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ENERGY MATRICES OF THE f^5 ELECTRON CONFIGURATION

Berkeley, California

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Lawrence Radiation Laboratory
Berkeley, California

October 15, 1962

ERRATUM

TO: All recipients of UCRL-10448

FROM: Technical Information Division

SUBJECT: UCRL-10448, "Energy Matrices of the f^5 Electron Configuration," by E. G. Wybourne, September 1962.

Since the completion of this report C. W. Nielson[7] has informed the author that he has now calculated the electrostatic matrices of all the f^n configurations. In the light of his calculations, the following corrections should be made:

Page 9.	14	13	3	546	11	E3
Page 14.	9	8	3	546	11	E3
Page 29.	26	25	12	455	1	E2
Page 36.	16	15	12	455	1	E2
Page 44.	19	17	-21	163438	253	E3
Page 49.	11	9	-21	163438	253	E3.

Research and Development

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ENERGY MATRICES OF THE f^5 ELECTRON CONFIGURATION

B. G. Wybourne

September 1962

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ENERGY MATRICES OF THE f^5 ELECTRON CONFIGURATION

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University of California
Berkeley, California

September 1962

ABSTRACT

The complete electrostatic and spin-orbit matrices of the f^5 electron configuration have been calculated and are presented in a tabulated form.

†Address after December 1, 1962: Division of Chemistry, Argonne National Laboratory, Lemont, Illionis.

ENERGY MATRICES OF THE f^5 ELECTRON CONFIGURATION

B. G. Wybourne

Lawrence Radiation Laboratory
University of California
Berkeley, California

September 1962

Introduction

In a recent paper[1] the calculation of the complete spin-orbit matrices for the f^5 electron configuration was reported. In an earlier paper[2] the complete electrostatic matrices were presented. Using the results of these calculations it has been possible to construct the energy matrices of the f^5 configuration. These energy matrices have been applied to the analysis of the crystal spectra of trivalent samarium, dysprosium[3] and plutonium ions.[4] To permit a wider usage of these energy matrices they have been tabulated by a direct print-out of the matrix elements which were checked and stored on punched cards. The results are given in this report.

THE ENERGY MATRICES

The states of the f^5 configuration have been labeled using the group theoretical classification of Racah.[5] The labeling of the states is performed by introducing two groups which provide two additional sets of quantum numbers W and U. The first is a set of three integral numbers $W \equiv (w_1 w_2 w_3)$ with $w_1 \geqslant w_2 \geqslant w_3 \geqslant 0$ and all $w \leqslant 2$, while the second is a set of two integers $U \equiv (u_1, u_2)$ with $2 \geqslant u_1 \geqslant u_2 \geqslant 0$. By specifying the quantum numbers WUSL all the states of the f^5 configuration are distinctly labeled with the exception of some of the states labeled with $U \equiv (31)$ and $U \equiv (40)$ where the same LS label occurs twice.[6] These states can only be separated in an arbitrary manner and in this we shall follow the separation made by Racah and in the tabulation of the matrix elements indicate one of the doubly occuring states with an asterisk.

The matrix elements of electrostatic interaction are expressed in terms of the parameters E^o, E^1, E^2, and E^3, which have been defined by Racah[5] in terms of the Slater radial F_k integrals as follows:

$$E^o = F_o - 10F_2 - 33F_4 - 286F_6$$

$$E^1 = (70F_2 + 231\,F_4 + 2002F_6)/9$$

$$E^2 = (F_2 - 3F_4 + 7F_6)/9$$

$$E^3 = (5F_2 + 6F_4 - 91F_6)/3$$

The energy contribution involving the parameter E^o is a constant for all terms of a given f^n configuration and is omitted from the tabulation. The coefficient associated with E^o for a given f^n configuration is given by the general expression:

$$e_o = n(n - 1)/2$$

Checking procedures for the electrostatic matrices have been given in an earlier paper.[2] Recently Nielson and Nutter[7] have checked the tables of Racah's paper[5] from which these matrix elements were evaluated and found one misprint. In table V1b of Racah paper the entry $(30|X(K^*)|31)$ should read $72(1122/23)^{1/2}$. The matrix element $(f^n(221)(30)K|e_2|f^n(221)(31)K^*)$ apart from the phase, should be $216(2346)^{1/2}/46$. This one matrix element in the f^5, f^6, and f^7 electrostatic energy matrices must be corrected in the earlier tabulations.[2,8]

The spin-orbit matrices were completely checked out by diagonalization of the matrices and requiring that the eigenvalues calculated in jj coupling be reproduced.[3]

TABULATION OF THE MATRICES

As the energy matrices are real and symmetric only the diagonal elements and the lower half of the off-diagonal elements are reproduced. The first entry is the J value of the energy matrix and immediately below it is the rank of the matrix. In the first and second columns of the tabulation the row and column in which the particular matrix element occurs is specified. The phase of the matrix element is given immediately after the column number (where no phase is indicated it is to be taken as positive). The actual matrix elements are given in the form $a\sqrt{b/d}$ where a is in column three the b in column four and d in column five. The matrices of the coefficients of the parameters are presented in the sequence E^1, E^2, E^3 and ZETA where ZETA represents the spin-orbit parameter ζ_f. As the coefficients of E^1 are diagonal in the WUSL scheme the Racah classification has been specified along side of the matrix elements of E^1. Only the non-zero matrix elements have been tabulated.

