Counting and properties of semi magic squares 6 × 6

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الملخص

في هذا البحث ، درسنا نوعاً يعتبر أشمل ما درسناه في المربعات شبه السحرية حيث نطلب فقط منه أن يكون شبه سحري ويحقق إضافة إلى ذلك المعادلتين: $a_{21}+a_{51}+=s,\ a_{12}+a_{15}=s$ ، حيث قمنا بتصميم برنامج لتعداد هذا النوع من المربعات وتصنيف خواصه الجبرية، وقد أوجدنا الشكل العام، وقمنا بتصنيف المربعات من خلال تقسيم بعض الخصائص واوجدنا مايزيد عن خمسة تريليون مربع شبه سحري.

نعتمد في الحسابات والبراهين على تطبيقات و نظريات وطرق الجبر الخطي، وبرامج حاسوبية، مصممة خصيصًا لحسابات المصفوفات.

Abstract

In this paper, we consider this type of the classical semi magic squares 6×6 having the four corner property, namely the semi squares, We list counting of this type . We present the general form of this type. We classified the set of squares according to their eigenvalues and determinant. We give an example to each class in our classification. In each example we give the basis of the nullspase of the square as well as the eigenvalues and the determinant of this square.

Our calculations and proofs are based on applying the theorems and methods of a linear algebra and computer programs, specially designed for matrix calculations.

Keywords: semi-magic squares, magic squares, characteristic polynomial, eigenvalues.

1- Introduction:

A magic square M is an n by n array of numbers whose rows, columns, and the two diagonals sum to S called the magic sum (magic constant). If all the diagonals including broken diagonals sum to S then the magic square is said to be pandiagonal.. If the entries of M are integers 1 through n^2 the magic sum S is $\frac{n(n^2+1)}{2}$ and M is said to be a classical magic square, The magic square have fascinated people since 2200 B.C , one such example of magic in numbers is the concept – of a magic square

4	9	2
3	5	7
8	1	6

Form (1)

This 3×3 magic square known as the (Chinese) Lo-shu square of the first nine consecutive integers is the smallest magic square and apart from rotations and reflections there are no others this size or smaller where the magic sum is 15 for n =3.

Semi-magic squares are square tables formed by different elements characterized by the sum of the elements in any row or column equal to a fixed amount called the magic constant. (1: ASHAB S., 2000).We studied such magic squares as matrices when studied, (2:ASHAB S., 1999: 248 -254), (3: ASHAB S., 2008, 21),(4:ASHAB S., 1998: 445-450).

Accordingly, we studied the algebraic properties by classification and counting, The study focused on type semi magic squares.

(5: NAKKAR., 2009) (6:MAYORAL., 308-313) , (7: KHAN.,1957: 261-263)

The ASHAB studied and count 5×5 semi magic squares using computer software (8:ASHAB., 2006).

Our research has focused on semi magic squares 6×6 having the four corner nested with semi magic squares 4×4 . Where we created the general form of the case semi-magical 6×6 nested with semi magic squares 4×4, with property of the four corners,

We have count this type of squares, and have used and computer software. (9:PALM.; J:2005) , (10:ALSHBOL:2004), And some programming languages that we produced semi-magic squares, we have designed several algorithms by classifying squares and studied at the heart of the subject Algebraic properties of each magic squares, we have linked each class of squares with a set of files to facilitate calculations and gain time.

(1-1): Important terms;

Definition:(1-1-1) Semi magic squares (11:AHMED., 2004)

Semi magic squares, when all row and column sums are constrained to have the same magic sum, The resultant matrices describe semi magic squares.

Definition:(1-1-2) Magic squares (1: ASHAB S., 2000).

Magic squares: if in addition to the above both the principal diagonal and the dexter diagonal also sum to S:

$$\sum_{i=1}^{n} a_{ii} = \sum_{i=1}^{n} a_{i,n-i+1} = S \qquad \text{for} \qquad j = 1,\ldots,n$$

We have a general magic square.

