A Simplified Procedure to Construct Pandiagonal Magic Squares Multiples of 4,
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A Simplified Procedure to Construct Pandiagonal Magic Squares Multiples of 4

Inder J. Taneja[1]

Abstract

*This work is revised version of author's previous work [6]. It brings **pandiagonal** magic squares of type 4k, i.e., multiple of 4. This means that it is possible to write **pandiagonal** magic squares of orders 4, 8, 12, etc. with equal sums magic squares of order 4. The procedure is based on half-sequential numbers entries. This works brings **pandiagonal** magic squares up to order 32. Total work is up to order 108. An excel file of complete work is attached for download.*

Contents

[1]*Formerly, Professor of Mathematics, Universidade Federal de Santa Catarina, Florianópolis, SC, Brazil (1978-2012). Also worked at Delhi University, India (1976-1978).*
E-mail: *ijtaneja@gmail.com;*
Web-sites: *http://inderjtaneja.com;*
Twitter: *@IJTANEJA;*
Instagram: *@crazynumbers.*

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1 Introduction

Magic squares are know in the literature for a long time. Lot of work has been done in this direction. There are lot of sites on internet bring about magic squares. This paper work with magic squares of order $4k$, $k \geq 2$. A systematic way is created in such a way that magic squares are represented block-wise, with each $4\times$ block a pandiagonal magic square of order 4 with same sum. Before let's consider a perfect pandiagonal magic square of order 4. This will serve a guide to construct other order magic squares.

	pan	34	34	34	34
34	7	12	1	14	34
34	2	13	8	11	34
34	16	3	10	5	34
	9	6	15	4	34
	34	34	34	34	34

It is one of the most **perfect pandiagonal magic square of order 4**. Below are some properties in colors resulting magic square sum for each color:

7	12	1	14
2	13	8	11
16	3	10	5
9	6	15	4

7	12	1	14
2	13	8	11
16	3	10	5
9	6	15	4

7	12	1	14
2	13	8	11
16	3	10	5
9	6	15	4

7	12	1	14
2	13	8	11
16	3	10	5
9	6	15	4

7	12	1	14
2	13	8	11
16	3	10	5
9	6	15	4

7	12	1	14
2	13	8	11
16	3	10	5
9	6	15	4

7	12	1	14
2	13	8	11
16	3	10	5
9	6	15	4

7	12	1	14
2	13	8	11
16	3	10	5
9	6	15	4

It is also known by **compact magic square**. More studies can be seen at Taneja [9].

The aim of this paper is to bring **pandiagonal magic square of equal sums blocks of order 4**, i.e., $4k$, $k \geq 2$, such as, of order 8, 12, 16, ... etc. It is done in such way that sum of each 4×4 block is of same sum, and the resulting magic square is **pandiagonal**. This work is revised and enlarged version of author's previous work.

1.1 Pandiagonal Magic Square of Order 8

Since we know that a magic square of order 8 is formed by 64 entries from 1 to 64. Let's divide these 64 numbers in such a way that we get 4 sets of equal sums numbers. See below:

$$A1 := \{1, 2, \ldots, 8,\ 57, 58, \ldots, 64\}, \qquad S_{A1} := 520.$$
$$A2 := \{9, 10, \ldots, 16,\ 49, 50, \ldots, 56\}, \qquad S_{A2} := 520.$$
$$A3 := \{17, 18, \ldots, 24,\ 41, 42, \ldots, 48\}, \qquad S_{A3} := 520.$$
$$A4 := \{25, 26, \ldots, 32,\ 33, 34, \ldots, 40\}, \qquad S_{A4} := 520.$$

The numbers 1 to 64 are divided in four parts resulting in equal sums of 520. Let's construct four magic squares of order 4 based on entries given in four sets $A1, A2, A3$ and $A4$, and put these magic squares according to following distribution.

A1	A2
A3	A4

The above distribution lead us to a **pandiagonal** magic square of order 8 as given below:

	pan	260	260	260	260	260	260	260	260
260	7	60	1	62	15	52	9	54	260
260	2	61	8	59	10	53	16	51	260
260	64	3	58	5	56	11	50	13	260
260	57	6	63	4	49	14	55	12	260
260	23	44	17	46	31	36	25	38	260
260	18	45	24	43	26	37	32	35	260
260	48	19	42	21	40	27	34	29	260
	41	22	47	20	33	30	39	28	260
8x8	260	260	260	260	260	260	260	260	260

In this case the magic sum is $S_{8\times 8}=260.$ Each 4×4 block is a perfect **pandiagonal magic square** of order 4 with the same magic sum $S_{4\times 4}=130.$