ACKNOWLEDGMENTS

These matrices were largely calculated during the authors researches at the University of Canterbury and at the Johns Hopkins University. The work performed at Johns Hopkins University was done with partial support from the U. S. Air Force Office of Scientific Research.

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J = 1/2 ENERGY MATRIX OF F5

10	RANK OF MATRIX					
1	1+	5	1	1	211,11,4P	E1
2	2+	5	1	1	211,30,4P	
3	3+	8	1	1	221,11,2P	
4	4+	8	1	1	221,30,2P	
5	5+	8	1	1	221,31,2P	
6	6+	12	1	1	210,11,2P	
7	7+	5	1	1	211,20,4D	
8	8+	5	1	1	211,21,4D	
9	9+	9	1	1	111,20,4D	
10	10+	0	1	1	110,10,6F	
2	1	390	11	3		E2
2	2	104	1	1		
4	3-	312	110	12		
4	4	26	1	1		
5	3+	6	1430	1		
5	4+	456	13	4		
5	5-	302	1	1		
7	7+	1144	1	7		
8	7+	156	66	7		
8	8-	1781	1	7		
10	10+	0	1	1		
1	1+	44	1	3		E3
2	1-	5	11	3		
2	2-	14	1	3		
3	3+	121	1	6		
4	3-	5	110	12		
4	4+	193	1	12		
5	3-	1	1430	4		
5	4+	17	13	4		
5	5+	143	1	4		
6	3-	33	2	2		
6	4+	3	55	2		
6	5-	3	715	2		
6	6+	22	1	1		
7	7+	22	1	7		
8	7+	10	66	7		
8	8+	202	1	7		
9	7-	33	7	7		
9	8+	6	462	7		
10	10+	0	1	1		
1	1-	1	1	18		ZETA
2	1-	5	11	18		
2	2-	5	1	18		
3	1	1	5	9		
3	2	1	55	18		
3	3	7	1	18		
4	1	5	22	18		
4	2	1	2	36		
4	3-	1	110	18		
4	4-	11	1	36		
5	2	1	26	4		
5	4	1	13	4		
5	5-	11	1	4		

6	1-	1	10	12
6	2	1	110	12
6	3-	1	2	6
6	4	1	55	3
7	1	5	7	12
7	2	1	77	84
7	3-	1	35	12
7	4	1	154	24
7	5-	1	2002	56
7	6-	1	70	4
7	7-	3	1	28
8	2	1	42	7
8	4-	1	21	2
8	5	1	273	14
8	7-	1	66	14
8	8	5	1	14
9	1	1	1	12
9	2-	1	11	12
9	3	1	5	12
9	4-	1	22	24
9	5-	1	286	8
9	6-	1	10	4
9	7	3	7	28
9	8	1	462	14
9	9-	3	1	4
10	7-	3	21	7
10	8	1	154	7
10	9-	1	3	1
10	10-	2	1	1

J = 3/2 ENERGY MATRIX OF F5

21 RANK OF MATRIX

1	1+	9	1	1	111,00,4S	E1
2	2	0	1	1	110,11,6P	
3	3+	5	1	1	211,11,4P	
4	4+	5	1	1	211,30,4P	
5	5+	8	1	1	221,11,2P	
6	6+	8	1	1	221,30,2P	
7	7+	8	1	1	221,31,2P	
8	8+	12	1	1	210,11,2P	
9	9+	5	1	1	211,20,4D	
10	10+	5	1	1	211,21,4D	
11	11+	9	1	1	111,20,4D	
12	12+	8	1	1	221,20,2D	
13	13+	8	1	1	221,21,2D	
14	14+	8	1	1	221,31,2D	
15	15+	12	1	1	210,20,2D	
16	16+	12	1	1	210,21,2D	
17	17	0	1	1	110,10,6F	
18	18+	5	1	1	211,10,4F	
19	19+	5	1	1	211,21,4F	
20	20+	5	1	1	211,30,4F	
21	21+	9	1	1	111,10,4F	
4	3+	130	11	1		E2
4	4+	104	1	1		
6	5-	312	110	12		
6	6+	26	1	1		
7	5+	6	1430	1		
7	6+	456	13	4		
7	7-	302	1	1		
9	9+	1144	1	7		
10	9+	156	66	7		
10	10-	1781	1	7		
12	12+	286	1	7		
13	12+	780	3	7		
13	13-	3055	1	77		
14	12-	216	182	7		
14	13-	180	546	77		
14	14+	2396	1	11		
15	15-	858	1	7		
16	15-	468	33	7		
16	16+	1131	1	7		
19	19-	65	1	1		
20	18+	20	143	1		
20	19-	72	195	3		
20	20-	76	1	1		
21	21+	0	1	1		
2	2	33	1	1		E3
3	3+	44	1	3		
4	3-	5	11	3		
4	4-	14	1	3		
5	5+	121	1	6		
6	5-	5	110	12		
6	6	193	1	12		
7	5-	1	1430	4		