Definition:(1-1-3) four corner property;

It said for the semi magic square it satisfy the property of the four corners, if the sum of the elements placed in the four corners of any square 4×4 Inside it is equal $\frac{2}{3}S$, We'll use the following code in this search:

(1-1-4): Linear System of semi magic squares with four-corner property;6×6

Assume that $\lfloor a_{ij} \rfloor$ the matrix associated with the semi-magic square A. Then the semi-magic squares 6×6 with the property four corner are squares whose elements meet the following equations 1, 2, 3:

1- Rows equations $\sum_{i=1}^{6} a_{ij} = S \qquad j = 1,\ldots,6$

2- Columns equations $\sum_{j=1}^{6} a_{ij} = S \qquad i = 1,\ldots,6$

3- Four-corner property $\forall a_{ij}$ then $a_{ij} + a_{(i+3)(j+3)} + a_{i(j+3)} + a_{(i+3)j} = \frac{2}{3}S$

where $j \le 3$, $i \le 3$,

By solving these equations we get the general form of these squares.

(2-1): A semi magic squares 6 × 6 with four-corner property:

Theorem (2-1-1):

The following form is one of the forms of the semi magic square 6 × 6 with the property four corners: sfcsi.

x	f	D	t	c	y
z	j	n	$2s-n-q-j$	q	$s-z$
A	$c+f-m$	e	a	m	J
r	B	E	$2s-r-t-x$	$2s-m-q-k$	K
d	$2s-k-q-j$	$d-n+z$	H	k	$s-d$
g	$s-f$	F	I	$s-c$	h

Form (2)

$A = 3s - g - r - d - x - z,$
$B = k - f - c + m + q,$
$D = 3s - f - c - t - x - y,$
$E = g - a + h + r - 2s + t + 2x + y - e,$
$F = a + c - d + f - g - h - r + 2s - x - z,$
$H = j - d + n + q - z,$
$I = d - a + r - s + x + z,$
$J = d - c - a - f + g + r + x + z - e,$
$K = d - h + s - J + z - y.$

Proof:

Assume that $A = \lfloor a_{ij} \rfloor$ the matrix associated with the semi-magic square 6 × 6. with the property four corner , nested with the semi pandiagonal magicsquare 4×4 so that the following equations satisfy 1, 2, 3:

1- Rows equations $\sum_{i=1}^{6} a_{ij} = 3S \quad j = 1,...,6$

2- Columns equations $\sum_{j=1}^{6} a_{ij} = 3S \quad i = 1,...,6$

3- Four-corner property $\forall a_{ij}$ then $a_{ij} + a_{(i+3)(j+3)} + a_{i(j+3)} + a_{(i+3)j} = 2S$
where $j \leq 3, \ i \leq 3,$

Which

$a_{11} + a_{14} + a_{41} + a_{44} = 2s,$
$a_{12} + a_{15} + a_{42} + a_{45} = 2s,$
$a_{13} + a_{16} + a_{43} + a_{46} = 2s,$
$a_{21} + a_{24} + a_{51} + a_{54} = 2s,$
$a_{22} + a_{25} + a_{52} + a_{55} = 2s,$
$a_{23} + a_{26} + a_{53} + a_{56} = 2s,$
$a_{31} + a_{34} + a_{61} + a_{64} = 2s,$
$a_{32} + a_{35} + a_{62} + a_{65} = 2s,$
$a_{33} + a_{36} + a_{63} + a_{66} = 2s.$

To solve the previous linear equations system, consisting of 21 equations and 36 variable, we perform the following steps

1- We write the variable operators of equations as a matrix.
2- We enter the matrix with a Matlab program in the computer and we will code that matrix by a.
3- We find the matrix solution using the command: b = rref (a).
4- Rewrite the solution of the resulting equations from the computer.
5- Hence our form is made (2).

Transformations Preserving This Type of Squares (sfcsi)(2-1-2): These are the classic eight transformations, in addition to four transformations specific to this type:

A - Swap the second and fifth cells in both the first and last rows.
B - Swap the second and fifth cells in both the first and last columns.
C - Swap the first and fourth rows in the inner 4x4 square at the center.
D - Swap the first and fourth columns in the inner 4x4 square at the center.