1.2 Pandiagonal Magic Square of Order 12

Since we know that a magic square of order 12 is formed by 144 entries from 1 to 144. Let's divide these 144 numbers in such a way that we get 9 sets of equal sums numbers. See below:

$$A1 := \{1, 2, \ldots, 8,\ 137, 138, \ldots, 144\}, \qquad S_{A1} := 1160.$$
$$A2 := \{9, 10, \ldots, 16,\ 129, 130, \ldots, 136\}, \qquad S_{A2} := 1160.$$
$$A3 := \{17, 18, \ldots, 24,\ 121, 122, \ldots, 128\}, \qquad S_{A3} := 1160.$$
$$A4 := \{25, 26, \ldots, 32,\ 113, 114, \ldots, 120\}, \qquad S_{A4} := 1160.$$
$$A5 := \{33, 34, \ldots, 40,\ 105, 106, \ldots, 112\}, \qquad S_{A5} := 1160.$$
$$A6 := \{41, 42, \ldots, 48,\ 97, 98, \ldots, 104\}, \qquad S_{A6} := 1160.$$
$$A7 := \{49, 50, \ldots, 56,\ 89, 90, \ldots, 96\}, \qquad S_{A7} := 1160.$$
$$A8 := \{57, 58, \ldots, 64,\ 81, 82, \ldots, 88\}, \qquad S_{A8} := 1160.$$
$$A9 := \{65, 66, \ldots, 72,\ 73, 74, \ldots, 80\}, \qquad S_{A9} := 1160.$$

The numbers 1 to 144 are divided in 9 parts resulting in equal sums of 1160. Let's construct 9 magic squares of order 4 based on entries given in 9 sets $A1, A2, \ldots A9$, and put these magic squares according to following distribution.

A1	A2	A3
A4	A5	A6
A7	A8	A9

The above distribution lead us to a **pandiagonal** magic square of order 12 as given below:

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	pan	870	870	870	870	870	870	870	870	870	870	870	870
870	7	140	1	142	15	132	9	134	23	124	17	126	870
870	2	141	8	139	10	133	16	131	18	125	24	123	870
870	144	3	138	5	136	11	130	13	128	19	122	21	870
870	137	6	143	4	129	14	135	12	121	22	127	20	870
870	31	116	25	118	39	108	33	110	47	100	41	102	870
870	26	117	32	115	34	109	40	107	42	101	48	99	870
870	120	27	114	29	112	35	106	37	104	43	98	45	870
870	113	30	119	28	105	38	111	36	97	46	103	44	870
870	55	92	49	94	63	84	57	86	71	76	65	78	870
870	50	93	56	91	58	85	64	83	66	77	72	75	870
870	96	51	90	53	88	59	82	61	80	67	74	69	870
	89	54	95	52	81	62	87	60	73	70	79	68	870
12x12	870	870	870	870	870	870	870	870	870	870	870	870	870

In this case the magic sum is $S_{12\times12} = 870$. Each 4×4 block is a perfect **pandiagonal magic square** of order 4 with the same magic sum $S_{4\times4} = 290$.

1.3 Pandiagonal Magic Square of Order 16

Since we know that a magic square of order 16 is formed by 256 entries from 1 to 256. Let's divide these 256 numbers in such a way that we get 16 sets of equal sums numbers. See below:

$$A1 := \{1, 2, \ldots, 8,\ 249, 250, \ldots, 256\}, \qquad S_{A1} := 2056.$$
$$A2 := \{9, 10, \ldots, 16,\ 241, 242, \ldots, 248\}, \qquad S_{A2} := 2056.$$
$$A3 := \{17, 18, \ldots, 24,\ 233, 234, \ldots, 240\}, \qquad S_{A3} := 2056.$$
$$A4 := \{25, 26, \ldots, 32,\ 225, 226, \ldots, 232\}, \qquad S_{A4} := 2056.$$
$$A5 := \{33, 34, \ldots, 40,\ 217, 218, \ldots, 224\}, \qquad S_{A5} := 2056.$$
$$A6 := \{41, 42, \ldots, 48,\ 209, 210, \ldots, 216\}, \qquad S_{A6} := 2056.$$
$$A7 := \{49, 50, \ldots, 56,\ 201, 202, \ldots, 208\}, \qquad S_{A7} := 2056.$$
$$A8 := \{57, 58, \ldots, 64,\ 193, 194, \ldots, 200\}, \qquad S_{A8} := 2056.$$
$$A9 := \{65, 66, \ldots, 72,\ 185, 186, \ldots, 192\}, \qquad S_{A9} := 2056.$$
$$A10 := \{73, 74, \ldots, 80,\ 177, 178, \ldots, 184\}, \qquad S_{A10} := 2056.$$
$$A11 := \{81, 82, \ldots, 88,\ 169, 170, \ldots, 176\}, \qquad S_{A11} := 2056.$$
$$A12 := \{89, 90, \ldots, 96,\ 161, 162, \ldots, 168\}, \qquad S_{A12} := 2056.$$
$$A13 := \{97, 98, \ldots, 104,\ 153, 154, \ldots, 160\}, \qquad S_{A13} := 2056.$$
$$A14 := \{105, 106, \ldots, 112,\ 145, 146, \ldots, 152\}, \qquad S_{A14} := 2056.$$
$$A15 := \{113, 114, \ldots, 120,\ 137, 138, \ldots, 144\}, \qquad S_{A15} := 2056.$$
$$A16 := \{121, 122, \ldots, 128,\ 129, 130, \ldots, 136\}, \qquad S_{A16} := 2056.$$

The numbers 1 to 256 are divided in 16 parts resulting in equal sums of 2056. Let's construct 16 magic squares of order 4 based on entries given in 16 sets $A1, A2, \ldots A16$, and put these magic squares according to following distribution.