7	6+	17	13	4
7	7+	143	1	4
8	5-	33	2	2
8	6+	3	55	2
8	7-	3	715	2
8	8+	22	1	1
9	9+	22	1	7
10	9+	10	66	7
10	10+	202	1	7
11	9-	33	7	7
11	10	6	462	7
12	12-	44	1	7
13	12-	22	3	7
13	13+	911	1	77
14	13+	3	546	77
14	14+	269	1	11
15	12-	33	1	7
15	13-	132	3	7
15	15+	132	1	7
16	12-	18	33	7
16	13-	171	11	77
16	14+	9	6006	11
16	15-	12	33	7
16	16	183	1	7
19	18-	1	165	3
19	19+	3	1	1
20	19-	2	195	3
20	20+	42	1	1
21	19+	9	11	1
21	21+	0	1	1
2	1	1	6	2
2	2-	7	1	10
3	1	1	6	1
3	2-	3	1	20
3	3-	1	1	45
4	2-	3	11	4
4	3-	1	11	9
4	4-	1	1	9
5	1-	1	3	1
5	3	5	2	18
5	4	5	22	36
5	5-	7	1	36
6	3	5	55	18
6	4	1	5	36
6	5	1	110	36
6	6	11	1	72
7	4	1	65	4
7	6-	1	13	8
7	7	11	1	8
8	1-	1	6	2
8	3-	5	1	12
8	4	5	11	12
8	5	1	2	12
8	6-	1	55	6

ZETA

9	3	1	35	3
9	4	1	385	105
9	5-	1	70	24
9	6	1	77	24
9	7-	1	1001	56
9	8-	1	35	4
9	9-	1	1	14
10	4	4	210	35
10	6-	1	42	4
10	7	1	546	28
10	9-	1	66	21
10	10	5	1	21
11	2-	3	5	10
11	3	1	5	15
11	4-	1	55	15
11	5	1	10	24
11	6-	1	11	24
11	7-	1	143	8
11	8-	1	5	4
11	9	1	7	14
11	10	1	462	21
11	11-	1	1	2
12	3-	1	35	12
12	4-	1	385	420
12	5	7	70	24
12	6	5	77	168
12	7	1	1001	56
12	8	1	35	4
12	9	1	1	28
12	10	1	66	42
12	11-	1	7	28
12	12-	1	1	14
13	4	1	1155	385
13	6-	31	231	308
13	7	1	3003	308
13	9-	43	3	42
13	10	17	22	231
13	11	1	21	42
13	12	23	3	42
13	13	955	1	924
14	4	3	1430	110
14	6	3	286	44
14	7	3	22	44
14	9	1	182	28
14	10	1	3003	462
14	11	1	26	4
14	12	1	182	28
14	13-	1	546	924
14	14-	1	1	22
15	3	1	35	12
15	4	1	385	420
15	5-	1	70	24
15	6-	11	77	168
15	7	1	1001	56
15	8	1	35	4
15	9-	13	1	28

15	10	4	66	21
15	11	1	7	28
15	12	2	1	7
15	13	17	3	21
15	14	1	182	28
15	15-	1	1	14
16	4-	3	105	35
16	6	3	21	28
16	7	3	273	28
16	9-	1	33	14
16	10	3	2	7
16	11-	1	231	14
16	12-	1	33	14
16	13	9	11	308
16	14-	1	6006	308
16	15	1	33	7
16	16-	19	1	28
17	9-	6	105	35
17	10	2	770	35
17	11-	2	15	5
17	17-	17	1	10
18	9-	8	70	105
18	10-	1	1155	630
18	11-	1	10	15
18	12	13	70	42
18	13	11	210	252
18	15	5	70	42
18	16	1	2310	84
18	17	1	6	10
18	18	23	1	15
19	10-	1	7	3
19	13	1	154	66
19	14-	2	429	33
19	16	1	14	2
19	17	1	110	10
19	18	1	165	90
19	19-	2	1	1
20	9-	1	10010	210
20	10-	1	1365	315
20	11	1	1430	30
20	12-	1	10010	210
20	13	1	30030	6930
20	14-	7	55	55
20	15	1	10010	210
20	16-	1	2730	210
20	19-	1	195	9
20	20-	2	1	3
21	9-	1	42	7
21	10-	1	77	14
21	12	1	42	14
21	13-	11	14	28
21	15-	3	42	14
21	16	1	154	28
21	17-	3	10	10
21	18-	1	15	5