Since the last transformations are independent of each other and independentof the previous

(2-2) Conclusions:
Calculate the number of sfcsi squares:
We have designed a program specifically for generating and calculating the number of semi-magic squares of this type, considering the previous formations to facilitate calculations and maintain the property of the square, as it is a semi-magic square with the property of having four equal corners. We managed to reduce the number of calculated squares by adhering to the following conditions:

$$z < d, f < c, q < j, q < k, q < 2s - k - q - j, x < h, x < y < g \ldots (1)$$

We divided the calculations for this type of squares into three classifications:

First Class(2-2-1):
Semi-magic squares with symmetrical corners, and we adhered to the following condition in this case:

$$h = s - x, \quad g = s - y$$

In this case, condition (1) translates to:

$$: z < d, f < c, q < j, q < k, q < 2s - k - q - j, 1 \le x < y \le 18$$

The results of counting these squares based on value x are shown in the following table:

X	Number	X	number	x	Number	x	number
1	9270363	5	8139574	9	5899081	13	3773111
2	9496185	6	7575885	10	5487324	14	3349655
3	8942201	7	7110499	11	4962236	15	2570921
4	8507031	8	6666887	12	4382607	16	1952371
						17	1027950

$$128 \times 99{,}113{,}881 = 12{,}686{,}576{,}768$$

Second Class(2-2-2):
Semi-magic squares with asymmetrical corners, and we adhered to the following condition in this case:

$$h \neq s - x, \quad h = 2s - x - y - g$$

In this case, condition (1) translates to:

$$z < d, f < c, q < j, q < k, q < 2s - k - q - j, 1 \leq x < y \leq 35$$

The results of counting these squares based on value x, y are shown in the following table:

X	y	number	x	y	number	x	Y	number
1	2	689320	2	12	3785503	3	24	4978293
1	3	893072	2	13	4399749	3	25	5276324
1	4	1284806	2	14	4528398	3	26	4572916
1	5	1309503	2	15	4901113	3	27	4752882
1	6	1817844	2	16	5417504	3	28	4333774
1	7	1969001	2	17	5825393	3	29	4052045
1	8	2384537	2	18	5467439	3	30	3848473
1	9	2672350	2	19	5544102	3	31	3924792
1	10	3034504	2	20	5531712	3	32	2662671
1	11	3228562	2	21	5137833	3	33	1842872

1	12	3721939	2	21	4971331	4	5	2454898
1	13	3720272	2	22	4901113	4	6	2605388
1	14	4262810	2	23	5544102	4	7	2782885
1	15	4948572	2	24	4895951	4	8	2898902
1	16	5187158	2	25	4624475	4	9	3633540
1	17	5498590	2	26	5055652	4	10	3711760
1	18	5833992	2	27	4297204	4	11	3957548
1	19	6427179	2	28	4662613	4	12	4299296
1	20	5691260	2	29	4193050	4	13	4431829
1	21	5400578	2	30	4030667	4	14	4645774
1	21	5400578	2	31	3605371	4	15	5281452
1	22	5136157	2	32	3684136	4	16	5649967
1	23	4875295	2	33	3220581	4	17	5449356
1	24	5046289	2	34	2025674	4	18	5336846
1	25	5065163	3	4	1834126	4	19	5678468
1	26	4734037	3	5	1845699	4	20	5143758
1	27	4935683	3	6	2412423	4	21	5331958
1	28	4295235	3	7	2689605	4	22	4951082
1	29	4351436	3	8	2904183	4	23	4758193
1	30	4117285	3	9	3092335	4	24	5162866
1	31	4005243	3	10	3482359	4	25	4441780
1	32	3467736	3	11	3621871	4	26	4483742
1	33	3422164	3	12	4031128	4	27	4275457
1	34	2754516	3	13	4461283	4	28	4125759
1	35	2346744	3	14	4538529	4	29	4086632
2	3	1255078	3	15	5280160	4	30	3271415
2	4	1539175	3	16	5554491	4	31	2329705
2	5	1851348	3	17	5965462	4	32	1573908
2	6	1951188	3	18	5251635	5	6	2917555
2	7	2380448	3	19	5889214	5	7	3034341
2	8	2676803	3	20	5471698	5	8	3488750
2	9	2777327	3	21	5046012	5	9	3394348
2	10	3148062	3	22	5101447	5	10	3934380
2	11	3640376	3	23	4726552	5	11	4317849
5	12	4292476	7	12	5068488	9	20	5097563