A1	A2	A3	A4
A5	A6	A7	A8
A9	A10	A11	A12
A13	A14	A15	A16

The above distribution lead us to a **pandiagonal** magic square of order 16 as given below:

	pan	2056	2056	2056	2056	2056	2056	2056	2056	2056	2056	2056	2056	2056	2056	2056	2056
2056	7	252	1	254	15	244	9	246	23	236	17	238	31	228	25	230	2056
2056	2	253	8	251	10	245	16	243	18	237	24	235	26	229	32	227	2056
2056	256	3	250	5	248	11	242	13	240	19	234	21	232	27	226	29	2056
2056	249	6	255	4	241	14	247	12	233	22	239	20	225	30	231	28	2056
2056	39	220	33	222	47	212	41	214	55	204	49	206	63	196	57	198	2056
2056	34	221	40	219	42	213	48	211	50	205	56	203	58	197	64	195	2056
2056	224	35	218	37	216	43	210	45	208	51	202	53	200	59	194	61	2056
2056	217	38	223	36	209	46	215	44	201	54	207	52	193	62	199	60	2056
2056	71	188	65	190	79	180	73	182	87	172	81	174	95	164	89	166	2056
2056	66	189	72	187	74	181	80	179	82	173	88	171	90	165	96	163	2056
2056	192	67	186	69	184	75	178	77	176	83	170	85	168	91	162	93	2056
2056	185	70	191	68	177	78	183	76	169	86	175	84	161	94	167	92	2056
2056	103	156	97	158	111	148	105	150	119	140	113	142	127	132	121	134	2056
2056	98	157	104	155	106	149	112	147	114	141	120	139	122	133	128	131	2056
2056	160	99	154	101	152	107	146	109	144	115	138	117	136	123	130	125	2056
	153	102	159	100	145	110	151	108	137	118	143	116	129	126	135	124	2056
16x16	2056	2056	2056	2056	2056	2056	2056	2056	2056	2056	2056	2056	2056	2056	2056	2056	2056

In this case the magic sum is $S_{16\times16} = 2056$. Each 4×4 block is a perfect **pandiagonal magic square** of order 4 with the same magic sum $S_{4\times4} = 514$.

1.4 Pandiagonal Magic Square of Order 20

Since we know that a magic square of order 20 is formed by 400 entries from 1 to 400. Let's divide these 400 numbers in such a way that we get 25 sets of equal sums numbers. See below:

$$A1 := \{1, 2, \ldots, 8, 397, 398, \ldots, 400\}, \qquad S_{A1} := 3208.$$

$$A2 := \{9, 10, \ldots, 16, 385, 386, \ldots, 396\}, \qquad S_{A2} := 3208.$$

$$A3 := \{17, 18, \ldots, 24, 377, 378, \ldots, 384\}, \qquad S_{A3} := 3208.$$

$$A4 := \{25, 26, \ldots, 32, 369, 370, \ldots, 376\}, \qquad S_{A4} := 3208.$$

$$A5 := \{33, 34, \ldots, 40,\ 361, 362, \ldots, 368\}, \qquad S_{A5} := 3208.$$

$$A6 := \{41, 42, \ldots, 48,\ 353, 354, \ldots, 360\}, \qquad S_{A6} := 3208.$$

$$A7 := \{49, 50, \ldots, 56,\ 345, 346, \ldots, 352\}, \qquad S_{A7} := 3208.$$

$$A8 := \{57, 58, \ldots, 64,\ 337, 338, \ldots, 344\}, \qquad S_{A8} := 3208.$$

$$A9 := \{65, 66, \ldots, 72,\ 329, 330, \ldots, 336\}, \qquad S_{A9} := 3208.$$

$$A10 := \{73, 74, \ldots, 80,\ 321, 322, \ldots, 328\}, \qquad S_{A10} := 3208.$$

$$A11 := \{81, 82, \ldots, 88,\ 313, 314, \ldots, 320\}, \qquad S_{A11} := 3208.$$

$$A12 := \{89, 90, \ldots, 96,\ 305, 306, \ldots, 312\}, \qquad S_{A12} := 3208.$$

$$A13 := \{97, 98, \ldots, 104,\ 297, 298, \ldots, 304\}, \qquad S_{A13} := 3208.$$

$$A14 := \{105, 106, \ldots, 112,\ 289, 290, \ldots, 296\}, \qquad S_{A14} := 3208.$$

$$A15 := \{113, 114, \ldots, 120,\ 281, 282, \ldots, 288\}, \qquad S_{A15} := 3208.$$

$$A16 := \{121, 122, \ldots, 128,\ 273, 274, \ldots, 280\}, \qquad S_{A16} := 3208.$$

$$A17 := \{129, 130, \ldots, 136,\ 265, 266, \ldots, 272\}, \qquad S_{A17} := 3208.$$

$$A18 := \{137, 137, \ldots, 144,\ 257, 258, \ldots, 264\}, \qquad S_{A18} := 3208.$$