21	19	1	11	2
21	21-	1	1	1

J = 5/2 ENERGY MATRIX OF F5

28 RANK OF MATRIX

1	1	0	1	1	110,11,6P	E1
2	2+	5	1	1	211,11,4P	
3	3+	5	1	1	211,30,4P	
4	4+	5	1	1	211,20,4D	
5	5+	5	1	1	211,21,4D	
6	6+	9	1	1	111,20,4D	
7	7+	8	1	1	221,20,2D	
8	8+	8	1	1	221,21,2D	
9	9+	8	1	1	221,31,2D	
10	10+	12	1	1	210,20,2D	
11	11+	12	1	1	210,21,2D	
12	12	0	1	1	110,10,6F	
13	13+	5	1	1	211,10,4F	
14	14+	5	1	1	211,21,4F	
15	15+	5	1	1	211,30,4F	
16	16+	9	1	1	111,10,4F	
17	17+	8	1	1	221,10,2F	
18	18+	8	1	1	221,21,2F	
19	19+	8	1	1	221,30,2F	
20	20+	8	1	1	221,31,2F	
21	21+	8	1	1	221,31,2F*	
22	22	12	1	1	210,21,2F	
23	23	18	1	1	100,10,2F	
24	24+	5	1	1	211,20,4G	
25	25+	5	1	1	211,21,4G	
26	26+	5	1	1	211,30,4G	
27	27+	9	1	1	111,20,4G	
28	28+	0	1	1	110,11,6H	
3	2+	130	11	1		E2
3	3+	104	1	1		
4	4+	1144	1	7		
5	4+	156	66	7		
5	5-	1781	1	7		
7	7+	286	1	7		
8	7+	780	3	7		
8	8-	3055	1	77		
9	7-	216	182	7		
9	8-	180	546	77		
9	9+	2396	1	11		
10	10-	858	1	7		
11	10-	468	33	7		
11	11+	1131	1	7		
14	14-	65	1	1		
15	13+	20	143	1		
15	14-	72	195	3		
15	15-	76	1	1		
18	18-	1495	1	11		
19	17+	5	143	1		
19	18+	720	4290	132		
19	19-	19	1	1		
20	18-	936	10	11		
20	19-	72	429	11		
20	20+	2210	1	11		

21	17-	15	429	1
21	18	144	1430	44
21	19-	147	3	1
21	20	168	143	11
21	21-	41	1	1
22	22	195	1	1
24	24-	1040	1	7
25	24-	48	2145	21
25	25	3267	1	21
26	24	52	15	1
26	25-	48	143	3
26	26	312	1	3
28	28	0	1	1
1	1	33	1	1
2	2	44	1	3
3	2-	5	11	3
3	3-	14	1	3
4	4	22	1	7
5	4	10	66	7
5	5	202	1	7
6	4-	33	7	7
6	5	6	462	7
7	7-	44	1	7
8	7-	22	3	7
8	8	911	1	77
9	8	3	546	77
9	9	269	1	11
10	7-	33	1	7
10	8-	132	3	7
10	10	132	1	7
11	7-	18	33	7
11	8-	171	11	77
11	9	9	6006	11
11	10-	12	33	7
11	11	183	1	7
14	13-	1	165	3
14	14	3	1	1
15	14-	2	195	3
15	15	42	1	1
16	14	9	11	1
18	17	43	30	30
18	18	240	1	11
19	18	29	4290	132
19	19	24	1	1
20	17	4	3	1
20	18-	9	10	11
20	19-	4	429	11
20	20	442	1	11
21	18-	3	1430	44
21	19	6	3	1
21	20-	20	143	11
21	21	12	1	1
22	17	3	330	10
22	18	27	11	11
22	19-	3	390	4

E3

22	20-	27	110	11
22	21-	9	130	4
22	22	6	1	1
23	18	36	5	5
23	20-	36	2	1
23	22-	12	55	5
24	24	8	1	7
25	24	5	2145	21
25	25	11	1	21
26	24	4	15	3
26	25	2	143	3
26	26	22	1	3
27	24-	12	7	7
27	25	1	15015	7
27	26-	4	105	1
28	28-	9	1	1
1	1-	1	1	5
2	1-	1	14	20
2	2	1	1	30
3	1-	1	154	4
3	2	1	11	6
3	3	1	1	6
4	2	7	15	12
4	3	1	165	60
4	4-	1	1	84
5	3	3	10	5
5	4-	1	66	126
5	5	5	1	126
6	1-	3	30	10
6	2	1	105	60
6	3-	1	1155	60
6	4	1	7	84
6	5	1	462	126
6	6-	1	1	12
7	2-	1	210	12
7	3-	1	2310	420
7	4	1	14	84
7	5	1	231	63
7	6-	1	2	12
7	7	1	1	21
8	3	3	770	385
8	4-	43	42	126
8	5	34	77	693
8	6	1	6	18
8	7-	23	3	63
8	8-	955	1	1386
9	3	3	2145	55
9	4	1	13	6
9	5	1	858	198
9	6	1	91	6
9	7-	1	182	42
9	8	1	546	1386
9	9	1	1	33
10	2	1	210	12
10	3	1	2310	420

ZETA

10	4-	13	14	84
10	5	8	231	63
10	6	1	2	12
10	7-	4	1	21
10	8-	34	3	63
10	9-	1	182	42
10	10	1	1	21
11	3-	9	70	35
11	4-	1	462	42
11	5	2	7	7
11	6-	1	66	6
11	7	1	33	21
11	8-	3	11	154
11	9	1	6006	462
11	10-	2	33	21
11	11	19	1	42
12	4-	9	30	35
12	5	6	55	35
12	6-	3	210	35
12	12-	6	1	5
13	4-	128	5	315
13	5-	4	330	945
13	6-	16	35	315
13	7	13	70	63
13	8	11	210	378
13	10	5	70	63
13	11	1	2310	126
13	12	3	6	20
13	13	161	1	180
14	5-	8	2	9
14	8	1	154	99
14	9-	4	429	99
14	11	1	14	3
14	12	3	110	20
14	13	7	165	1080
14	14-	7	1	6
15	4-	8	715	315
15	5-	8	390	945
15	6	8	5005	315
15	7-	1	10010	315
15	8	1	30030	10395
15	9-	14	55	165
15	10	1	10010	315
15	11-	1	2730	315
15	14-	7	195	108
15	15-	7	1	18
16	4-	16	3	21
16	5-	4	22	21
16	7	1	42	21
16	8-	11	14	42
16	10-	1	42	7
16	11	1	154	42
16	12-	9	10	20
16	13-	7	15	60
16	14	7	11	24