5	13	4900051	7	13	5428614	9	21	4166984
5	14	5856236	7	14	5683774	9	22	4204087
5	15	5783581	7	15	5996915	9	23	3618566
5	16	6089170	7	16	5685810	9	24	3014193
5	17	5465145	7	17	5149791	9	25	2659566
5	18	5224052	7	18	5392066	9	26	1952437
5	19	5409285	7	19	5572207	9	27	1404296
5	20	5181590	7	20	5495201	10	11	6284762
5	21	4959222	7	21	5167266	10	12	6301709
5	22	4768440	7	22	5201767	10	13	6534298

5	23	4712734	7	23	5198359	10	14	6201895
5	24	4792739	7	24	4417643	10	15	5931617
5	25	5027415	7	25	3875163	10	16	5611391
5	26	4609222	7	26	3257497	10	17	5414834
5	27	4503980	7	27	2768986	10	18	5324441
5	28	3687639	7	28	2071598	10	19	4656964
5	29	3030049	7	29	1445944	10	20	4064597
5	30	2312262	8	9	4670164	10	21	3804323
5	31	1577404	8	10	4804558	10	22	3540679
6	7	3651144	8	11	5319588	10	23	2751248
6	8	3645902	8	12	5529494	10	24	2462527
6	9	3884506	8	13	5671944	10	25	1898046
6	10	4080883	8	14	5814304	10	26	1296320
6	11	4306889	8	15	5838977	11	12	6245175
6	12	4915554	8	16	5691800	11	13	6570197
6	13	5129501	8	17	5681260	11	14	6321894
6	14	5214634	8	18	5572776	11	15	5777130
6	15	5867843	8	19	5211793	11	16	5510311
6	16	5809333	8	20	5339196	11	17	5081419
6	17	5586624	8	21	4997833	11	18	4618688
6	18	5406795	8	22	4818679	11	19	4203981
6	19	5443433	8	23	4163053	11	20	3769697
6	20	4941422	8	24	3648421	11	21	3624499
6	21	4974910	8	25	3040498	11	22	2980986

6	22	5133979	8	26	2670054	11	23	2397337
6	23	5123514	8	27	2045097	11	24	1897123
6	24	5022216	8	28	1370962	11	25	1378746
6	25	4592014	9	10	5271921	12	13	7037475
6	26	4060252	9	11	5713944	12	14	5945958
6	27	3352601	9	12	5756000	12	15	5347475
6	28	2866843	9	13	5969094	12	16	4805283
6	29	2114359	9	14	6133690	12	17	4469172
6	30	1396250	9	15	5730875	12	18	3800258
7	8	4003153	9	16	5662201	12	19	3884563
7	9	4417629	9	17	5346378	12	20	2807139
7	10	4532736	9	18	5307857	12	21	2972146
7	11	4752311	9	19	5874254	12	22	2381369
12	23	1741584	13	23	1286182	15	18	2919429
12	24	1087254	14	15	4602952	15	19	1958926
13	14	5354949	14	16	3881998	15	20	2003359
13	15	4875471	14	17	4033770	15	21	1381548
13	16	4454915	14	18	2737733	16	17	2942170
13	17	3566262	14	19	2809005	16	18	1844601
13	18	3825576	14	20	2511380	16	19	1674510
13	19	2974650	14	21	1893634	16	20	1237474
13	20	2818028	14	22	1142784	17	18	2192170
13	21	2458501	15	16	3895092	17	19	1550296
13	22	1897214	15	17	2658580			

We note that squares with asymmetrical corners in the second class meet the sum condition similar to those with symmetrical corners in the first class, in addition to their specific conditions.

$$128 \times 46{,}408{,}229 = 160{,}677{,}829{,}632$$

Third Class(2-2-3):