$$A19 := \{145, 146, \ldots, 152,\ 249, 250, \ldots, 256\}, \qquad S_{A19} := 3208.$$

$$A20 := \{153, 154, \ldots, 160,\ 241, 242, \ldots, 248\}, \qquad S_{A20} := 3208.$$

$$A21 := \{161, 162, \ldots, 168,\ 233, 234, \ldots, 240\}, \qquad S_{A21} := 3208.$$

$$A22 := \{169, 170, \ldots, 176,\ 225, 226, \ldots, 232\}, \qquad S_{A22} := 3208.$$

$$A23 := \{171, 172, \ldots, 184,\ 217, 218, \ldots, 224\}, \qquad S_{A23} := 3208.$$

$$A24 := \{185, 186, \ldots, 192,\ 209, 210, \ldots, 216\}, \qquad S_{A24} := 3208.$$

$$A25 := \{193, 194, \ldots, 200,\ 201, 202, \ldots, 208\}, \qquad S_{A25} := 3208.$$

The numbers 1 to 400 are divided in 25 parts resulting in equal sums of 3208. Let's construct 25 magic squares of order 4 based on entries given in 25 sets $A1, A2, \ldots A25$, and put these magic squares according to following distribution.

A1	A2	A3	A4	A5
A6	A7	A8	A9	A10
A11	A12	A13	A14	A15
A16	A17	A18	A19	A20
A21	A22	A23	A24	A25

The above distribution lead us to a **pandiagonal** magic square of order 20 as given below:

	pan	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010
4010	7	396	1	398	15	388	9	390	23	380	17	382	31	372	25	374	39	364	33	366	4010
4010	2	397	8	395	10	389	16	387	18	381	24	379	26	373	32	371	34	365	40	363	4010
4010	400	3	394	5	392	11	386	13	384	19	378	21	376	27	370	29	368	35	362	37	4010
4010	393	6	399	4	385	14	391	12	377	22	383	20	369	30	375	28	361	38	367	36	4010
4010	47	356	41	358	55	348	49	350	63	340	57	342	71	332	65	334	79	324	73	326	4010
4010	42	357	48	355	50	349	56	347	58	341	64	339	66	333	72	331	74	325	80	323	4010
4010	360	43	354	45	352	51	346	53	344	59	338	61	336	67	330	69	328	75	322	77	4010
4010	353	46	359	44	345	54	351	52	337	62	343	60	329	70	335	68	321	78	327	76	4010
4010	87	316	81	318	95	308	89	310	103	300	97	302	111	292	105	294	119	284	113	286	4010
4010	82	317	88	315	90	309	96	307	98	301	104	299	106	293	112	291	114	285	120	283	4010
4010	320	83	314	85	312	91	306	93	304	99	298	101	296	107	290	109	288	115	282	117	4010
4010	313	86	319	84	305	94	311	92	297	102	303	100	289	110	295	108	281	118	287	116	4010
4010	127	276	121	278	135	268	129	270	143	260	137	262	151	252	145	254	159	244	153	246	4010
4010	122	277	128	275	130	269	136	267	138	261	144	259	146	253	152	251	154	245	160	243	4010
4010	280	123	274	125	272	131	266	133	264	139	258	141	256	147	250	149	248	155	242	157	4010
4010	273	126	279	124	265	134	271	132	257	142	263	140	249	150	255	148	241	158	247	156	4010
4010	167	236	161	238	175	228	169	230	183	220	177	222	191	212	185	214	199	204	193	206	4010
4010	162	237	168	235	170	229	176	227	178	221	184	219	186	213	192	211	194	205	200	203	4010
4010	240	163	234	165	232	171	226	173	224	179	218	181	216	187	210	189	208	195	202	197	4010
	233	166	239	164	225	174	231	172	217	182	223	180	209	190	215	188	201	198	207	196	4010
20x20	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010	4010

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In this case the magic sum is $S_{20\times 20} = 4010$. Each 4×4 block is a perfect **pandiagonal magic square** of order 4 with the same magic sum $S_{4\times 4} = 802$.

1.5 Pandiagonal Magic Square of Order 24

Since we know that a magic square of order 24 is formed by 576 entries from 1 to 576. Let's divide these 576 numbers in such a way that we get 36 sets of equal sums numbers. See below:

$$A1 := \{1, 2, \ldots, 8,\ 569, 570, \ldots, 576\}, \qquad S_{A1} := 4616.$$
$$A2 := \{9, 10, \ldots, 16,\ 561, 562, \ldots, 568\}, \qquad S_{A2} := 4616.$$
$$A3 := \{17, 18, \ldots, 24,\ 552, 553, \ldots, 560\}, \qquad S_{A3} := 4616.$$
$$A4 := \{25, 26, \ldots, 32,\ 545, 546, \ldots, 552\}, \qquad S_{A4} := 4616.$$
$$A5 := \{33, 34, \ldots, 40,\ 537, 538, \ldots, 544\}, \qquad S_{A5} := 4616.$$
$$A6 := \{41, 42, \ldots, 48,\ 529, 530, \ldots, 536\}, \qquad S_{A6} := 4616.$$
$$A7 := \{49, 50, \ldots, 56,\ 521, 522, \ldots, 528\}, \qquad S_{A7} := 4616.$$
$$A8 := \{57, 58, \ldots, 64,\ 513, 514, \ldots, 520\}, \qquad S_{A8} := 4616.$$
$$A9 := \{65, 66, \ldots, 72,\ 505, 506, \ldots, 512\}, \qquad S_{A9} := 4616.$$
$$A10 := \{73, 74, \ldots, 80,\ 497, 498, \ldots, 504\}, \qquad S_{A10} := 4616.$$
$$A11 := \{81, 82, \ldots, 88,\ 489, 490, \ldots, 496\}, \qquad S_{A11} := 4616.$$
$$A12 := \{89, 90, \ldots, 96,\ 481, 482, \ldots, 488\}, \qquad S_{A12} := 4616.$$
$$A13 := \{97, 98, \ldots, 104,\ 473, 474, \ldots, 480\}, \qquad S_{A13} := 4616.$$
$$A14 := \{105, 106, \ldots, 112,\ 465, 466, \ldots, 472\}, \qquad S_{A14} := 4616.$$
$$A15 := \{113, 114, \ldots, 120,\ 457, 458, \ldots, 464\}, \qquad S_{A15} := 4616.$$
$$A16 := \{121, 122, \ldots, 128,\ 449, 450, \ldots, 456\}, \qquad S_{A16} := 4616.$$
$$A17 := \{129, 130, \ldots, 136,\ 441, 442, \ldots, 448\}, \qquad S_{A17} := 4616.$$
$$A18 := \{137, 137, \ldots, 144,\ 433, 434, \ldots, 440\}, \qquad S_{A18} := 4616.$$
$$A19 := \{145, 146, \ldots, 152,\ 425, 426, \ldots, 432\}, \qquad S_{A19} := 4616.$$
$$A20 := \{153, 154, \ldots, 160,\ 417, 418, \ldots, 424\}, \qquad S_{A20} := 4616.$$

$$A21 := \{161, 162, \ldots, 168,\ 409, 410, \ldots, 416\}, \qquad S_{A21} := 4616.$$

$$A22 := \{169, 170, \ldots, 176,\ 401, 402, \ldots, 408\}, \qquad S_{A22} := 4616.$$

$$A23 := \{171, 172, \ldots, 184,\ 393, 394, \ldots, 400\}, \qquad S_{A23} := 4616.$$

$$A24 := \{185, 186, \ldots, 192,\ 385, 386, \ldots, 392\}, \qquad S_{A24} := 4616.$$

$$A25 := \{193, 194, \ldots, 200,\ 201, 202, \ldots, 384\}, \qquad S_{A25} := 4616.$$

$$A26 := \{201, 202, \ldots, 208,\ 369, 370, \ldots, 376\}, \qquad S_{A26} := 4616.$$

$$A27 := \{209, 210, \ldots, 216,\ 361, 362, \ldots, 368\}, \qquad S_{A27} := 4616.$$

$$A28 := \{217, 218, \ldots, 224,\ 353, 354, \ldots, 360\}, \qquad S_{A28} := 4616.$$

$$A29 := \{225, 226, \ldots, 232,\ 245, 246, \ldots, 352\}, \qquad S_{A29} := 4616.$$

$$A30 := \{233, 234, \ldots, 240,\ 337, 338, \ldots, 344\}, \qquad S_{A30} := 4616.$$

$$A31 := \{241, 242, \ldots, 248,\ 329, 330, \ldots, 336\}, \qquad S_{A31} := 4616.$$

$$A32 := \{249, 250, \ldots, 256,\ 321, 322, \ldots, 328\}, \qquad S_{A32} := 4616.$$

$$A33 := \{257, 258, \ldots, 264,\ 313, 314, \ldots, 320\}, \qquad S_{A33} := 4616.$$

$$A34 := \{265, 266, \ldots, 272,\ 305, 306, \ldots, 312\}, \qquad S_{A34} := 4616.$$

$$A35 := \{273, 274, \ldots, 280,\ 297, 298, \ldots, 304\}, \qquad S_{A35} := 4616.$$

$$A36 := \{281, 282, \ldots, 288,\ 289, 290, \ldots, 296\}, \qquad S_{A36} := 4616.$$

The numbers 1 to 576 are divided in 36 parts resulting in equal sums of 4616. Let's construct 36 magic squares of order 4 based on entries given in 36 sets $A1, A2, \ldots A36$, and put these magic squares according to following distribution.