16	16-	7	1	12
17	4-	25	1	63
17	5	5	66	378
17	6	1	7	63
17	7-	20	14	63
17	8	55	42	756
17	10	8	14	63
17	11-	1	462	252
17	13-	5	5	18
17	14-	5	33	108
17	16-	1	3	6
17	17	14	1	9
18	5-	1	55	99
18	8-	65	35	198
18	9-	1	390	99
18	11	1	385	66
18	13	55	6	216
18	14	1	110	33
18	15-	5	858	1188
18	16-	11	10	24
18	17-	11	30	108
18	18-	35	1	33
19	4	1	143	18
19	5-	1	78	108
19	6-	1	1001	126
19	7-	5	2002	252
19	8	31	6006	16632
19	9	7	11	66
19	10	11	2002	252
19	11-	1	546	504
19	14-	35	39	216
19	15	1	5	18
19	18	31	4290	2376
19	19-	11	1	18
20	4	11	3	63
20	5-	31	22	693
20	6	11	21	63
20	7	11	42	126
20	8	31	14	1386
20	9-	23	39	99
20	10	11	42	126
20	11	31	154	462
20	14-	5	11	198
20	15-	1	2145	99
20	18	1	10	198
20	19-	1	429	99
20	20-	170	1	99
21	4-	1	429	126
21	5-	23	26	252
21	6-	1	3003	126
21	7-	1	6006	252
21	8	23	2002	5544
21	9-	71	33	198
21	10-	1	6006	252
21	11	23	182	168

21	14	5	13	72
21	15-	7	15	18
21	18-	1	1430	792
21	19-	7	3	18
21	20-	7	143	99
21	21	23	1	18
22	5-	1	5	3
22	8	1	385	66
22	9-	1	4290	33
22	11	1	35	6
22	13	5	66	72
22	14-	1	10	3
22	15	5	78	36
22	16	1	110	24
22	17	1	330	180
22	18	5	11	33
22	19-	1	390	72
22	20	1	110	66
22	21-	1	130	24
22	22	1	1	3
23	6	4	42	21
23	10	4	21	21
23	11	4	77	21
23	16	2	2	3
23	22-	4	55	15
23	23-	2	1	3
24	12	1	66	28
24	13-	4	11	21
24	14	1	15	24
24	15	5	13	42
24	16-	1	165	14
24	17	5	55	42
24	18-	43	66	264
24	19	1	65	6
24	20-	10	165	231
24	21-	1	195	42
24	22-	1	6	8
24	24-	5	1	28
25	12-	1	130	28
25	13-	1	195	168
25	15-	5	165	84
25	16-	15	13	56
25	17-	5	39	84
25	19	5	33	24
25	20	11	13	42
25	21-	47	11	168
25	24-	1	2145	168
25	25-	73	1	42
26	14-	5	1	4
26	18	1	110	44
26	20-	13	11	33
26	21-	2	13	3
26	22-	3	10	4
26	24	1	15	6
26	25	1	143	12

26	26-	5	1	6
27	12	1	462	84
27	13-	1	77	42
27	14-	1	105	24
27	15-	5	91	42
27	17-	1	385	210
27	18	1	462	264
27	19-	1	455	42
27	20-	10	1155	231
27	21-	1	1365	42
27	22-	1	42	8
27	23-	2	2310	35
27	24	5	7	28
27	25	1	15015	168
27	26-	1	105	6
27	27-	5	1	4
28	26	1	7	1
28	27	2	15	3
28	28-	3	1	1