Semi-magic squares 6×6 with the property of having four corners and not belonging to either the first or second categories, and we adhered to the following condition in this case:

$$h \neq s - x, \quad h \neq 2s - x - y - g$$

In this case, condition (1) translates to:

$$z < d, f < c, q < j, q < k, q < 2s - k - q - j, 1 \le x < y \le 35$$

The results of counting these squares based on value x, y are shown in the following table:

X	y	number	x	y	number	x	y	number
1	2	126228286	1	33	45098628	2	31	60668400
1	3	147153080	1	34	31522321	2	32	50624692
1	4	130968121	1	35	18531350	2	33	38625749
1	5	145109966	2	3	131554700	2	34	28913982
1	6	142407914	2	4	150887708	2	35	18408386
1	7	154638608	2	5	142647932	3	4	141287633
1	8	153096119	2	6	156327417	3	5	150636316
1	9	167990657	2	7	151298977	3	6	149513382
1	10	158699830	2	8	160756162	3	7	164688146
1	11	170960742	2	9	155801001	3	8	160266533
1	12	169531340	2	10	169172838	3	9	164040454
1	13	170053202	2	11	161527417	3	10	161009846
1	14	169763904	2	12	171684235	3	11	166922602
1	15	181053431	2	13	167893076	3	12	157896535
1	16	166434234	2	14	172879948	3	13	168595281
1	17	169768357	2	15	165638793	3	14	160068478
1	18	161193374	2	16	169197207	3	15	168320782
1	19	184415993	2	17	160585403	3	16	159660945
1	20	168495802	2	18	167555233	3	17	158028328
1	21	164006459	2	19	165276368	3	18	152712311
1	22	153308047	2	20	158316399	3	19	166997147
1	23	149418018	2	21	148855372	3	20	153137664
1	24	141603106	2	22	148293269	3	21	145823607
1	25	131483249	2	23	134270434	3	22	138292949
1	26	120342000	2	24	127774955	3	23	132337400
1	27	115377278	2	25	118094056	3	24	120402860
1	28	100369157	2	26	114200057	3	25	116581013
1	29	93093959	2	27	101123566	3	26	103640914
1	30	80435906	2	28	95690577	3	27	97902362

1	31	69763843	2	29	81632131	3	28	85149296
1	32	56491144	2	30	73396641	3	29	74824159
3	30	63799839	5	17	148012207	7	8	160275783
3	31	56607444	5	18	141875386	7	9	166631477
3	32	45370076	5	19	147088345	7	10	156475991
3	33	35728057	5	20	133691383	7	11	158982621
3	34	32023368	5	21	129660481	7	12	151538860
3	35	10325035	5	22	120632798	7	13	150588312
4	5	151522942	5	23	108623999	7	14	145556306
4	6	161584609	5	24	103889022	7	15	143491820
4	7	152813560	5	25	98745749	7	16	138187079
4	8	158800881	5	26	86556059	7	17	132435644
4	9	163168557	5	27	80430633	7	18	131939325
4	10	165356568	5	28	71940494	7	19	135084890
4	11	160098108	5	29	62874245	7	20	125804728
4	12	166223965	5	30	53579083	7	21	118030448
4	13	155232980	5	31	45885992	7	22	110535046
4	14	156912281	5	32	51709204	7	23	101150604
4	15	154057105	5	33	24406002	7	24	92551583
4	16	151884007	5	34	15726495	7	25	85062499
4	17	151601482	5	35	7958656	7	26	76048502
4	18	151986217	6	7	162458903	7	27	68985908
4	19	151685445	6	8	165392099	7	28	59317930
4	20	144209088	6	9	156087416	7	29	52238671
4	21	138127073	6	10	161471657	7	30	64416502
4	22	132621448	6	11	153810971	7	31	32797689
4	23	120001699	6	12	159580487	7	32	25315120
4	24	113133674	6	13	152560156	7	33	19007047
4	25	100725734	6	14	149853718	7	34	11813805
4	26	95516116	6	15	144106520	7	35	6192086
4	27	84912239	6	16	149829116	8	9	158414097
4	28	76178266	6	17	142267645	8	10	157846796
4	29	67346701	6	18	141723822	8	11	155029863
4	30	59591008	6	19	137206096	8	12	152636927
4	31	48752772	6	20	128742123	8	13	145024162