A1	A2	A3	A4	A5	A6
A7	A8	A9	A10	A11	A12
A13	A14	A15	A16	A17	A18
A19	A20	A21	A22	A23	A24
A25	A26	A27	A28	A29	A30
A31	A32	A33	A34	A35	A36

The above distribution lead us to a **pandiagonal** magic square of order 24 as given below:

	pan	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924
6924	7	572	1	574	15	564	9	566	23	556	17	558	31	548	25	550	39	540	33	542	47	532	41	534	6924
6924	2	573	8	571	10	565	16	563	18	557	24	555	26	549	32	547	34	541	40	539	42	533	48	531	6924
6924	576	3	570	5	568	11	562	13	560	19	554	21	552	27	546	29	544	35	538	37	536	43	530	45	6924
6924	569	6	575	4	561	14	567	12	553	22	559	20	545	30	551	28	537	38	543	36	529	46	535	44	6924
6924	55	524	49	526	63	516	57	518	71	508	65	510	79	500	73	502	87	492	81	494	95	484	89	486	6924
6924	50	525	56	523	58	517	64	515	66	509	72	507	74	501	80	499	82	493	88	491	90	485	96	483	6924
6924	528	51	522	53	520	59	514	61	512	67	506	69	504	75	498	77	496	83	490	85	488	91	482	93	6924
6924	521	54	527	52	513	62	519	60	505	70	511	68	497	78	503	76	489	86	495	84	481	94	487	92	6924
6924	103	476	97	478	111	468	105	470	119	460	113	462	127	452	121	454	135	444	129	446	143	436	137	438	6924
6924	98	477	104	475	106	469	112	467	114	461	120	459	122	453	128	451	130	445	136	443	138	437	144	435	6924
6924	480	99	474	101	472	107	466	109	464	115	458	117	456	123	450	125	448	131	442	133	440	139	434	141	6924
6924	473	102	479	100	465	110	471	108	457	118	463	116	449	126	455	124	441	134	447	132	433	142	439	140	6924
6924	151	428	145	430	159	420	153	422	167	412	161	414	175	404	169	406	183	396	177	398	191	388	185	390	6924
6924	146	429	152	427	154	421	160	419	162	413	168	411	170	405	176	403	178	397	184	395	186	389	192	387	6924
6924	432	147	426	149	424	155	418	157	416	163	410	165	408	171	402	173	400	179	394	181	392	187	386	189	6924
6924	425	150	431	148	417	158	423	156	409	166	415	164	401	174	407	172	393	182	399	180	385	190	391	188	6924
6924	199	380	193	382	207	372	201	374	215	364	209	366	223	356	217	358	231	348	225	350	239	340	233	342	6924
6924	194	381	200	379	202	373	208	371	210	365	216	363	218	357	224	355	226	349	232	347	234	341	240	339	6924
6924	384	195	378	197	376	203	370	205	368	211	362	213	360	219	354	221	352	227	346	229	344	235	338	237	6924
6924	377	198	383	196	369	206	375	204	361	214	367	212	353	222	359	220	345	230	351	228	337	238	343	236	6924
6924	247	332	241	334	255	324	249	326	263	316	257	318	271	308	265	310	279	300	273	302	287	292	281	294	6924
6924	242	333	248	331	250	325	256	323	258	317	264	315	266	309	272	307	274	301	280	299	282	293	288	291	6924
6924	336	243	330	245	328	251	322	253	320	259	314	261	312	267	306	269	304	275	298	277	296	283	290	285	6924
	329	246	335	244	321	254	327	252	313	262	319	260	305	270	311	268	297	278	303	276	289	286	295	284	6924
24x24	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924	6924

In this case the magic sum is $S_{24\times 24} = 6924$. Each 4×4 block is a perfect **pandiagonal magic square** of order 4 with the same magic sum $S_{4\times 4} = 1154$.

1.6 Pandiagonal Magic Square of Order 28

Since we know that a magic square of order 28 is formed by 784 entries from 1 to 784. Dividing these 784 numbers in such a way that we get 49 sets of equal sums numbers. Proceeding on the same procedure as given in above magic squares, we get magic square of order 28