J = 7/2 ENERGY MATRIX OF F5

30 RANK OF MATRIX

1	1	0	1	1	110,11,6P	E1
2	2	5	1	1	211,20,4D	
3	3	5	1	1	211,21,4D	
4	4	9	1	1	111,20,4D	
5	5	0	1	1	110,10,6F	
6	6	5	1	1	211,10,4F	
7	7	5	1	1	211,21,4F	
8	8	5	1	1	211,30,4F	
9	9	9	1	1	111,10,4F	
10	10	8	1	1	221,10,2F	
11	11	8	1	1	221,21,2F	
12	12	8	1	1	221,30,2F	
13	13	8	1	1	221,31,2F	
14	14	8	1	1	221,31,2F*	
15	15	12	1	1	210,21,2F	
16	16	18	1	1	100,10,2F	
17	17	5	1	1	211,20,4G	
18	18	5	1	1	211,21,4G	
19	19	5	1	1	211,30,4G	
20	20	9	1	1	111,20,4G	
21	21	8	1	1	221,20,2G	
22	22	8	1	1	221,21,2G	
23	23	8	1	1	221,30,2G	
24	24	8	1	1	221,31,2G	
25	25	12	1	1	210,20,2G	
26	26	12	1	1	210,21,2G	
27	27	0	1	1	110,11,6H	
28	28	5	1	1	211,11,4H	
29	29	5	1	1	211,21,4H	
30	30	5	1	1	211,30,4H	
2	2	1144	1	7		E2
3	2	156	66	7		
3	3-	1781	1	7		
7	7-	65	1	1		
8	6	20	143	1		
8	7-	72	195	3		
8	8-	76	1	1		
11	11-	1495	1	11		
12	10	5	143	1		
12	11	720	4290	132		
12	12-	19	1	1		
13	11-	936	10	11		
13	12-	72	429	11		
13	13	2210	1	11		
14	10-	15	429	1		
14	11	144	1430	44		
14	12-	147	3	1		
14	13	168	143	11		
14	14-	41	1	1		
15	15	195	1	1		
17	17-	1040	1	7		
18	17-	48	2145	21		
18	18	3267	1	21		

19	17	52	15	1
19	18-	16	143	1
19	19	312	1	3
21	21-	260	1	7
22	21-	240	390	42
22	22	2943	1	21
23	21-	13	15	1
23	22	40	26	1
23	23	26	1	1
24	21	45	1365	7
24	22	2208	14	28
24	23	30	91	1
24	24-	122	1	1
25	25	780	1	7
26	25	24	4290	7
26	26-	1683	1	7
29	28-	10	182	1
29	29	197	1	1
30	28-	30	39	3
30	29-	66	42	3
30	30-	176	1	1
1	1	33	1	1
2	2	22	1	7
3	2	10	66	7
3	3	202	1	7
4	2-	33	7	7
4	3	6	462	7
7	6-	1	165	3
7	7	3	1	1
8	7-	2	195	3
8	8	42	1	1
9	7	9	11	1
11	10	43	30	30
11	11	240	1	11
12	11	29	4290	132
12	12	24	1	1
13	10	4	3	1
13	11-	9	10	11
13	12-	4	429	11
13	13	442	1	11
14	11-	3	1430	44
14	12	6	3	1
14	13-	20	143	11
14	14	12	1	1
15	10	3	330	10
15	11	27	11	11
15	12-	3	390	4
15	13-	27	110	11
15	14-	9	130	4
15	15	6	1	1
16	11	36	5	5
16	13-	36	2	1
16	15-	12	55	5
17	17	8	1	7
18	17	5	2145	21

E3

18	18	11	1	21	
19	17	4	15	3	
19	18	2	143	3	
19	19	22	1	3	
20	17-	12	7	7	
20	18	1	15015	7	
20	19-	4	105	1	
21	21-	16	1	7	
22	21-	11	390	42	
22	22	356	1	21	
23	21	8	15	3	
23	22-	29	26	12	
23	23	37	1	3	
24	22	7	14	28	
24	23	1	91	1	
24	24	41	1	1	
25	21-	12	1	7	
25	22-	11	390	7	
25	23-	8	15	1	
25	25	48	1	7	
26	21-	3	4290	14	
26	22	15	11	7	
26	23	3	286	4	
26	24	3	154	4	
26	25-	1	4290	7	
26	26	22	1	7	
27	27-	9	1	1	
28	28-	4	1	1	
29	29	26	1	1	
30	28-	5	39	3	
30	29	4	42	3	
30	30	14	1	1	
1	1+	1	1	2	ZETA
2	2+	1	1	14	
3	2+	1	66	21	
3	3-	5	1	21	
4	1-	3	1	1	
4	2-	1	7	14	
4	3-	1	462	21	
4	4+	1	1	2	
5	2-	9	2	14	
5	3+	1	33	7	
5	4-	3	14	14	
5	5-	1	1	2	
6	2-	8	6	21	
6	3-	1	11	42	
6	4-	1	42	21	
6	5+	1	3	4	
7	3-	1	15	3	
7	5+	1	55	4	
8	2-	1	858	42	
8	3-	1	13	21	
8	4+	1	6006	42	
9	2-	3	10	7	
9	3-	1	165	14	

9	5-	3	5	4
10	2-	25	2	42
10	3+	5	33	126
10	4+	1	14	42
10	6-	5	3	12
10	7-	1	55	24
10	9-	3	5	20
10	10-	7	1	6
11	3-	1	110	66
11	6+	11	10	48
11	7	1	66	22
11	8-	1	1430	264
11	9-	11	6	16
11	10	11	30	144
11	11+	35	1	44
12	2+	1	286	12
12	3-	1	39	36
12	4-	1	2002	84
12	7-	7	65	48
12	8+	1	3	12
12	11-	31	4290	3168
12	12+	11	1	24
13	2	11	6	42
13	3-	31	11	231
13	4	11	42	42
13	7-	1	165	132
13	8-	1	143	22
13	11-	1	10	264
13	12+	1	429	132
13	13+	85	1	66
14	2-	1	858	84
14	3-	23	13	84
14	4-	1	6006	84
14	7+	1	195	48
14	8-	7	1	4
14	11+	1	1430	1056
14	12	7	3	24
14	13+	7	143	132
14	14-	23	1	24
15	3-	1	10	2
15	6+	1	110	16
15	7-	1	6	2
15	8+	1	130	8
15	9	1	66	16
15	10-	1	330	240
15	11-	5	11	44
15	12+	1	390	96
15	13-	1	110	88
15	14+	1	130	32
15	15-	1	1	4
16	4+	4	21	7
16	9+	1	30	5
16	15	1	55	5
16	16+	1	1	2
17	5+	3	33	28