4	32	41078916	6	21	119520937	8	14	141656412
4	33	43277772	6	22	119670040	8	15	140025670
4	34	18050415	6	23	106237669	8	16	137646488
4	35	8864718	6	24	98511015	8	17	129571732
5	6	155017321	6	25	87533201	8	18	129319778
5	7	160653335	6	26	82215986	8	19	122186386
5	8	155106725	6	27	73288116	8	20	115010462
5	9	158691804	6	28	66607036	8	21	106408503
5	10	160634237	6	29	55557974	8	22	101577565
5	11	169696620	6	30	49201950	8	23	92818273
5	12	153661700	6	31	58678370	8	24	85591509
5	13	158869453	6	32	28530081	8	25	76511537
5	14	157775977	6	33	20772597	8	26	69940157
5	15	156306548	6	34	13965239	8	27	62533812
5	16	147357548	6	35	6958243	8	28	55237915
8	29	68805656	10	26	58829374	12	27	37208282
8	30	36072592	10	27	76119039	12	28	33232801
8	31	28550849	10	28	41341857	12	29	26635059
8	32	23103010	10	29	34433510	12	30	22305812
8	33	16476619	10	30	28904121	12	31	16991197
8	34	10600114	10	31	22709725	12	32	13310068
8	35	5262541	10	32	17386577	12	33	9148397
9	10	154805492	10	33	12462911	12	34	5970622
9	11	156393335	10	34	8184370	12	35	2608333
9	12	144099639	10	35	3809456	13	14	116977406
9	13	144759842	11	12	135669824	13	15	114426488
9	14	134983702	11	13	132907995	13	16	103055325
9	15	130265564	11	14	127962644	13	17	98902970
9	16	128250483	11	15	124612408	13	18	95685061
9	17	122661087	11	16	117874825	13	19	91585231
9	18	115869867	11	17	114364706	13	20	84927318
9	19	122761431	11	18	108153083	13	21	77979468
9	20	112134281	11	19	108024474	13	22	68955590
9	21	103683051	11	20	97142048	13	23	62008671
9	22	96932416	11	21	89576261	13	24	82441794

9	23	88308817	11	22	83352448	13	25	44512679
9	24	79003121	11	23	75539291	13	26	40463118
9	25	73163388	11	24	68635556	13	27	34048109
9	26	63136775	11	25	62040312	13	28	28610819
9	27	57625324	11	26	79228941	13	29	23655758
9	28	73027583	11	27	42537768	13	30	19267248
9	29	38594748	11	28	36028827	13	31	15057217
9	30	31552437	11	29	30454050	13	32	10982224
9	31	26457931	11	30	25367141	13	33	7984445
9	32	19841067	11	31	20259261	13	34	4730310
9	33	14058748	11	32	14797691	13	35	2269865
9	34	9266320	11	33	11027067	14	15	107234430
9	35	4499372	11	34	6950178	14	16	101650698
10	11	149821301	11	35	3279844	14	17	94141576
10	12	149036555	12	13	132346022	14	18	89851576
10	13	138820040	12	14	126961753	14	19	84463798
10	14	139151449	12	15	117517902	14	20	74626896
10	15	129323750	12	16	113974566	14	21	69590654
10	16	124632669	12	17	105839030	14	22	63614597
10	17	116562579	12	18	102768923	14	23	84034890
10	18	118884483	12	19	99819355	14	24	46207068
10	19	108966266	12	20	90421209	14	25	40165645
10	20	104351311	12	21	82514473	14	26	35407163
10	21	96239796	12	22	77430924	14	27	29315807
10	22	89195012	12	23	67158486	14	28	25485361
10	23	78058571	12	24	60113499	14	29	20524846
10	24	73415720	12	25	80613193	14	30	16706864
10	25	64249647	12	26	45569544	14	31	12784888
14	32	9233776	17	23	35336203	20	23	26815460
14	33	6744509	17	24	32243157	20	24	22824682
14	34	4128199	17	25	27630091	20	25	19360294
14	35	1800980	17	26	22997139	20	26	16064932
15	16	94725308	17	27	19705137	20	27	13028190
15	17	87389091	17	28	16033600	20	28	10340736
15	18	81660447	17	29	12398630	20	29	8159505