	pan	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990
10990	7	780	1	782	15	772	9	774	23	764	17	766	31	756	25	758	39	748	33	750	47	740	41	742	55	732	49	734	10990
10990	2	781	8	779	10	773	16	771	18	765	24	763	26	757	32	755	34	749	40	747	42	741	48	739	50	733	56	731	10990
10990	784	3	778	5	776	11	770	13	768	19	762	21	760	27	754	29	752	35	746	37	744	43	738	45	736	51	730	53	10990
10990	777	6	783	4	769	14	775	12	761	22	767	20	753	30	759	28	745	38	751	36	737	46	743	44	729	54	735	52	10990
10990	63	724	57	726	71	716	65	718	79	708	73	710	87	700	81	702	95	692	89	694	103	684	97	686	111	676	105	678	10990
10990	58	725	64	723	66	717	72	715	74	709	80	707	82	701	88	699	90	693	96	691	98	685	104	683	106	677	112	675	10990
10990	728	59	722	61	720	67	714	69	712	75	706	77	704	83	698	85	696	91	690	93	688	99	682	101	680	107	674	109	10990
10990	721	62	727	60	713	70	719	68	705	78	711	76	697	86	703	84	689	94	695	92	681	102	687	100	673	110	679	108	10990
10990	119	668	113	670	127	660	121	662	135	652	129	654	143	644	137	646	151	636	145	638	159	628	153	630	167	620	161	622	10990
10990	114	669	120	667	122	661	128	659	130	653	136	651	138	645	144	643	146	637	152	635	154	629	160	627	162	621	168	619	10990
10990	672	115	666	117	664	123	658	125	656	131	650	133	648	139	642	141	640	147	634	149	632	155	626	157	624	163	618	165	10990
10990	665	118	671	116	657	126	663	124	649	134	655	132	641	142	647	140	633	150	639	148	625	158	631	156	617	166	623	164	10990
10990	175	612	169	614	183	604	177	606	191	596	185	598	199	588	193	590	207	580	201	582	215	572	209	574	223	564	217	566	10990
10990	170	613	176	611	178	605	184	603	186	597	192	595	194	589	200	587	202	581	208	579	210	573	216	571	218	565	224	563	10990
10990	616	171	610	173	608	179	602	181	600	187	594	189	592	195	586	197	584	203	578	205	576	211	570	213	568	219	562	221	10990
10990	609	174	615	172	601	182	607	180	593	190	599	188	585	198	591	196	577	206	583	204	569	214	575	212	561	222	567	220	10990
10990	231	556	225	558	239	548	233	550	247	540	241	542	255	532	249	534	263	524	257	526	271	516	265	518	279	508	273	510	10990
10990	226	557	232	555	234	549	240	547	242	541	248	539	250	533	256	531	258	525	264	523	266	517	272	515	274	509	280	507	10990
10990	560	227	554	229	552	235	546	237	544	243	538	245	536	251	530	253	528	259	522	261	520	267	514	269	512	275	506	277	10990
10990	553	230	559	228	545	238	551	236	537	246	543	244	529	254	535	252	521	262	527	260	513	270	519	268	505	278	511	276	10990
10990	287	500	281	502	295	492	289	494	303	484	297	486	311	476	305	478	319	468	313	470	327	460	321	462	335	452	329	454	10990
10990	282	501	288	499	290	493	296	491	298	485	304	483	306	477	312	475	314	469	320	467	322	461	328	459	330	453	336	451	10990
10990	504	283	498	285	496	291	490	293	488	299	482	301	480	307	474	309	472	315	466	317	464	323	458	325	456	331	450	333	10990
10990	497	286	503	284	489	294	495	292	481	302	487	300	473	310	479	308	465	318	471	316	457	326	463	324	449	334	455	332	10990
10990	343	444	337	446	351	436	345	438	359	428	353	430	367	420	361	422	375	412	369	414	383	404	377	406	391	396	385	398	10990
10990	338	445	344	443	346	437	352	435	354	429	360	427	362	421	368	419	370	413	376	411	378	405	384	403	386	397	392	395	10990
10990	448	339	442	341	440	347	434	349	432	355	426	357	424	363	418	365	416	371	410	373	408	379	402	381	400	387	394	389	10990
	441	342	447	340	433	350	439	348	425	358	431	356	417	366	423	364	409	374	415	372	401	382	407	380	393	390	399	388	10990
28x28	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990	10990

In this case the magic sum is $S_{28\times 28} = 10990$. Each 4×4 block is a perfect **pandiagonal magic square** of order 4 with the same magic sum $S_{4\times 4} = 1570$.

1.7 Pandiagonal Magic Square of Order 32

Since we know that a magic square of order 32 is formed by 1024 entries from 1 to 1024. Dividing these 1024 numbers in such a way that we get 64 sets of equal sums numbers. Proceeding on the same procedure as given in above magic squares, we get magic square of order 32