17	6-	16	11	63
17	7+	1	15	18
17	8+	10	13	63
17	9-	2	165	21
17	10	25	33	252
17	11-	43	110	528
17	12	5	39	36
17	13-	25	11	231
17	14-	5	13	84
17	15-	1	10	16
17	17-	2	1	21
18	5-	3	65	28
18	6-	1	195	126
18	8-	5	165	63
18	9-	5	13	14
18	10-	5	65	168
18	12	5	55	48
18	13	11	195	252
18	14-	47	165	1008
18	17-	1	2145	315
18	18-	292	1	315
19	7-	5	1	3
19	11+	5	66	264
19	13-	13	165	198
19	14-	1	195	9
19	15-	5	6	8
19	17+	4	15	45
19	18+	2	143	45
19	19-	4	1	9
20	5+	1	231	28
20	6-	2	77	63
20	7-	1	105	18
20	8-	10	91	63
20	10-	1	231	252
20	11	1	770	528
20	12-	5	273	252
20	13-	25	77	231
20	14-	5	91	84
20	15-	1	70	16
20	16-	1	154	7
20	17+	2	7	21
20	18+	1	15015	315
20	19-	4	105	45
20	20-	2	1	3
21	6-	13	385	252
21	7-	1	21	72
21	8-	1	455	126
21	9-	1	231	84
21	10-	2	1155	63
21	11-	23	154	528
21	12+	5	1365	252
21	13+	5	385	231
21	14+	1	455	84
21	15+	1	14	16
21	17+	1	35	84

21	18+	1	3003	504
21	19-	1	21	18
21	20-	1	5	12
21	21-	5	1	42
22	6-	5	6006	1008
22	8-	5	42	504
22	9+	1	10010	112
22	10+	5	2002	336
22	12+	155	14	672
22	13+	1	6006	504
22	14-	47	42	2016
22	17-	43	546	1008
22	18	11	770	630
22	19+	1	910	360
22	20+	1	78	144
22	21+	23	390	1008
22	22-	145	1	252
23	7-	7	35	48
23	11+	31	2310	1056
23	13+	13	231	396
23	14+	1	273	18
23	15-	1	210	32
23	17-	7	21	36
23	18+	7	5005	720
23	19+	1	35	36
23	20+	7	3	36
23	21+	5	15	36
23	22-	31	26	288
23	23-	55	1	72
24	7+	1	65	16
24	11-	1	4290	352
24	13+	1	429	132
24	14	1	3	6
24	15-	3	390	32
24	17+	1	39	12
24	18+	19	55	240
24	19-	7	65	60
24	20+	1	273	12
24	21+	1	1365	84
24	22-	19	14	672
24	23-	1	91	24
24	24+	3	1	8
25	6-	5	385	252
25	7-	1	21	9
25	8+	1	455	126
25	9+	1	231	28
25	10+	4	1155	315
25	11-	17	154	264
25	12-	11	1365	252
25	13+	5	385	231
25	14+	1	455	84
25	15-	1	14	8
25	16+	1	770	35
25	17-	13	35	84
25	18+	1	3003	63

25	19+	1	21	18
25	20+	1	5	12
25	21+	10	1	21
25	22+	17	390	504
25	23-	11	15	36
25	24+	1	1365	84
25	25-	5	1	42
26	6-	5	546	336
26	8+	5	462	168
26	9-	1	910	112
26	10-	1	182	112
26	12-	5	154	224
26	13+	11	546	168
26	14-	47	462	672
26	16+	1	273	7
26	17-	1	6006	336
26	18-	19	70	210
26	19-	1	10010	120
26	20-	1	858	48
26	21-	1	4290	336
26	22	13	11	84
26	23+	1	286	96
26	24-	19	154	224
26	25+	1	4290	168
26	26+	1	1	28
27	19+	3	14	5
27	20+	2	30	5
27	27-	23	1	10
28	17+	7	10	18
28	19-	7	6	45
28	20+	1	70	90
28	21+	5	14	18
28	23-	1	210	9
28	25-	5	14	18
28	27-	1	21	10
28	28-	1	1	5
29	17+	1	455	90
29	18-	1	231	15
29	19+	1	273	45
29	20-	7	65	90
29	21+	1	13	18
29	22+	1	30	30
29	23-	7	195	180
29	24+	1	105	20
29	25+	4	13	9
29	26+	1	330	10
29	29-	1	1	5
30	17+	1	390	90
30	18	4	22	15
30	20-	1	2730	90
30	21+	1	546	126
30	22-	4	35	105
30	24-	1	10	5
30	25-	1	546	126
30	26	4	385	35