15	19	80532586	17	30	10077142	20	30	5933315
15	20	70831624	17	31	7463199	20	31	4573890
15	21	63375666	17	32	5317834	20	32	3165373
15	22	86198557	17	33	3596299	20	33	1922694
15	23	46819079	17	34	2091822	20	34	1077150
15	24	40921728	17	35	900719	20	35	432690
15	25	36925465	18	19	88413882	21	22	26631246
15	26	31097440	18	20	43784387	21	23	22800123
15	27	26562335	18	21	40933220	21	24	18532085
15	28	21967586	18	22	37395978	21	25	16382411
15	29	17653613	18	23	31488568	21	26	12863465
15	30	14222391	18	24	27519621	21	27	10996306
15	31	11034989	18	25	23813135	21	28	8365389
15	32	7855668	18	26	20212015	21	29	6714024
15	33	5564672	18	27	16087232	21	30	4840243
15	34	3210870	18	28	13812241	21	31	3619255
15	35	1433804	18	29	10396585	21	32	2398918
16	17	80999783	18	30	8399142	21	33	1532149
16	18	76435251	18	31	6247214	21	34	876638
16	19	71515804	18	32	4561681	21	35	353789
16	20	63255913	18	33	2963289	22	23	19029480
16	21	86107235	18	34	1774166	22	24	16649834
16	22	46705544	18	35	726237	22	25	13139448
16	23	41238533	19	20	48762569	22	26	10898690
16	24	36984404	19	21	43669958	22	27	8880265
16	25	31292774	19	22	36490200	22	28	6857068
16	26	26940621	19	23	32765622	22	29	5316847
16	27	22863098	19	24	27582087	22	30	3953489
16	28	18919193	19	25	23490488	22	31	2757808
16	29	14807467	19	26	19247445	22	32	1977405
16	30	12205527	19	27	16824409	22	33	1182427
16	31	8997135	19	28	12431356	22	34	679237
16	32	6797347	19	29	10352084	22	35	237588
16	33	4621448	19	30	7611890	23	24	12553213
16	34	2668808	19	31	5841076	23	25	10701381

16	35	1144932	19	32	3897683	23	26	8118598
17	18	69310359	19	33	2525775	23	27	6966087
17	19	61311788	19	34	1329387	23	28	4905393
17	20	87605504	19	35	561700	23	29	3872509
17	21	46654971	20	21	35831132	23	30	2806074
17	22	41591871	20	22	31500209	23	31	2036989
23	32	1392187	25	32	706689	28	29	719570
23	33	832139	25	33	453516	28	30	519542
23	34	425461	25	34	210246	28	31	339361
23	35	166979	25	35	73794	28	32	204089
24	25	8521478	26	27	2793837	28	33	112049
24	26	6638940	26	28	2174346	28	34	40211
24	27	5290931	26	29	1570746	28	35	2834
24	28	4116958	26	30	1149955	29	30	312910
24	29	3042571	26	31	797313	29	31	214434
24	30	2268117	26	32	512065	29	32	113597
24	31	1600509	26	33	296191	29	33	65646
24	32	1047703	26	34	126186	29	34	24462
24	33	627415	26	35	29813	29	35	6222
24	34	313209	27	28	1524128	30	31	102691
24	35	93624	27	29	1129062	30	32	51232
25	26	4812076	27	30	791987	30	33	27945
25	27	3997996	27	31	565305	30	34	6936
25	28	2888305	27	32	335053	30	35	0
25	29	2225902	27	33	207953	31	32	12462
25	30	1597980	27	34	89542	31	33	4558
25	31	1131917	27	35	20795	31	34	0
						31	35	0

We conclude that the number of squares with asymmetrical corners in the third class is:

$$128 \times 41,015,102,653 = 5,249,933,139,584$$

Thus, the total number of squares in the first, second, and third categories of type sfcsi is:

$$5,249,933,139,584 + 12,686,576,768 + 160,677,829,632 = 5,423,297,545,984$$

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