	pan	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400
16400	7	1020	1	1022	15	1012	9	1014	23	1004	17	1006	31	996	25	998	39	988	33	990	47	980	41	982	55	972	49	974	63	964	57	966	16400
16400	2	1021	8	1019	10	1013	16	1011	18	1005	24	1003	26	997	32	995	34	989	40	987	42	981	48	979	50	973	56	971	58	965	64	963	16400
16400	1024	3	1018	5	1016	11	1010	13	1008	19	1002	21	1000	27	994	29	992	35	986	37	984	43	978	45	976	51	970	53	968	59	962	61	16400
16400	1017	6	1023	4	1009	14	1015	12	1001	22	1007	20	993	30	999	28	985	38	991	36	977	46	983	44	969	54	975	52	961	62	967	60	16400
16400	71	956	65	958	79	948	73	950	87	940	81	942	95	932	89	934	103	924	97	926	111	916	105	918	119	908	113	910	127	900	121	902	16400
16400	66	957	72	955	74	949	80	947	82	941	88	939	90	933	96	931	98	925	104	923	106	917	112	915	114	909	120	907	122	901	128	899	16400
16400	960	67	954	69	952	75	946	77	944	83	938	85	936	91	930	93	928	99	922	101	920	107	914	109	912	115	906	117	904	123	898	125	16400
16400	953	70	959	68	945	78	951	76	937	86	943	84	929	94	935	92	921	102	927	100	913	110	919	108	905	118	911	116	897	126	903	124	16400
16400	135	892	129	894	143	884	137	886	151	876	145	878	159	868	153	870	167	860	161	862	175	852	169	854	183	844	177	846	191	836	185	838	16400
16400	130	893	136	891	138	885	144	883	146	877	152	875	154	869	160	867	162	861	168	859	170	853	176	851	178	845	184	843	186	837	192	835	16400
16400	896	131	890	133	888	139	882	141	880	147	874	149	872	155	866	157	864	163	858	165	856	171	850	173	848	179	842	181	840	187	834	189	16400
16400	889	134	895	132	881	142	887	140	873	150	879	148	865	158	871	156	857	166	863	164	849	174	855	172	841	182	847	180	833	190	839	188	16400
16400	199	828	193	830	207	820	201	822	215	812	209	814	223	804	217	806	231	796	225	798	239	788	233	790	247	780	241	782	255	772	249	774	16400
16400	194	829	200	827	202	821	208	819	210	813	216	811	218	805	224	803	226	797	232	795	234	789	240	787	242	781	248	779	250	773	256	771	16400
16400	832	195	826	197	824	203	818	205	816	211	810	213	808	219	802	221	800	227	794	229	792	235	786	237	784	243	778	245	776	251	770	253	16400
16400	825	198	831	196	817	206	823	204	809	214	815	212	801	222	807	220	793	230	799	228	785	238	791	236	777	246	783	244	769	254	775	252	16400
16400	263	764	257	766	271	756	265	758	279	748	273	750	287	740	281	742	295	732	289	734	303	724	297	726	311	716	305	718	319	708	313	710	16400
16400	258	765	264	763	266	757	272	755	274	749	280	747	282	741	288	739	290	733	296	731	298	725	304	723	306	717	312	715	314	709	320	707	16400
16400	768	259	762	261	760	267	754	269	752	275	746	277	744	283	738	285	736	291	730	293	728	299	722	301	720	307	714	309	712	315	706	317	16400
16400	761	262	767	260	753	270	759	268	745	278	751	276	737	286	743	284	729	294	735	292	721	302	727	300	713	310	719	308	705	318	711	316	16400
16400	327	700	321	702	335	692	329	694	343	684	337	686	351	676	345	678	359	668	353	670	367	660	361	662	375	652	369	654	383	644	377	646	16400
16400	322	701	328	699	330	693	336	691	338	685	344	683	346	677	352	675	354	669	360	667	362	661	368	659	370	653	376	651	378	645	384	643	16400
16400	704	323	698	325	696	331	690	333	688	339	682	341	680	347	674	349	672	355	666	357	664	363	658	365	656	371	650	373	648	379	642	381	16400
16400	697	326	703	324	689	334	695	332	681	342	687	340	673	350	679	348	665	358	671	356	657	366	663	364	649	374	655	372	641	382	647	380	16400
16400	391	636	385	638	399	628	393	630	407	620	401	622	415	612	409	614	423	604	417	606	431	596	425	598	439	588	433	590	447	580	441	582	16400
16400	386	637	392	635	394	629	400	627	402	621	408	619	410	613	416	611	418	605	424	603	426	597	432	595	434	589	440	587	442	581	448	579	16400
16400	640	387	634	389	632	395	626	397	624	403	618	405	616	411	610	413	608	419	602	421	600	427	594	429	592	435	586	437	584	443	578	445	16400
16400	633	390	639	388	625	398	631	396	617	406	623	404	609	414	615	412	601	422	607	420	593	430	599	428	585	438	591	436	577	446	583	444	16400
16400	455	572	449	574	463	564	457	566	471	556	465	558	479	548	473	550	487	540	481	542	495	532	489	534	503	524	497	526	511	516	505	518	16400
16400	450	573	456	571	458	565	464	563	466	557	472	555	474	549	480	547	482	541	488	539	490	533	496	531	498	525	504	523	506	517	512	515	16400
16400	576	451	570	453	568	459	562	461	560	467	554	469	552	475	546	477	544	483	538	485	536	491	530	493	528	499	522	501	520	507	514	509	16400
	569	454	575	452	561	462	567	460	553	470	559	468	545	478	551	476	537	486	543	484	529	494	535	492	521	502	527	500	513	510	519	508	16400
32x32	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400	16400

In this case the magic sum is $S_{32\times 32} = 16400$. Each 4×4 block is a perfect **pandiagonal magic square** of order 4 with the same magic sum $S_{4\times 4} = 2050$.

For more studies on magic squares in this direction refer [1, 2, 3, 4].

Remark 1.1. *Above we have given* ***pandiagonal*** *magic squares up to order 32 multiples of 4. The* ***pandiagonal*** *magic squares multiples of 4 up to order 108 is given in an excel file attached with this work.*

2 Author's Contribution to Magic Squares and Recreation Numbers

For author's contribution to **magic squares** and **recreation numbers** please see the links below:

- **Inder J. Taneja**, Magic Squares, *https://inderjtaneja.com/2019/06/27/publications-magic-squares/*
- **Inder J. Taneja**, Recreation of Numbers, *https://inderjtaneja.com/2019/06/27/publications-recreation-of-numbers/*

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[4] **Willem Barink**, The construction of perfect panmagic squares of order $4k$, ($k \geq 2$), *www.allergrootste.com/friends/wba/magic-squares.html*

- **Block-Wise Magic Squares**

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• Bordered Magic Squares

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- **Block-Bordered Magic Squares**

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- **Block-Wise and Block-Bordered Magic Squares**

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