7,6,80](2) + [11,10,76](2) + [15,14,72](2) + [19,18,68](2) + [23,22,64](2) + [27,26,60](2) + [31,30,56](2) + [35,34,52](2) + [39,38,48](2) + [41,42,44]
86	[1,2,84](2) + [3,4,82](2) + [5,6,80](2) + [7,8,78](2) + [9,10,76](2) + [11,12,74](2) + [13,14,72](2) + [15,16,70](2) + [17,18,68](2) + [19,20,66](2) + [21,22,64](2) + [23,24,62](2) + [25,26,60](2) + [27,28,58](2) + [29,30,56](2) + [31,32,54](2) + [33,34,52](2) + [35,36,50](2) + [37,38,48](2) + [39,40,46](2) + [41,42,44] + [41,42]t(2)
87	[1,2,86](2) + [3,4,84](2) + [5,6,82](2) + [7,8,80](2) + [9,10,78](2) + [11,12,76](2) + [13,14,74](2) + [15,16,72](2) + [17,18,70](2) + [19,20,68](2) + [21,22,66](2) + [23,24,64](2) + [25,26,62](2) + [27,28,60](2) + [29,30,58](2) + [31,32,56](2) + [33,34,54](2) + [35,36,52](2) + [37,38,50](2) +[39,40,48](2) + [41,45,43](2) + [41,43,46]
88	[1,2,86] + [3,4,84] + [5,6,82] + [7,8,80] + [9,10,78] + [11,12,76] + [13,14,74] + [15,16,72] + [17,18,70] + [19,20,68] + [21,22,66] + [23,24,64] + [25,26,62] + [27,28,60] + [29,30,58] + [31,32,56] + [33,34,54] + [35,36,52] + [37,38,50] + [39,40,48] + [41,42,46] + [44,44]t
89	[3,2,88] + [7,6,84] + [11,10,80] + [15,14,76] + [19,18,72] + [23,22,68] + [27,26,64] + [31,30,60] + [35,34,56] + [39,38,52] + [43,42,48]
90	[1,2,88](2) + [3,4,86](2) + [5,6,84](2) + [7,8,82](2) + [9,10,80](2) + [11,12,78](2) + [13,14,76](2) + [15,16,74](2) + [17,18,72](2) + [19,20,70](2) + [21,22,68](2) + [23,24,66](2) + [25,26,64](2) + [27,28,62](2) + [29,30,60](2) + [31,32,58](2) + [33,34,56](2) + [35,36,54](2) + [37,38,52](2) + [39,40,50](2) + [41,42,48](2) + [43,44,46] + [43,44]t(2)
91	[1,2,90](2) + [3,4,88](2) + [5,6,86](2) + [7,8,84](2) + [9,10,82](2) + [11,12,80](2) + [13,14,78](2) + [15,16,76](2) + [17,18,74](2) + [19,20,72](2) + [21,22,70](2) + [23,24,68](2) + [25,26,66](2) + [27,28,64](2) + [29,30,62](2) + [31,32,60](2) + [33,34,58](2) + [35,36,56](2) + [37,38,54](2) +[39,40,52](2) + [41,42,50](2) + [43,47,45](2) + [43,45,48]
92	[1,2,90] + [3,4,88] + [5,6,86] + [7,8,84] + [9,10,82] + [11,12,80] + [13,14,78] + [15,16,76] + [17,18,74] + [19,20,72] + [21,22,70] + [23,24,68] + [25,26,66] + [27,28,64] + [29,30,62] + [31,32,60] + [33,34,58] + [35,36,56] + [37,38,54] + [39,40,52] + [41,42,50] + [43,44,50] + [46,46]t

v	**Initial Blocks**
93	[3,2,92](2) + [7,6,88](2) + [11,10,84](2) + [15,14,80](2) + [19,18,76](2) + [23,22,72](2) + [27,26,68](2) + [31,30,64](2) + [35,34,60](2) + [39,38,56](2) + [43,42,52](2) + [45,46,48]
94	[1,2,92](2) + [3,4,90](2) + [5,6,88](2) + [7,8,86](2) + [9,10,84](2) + [11,12,82](2) + [13,14,80](2) + [15,16,78](2) + [17,18,76](2) + [19,20,74](2) + [21,22,72](2) + [23,24,70](2) + [25,26,68](2) + [27,28,66](2) + [29,30,64](2) + [31,32,62](2) + [33,34,60](2) + [35,36,58](2) + [37,38,56](2) + [39,40,54](2) + [41,42,52](2) + [43,44,50](2) + [45,46,48] + [45,46]t(2)
95	[1,2,94](2) + [3,4,92](2) + [5,6,90](2) + [7,8,88](2) + [9,10,86](2) + [11,12,84](2) + [13,14,82](2) + [15,16,80](2) + [17,18,78](2) + [19,20,76](2) + [21,22,74](2) + [23,24,72](2) + [25,26,70](2) + [27,28,68](2) + [29,30,66](2) + [31,32,64](2) + [33,34,62](2) + [35,36,60](2) + [37,38,58](2) +[39,40,56](2) + [41,42,54](2) + [43,44,52](2) + [45,49,47](2) + [45,47,50]
96	[1,2,94] + [3,4,92] + [5,6,90] + [7,8,88] + [9,10,86] + [11,12,84] + [13,14,82] + [15,16,80] + [17,18,78] + [19,20,76] + [21,22,74] + [23,24,72] + [25,26,70] + [27,28,68] + [29,30,66] + [31,32,64] + [33,34,62] + [35,36,60] + [37,38,58] + [39,40,56] + [41,42,54] + [43,44,52] + [45,46,50] + [48,48]t
97	[3,2,96] + [7,6,92] + [11,10,88] + [15,14,84] + [19,18,80] + [23,22,76] + [27,26,72] + [31,30,68] + [35,34,64] + [39,38,60] + [43,42,56] + [47,46,52]
98	[1,2,96](2) + [3,4,94](2) + [5,6,92](2) + [7,8,90](2) + [9,10,88](2) + [11,12,86](2) + [13,14,84](2) + [15,16,82](2) + [17,18,80](2) + [19,20,78](2) + [21,22,76](2) + [23,24,74](2) + [25,26,72](2) + [27,28,70](2) + [29,30,68](2) + [31,32,66](2) + [33,34,64](2) + [35,36,62](2) + [37,38,60](2) + [39,40,58](2) + [41,42,56](2) + [43,44,54](2) + [45,46,52](2) + [47,48,50] + [47,48]t(2)
99	[1,2,98](2) + [3,4,96](2) + [5,6,94](2) + [7,8,92](2) + [9,10,90](2) + [11,12,88](2) + [13,14,86](2) + [15,16,84](2) + [17,18,82](2) + [19,20,80](2) + [21,22,78](2) + [23,24,76](2) + [25,26,74](2) + [27,28,72](2) + [29,30,70](2) + [31,32,68](2) + [33,34,66](2) + [35,36,64](2) + [37,38,62](2) +[39,40,60](2) + [41,42,58](2) + [43,44,56](2) + [45,46,52](2) + [47,51,49](2) + [47,49,52]
100	[1,2,98] + [3,4,96] + [5,6,94] + [7,8,92] + [9,10,90] + [11,12,88] + [13,14,86] + [15,16,84] + [17,18,82] + [19,20,80] + [21,22,78] + [23,24,76] + [25,26,74] + [27,28,72] + [29,30,70] + [31,32,68] + [33,34,66] + [35,36,64] + [37,38,62] + [39,40,60] + [41,42,58] + [43,44,56] + [45,46,54] + [47,48,52] + [50,50]t

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