30 27-	1	91	10
30 28-	1	39	15
30 29+	2	42	15
30 30-	1	1	1

J = 9/2 ENERGY MATRIX OF F5

29 RANK OF MATRIX

1	1	0	1	1	110,10,6F	
2	2	5	1	1	211,10,4F	
3	3	5	1	1	211,21,4F	
4	4	5	1	1	211,30,4F	
5	5	9	1	1	111,10,4F	
6	6	5	1	1	211,20,4G	
7	7	5	1	1	211,21,4G	
8	8	5	1	1	211,30,4G	
9	9	9	1	1	111,20,4G	
10	10	8	1	1	221,20,2G	
11	11	8	1	1	221,21,2G	
12	12	8	1	1	221,30,2G	
13	13	8	1	1	221,31,2G	
14	14	12	1	1	210,20,2G	
15	15	12	1	1	210,21,2G	
16	16	0	1	1	110,11,6H	
17	17	5	1	1	211,11,4H	
18	18	5	1	1	211,21,4H	
19	19	5	1	1	211,30,4H	
20	20	8	1	1	221,11,2H	
21	21	8	1	1	221,21,2H	
22	22	8	1	1	221,30,2H	
23	23	8	1	1	221,31,2H	
24	24	8	1	1	221,31,2H*	
25	25	12	1	1	210,11,2H	
26	26	12	1	1	210,21,2H	
27	27	5	1	1	211,20,4I	
28	28	5	1	1	211,30,4I	
29	29	9	1	1	111,20,4I	
3	3-	65	1	1		E2
4	2	20	143	1		
4	3-	72	195	3		
4	4-	76	1	1		
6	6-	1040	1	7		
7	6-	48	2145	21		
7	7	3267	1	21		
8	6	156	15	3		
8	7-	48	143	3		
8	8	312	1	3		
10	10-	260	1	7		
11	10-	240	390	42		
11	11	2943	1	21		
12	10-	39	15	3		
12	11	480	26	12		
12	12	26	1	1		
13	10	45	1365	7		
13	11	2208	14	28		
13	12	30	91	1		
13	13-	122	1	1		
14	14	780	1	7		
14	13	24	4290	7		
15	15-	1683	1	7		
18	17-	10	182	1		

18	18	197	1	1
19	17-	30	39	3
19	18-	66	42	3
19	19-	176	1	1
21	20	14	10010	11
21	21-	977	1	11
22	20	2	390	1
22	21	10	231	1
22	22-	44	1	1
23	20	2	3315	1
23	21	31	7854	11
23	22-	30	34	1
23	23-	92	1	1
24	20-	600	3003	132
24	21	103	30	11
24	22-	528	770	88
24	23-	192	6545	88
24	24	10720	1	88
26	26	21	1	1
27	27	40	1	1
28	27-	120	3	1
28	28-	50	1	1
29	29	0	1	1
3	2-	1	165	3
3	3	3	1	1
4	3-	2	195	3
4	4	42	1	1
5	3	9	11	1
6	6	8	1	7
7	6	5	2145	21
7	7	11	1	21
8	6	4	15	3
8	7	2	143	3
8	8	22	1	3
9	6-	12	7	7
9	7	1	15015	7
9	8-	4	105	1
10	10-	16	1	7
11	10-	11	390	42
11	11	356	1	21
12	10	8	15	3
12	11-	29	26	12
12	12	37	1	3
13	11	7	14	28
13	12	1	91	1
13	13	41	1	1
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14	11-	11	390	7
14	12-	8	15	1
14	14	48	1	7
15	10-	3	4290	14
15	11	15	11	7
15	12	3	286	4
15	13	3	154	4
15	14-	1	4290	7

E3

15	15	22	1	7
16	16-	9	1	1
17	17-	4	1	1
18	18	26	1	1
19	17-	5	39	3
19	18	4	42	3
19	19	14	1	1
20	20-	11	1	2
21	21-	59	1	11
22	20-	5	390	12
22	21-	29	231	33
22	22	41	1	4
23	20-	1	3315	12
23	21-	1	7845	66
23	22	1	34	8
23	23	13	1	8
24	20-	11	3003	132
24	21-	37	30	66
24	22	31	770	88
24	23-	5	6545	88
24	24	2199	1	88
25	20	9	2	2
25	22	3	195	2
25	23-	1	6630	4
25	24-	1	6006	4
25	25-	6	1	1
26	21-	45	11	11
26	22	3	21	1
26	23-	1	714	2
26	24-	37	330	22
26	26	21	1	1
27	27-	2	1	1
28	27	2	3	1
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29	27	3	7	1
29	28-	6	21	1
29	29	0	1	1
1	1	2	1	5
2	1	1	66	20
2	2-	23	1	20
3	1	11	10	20
3	2-	1	165	120
3	3	3	1	2
4	3	1	195	12
4	4	1	1	2
5	1-	3	110	20
5	2	3	15	20
5	3-	3	11	8
5	5	3	1	4
6	1	3	2310	140
6	2-	44	35	315
6	3	1	231	72
6	4	1	5005	126
6	5-	11	21	42
6	6	1	1	84

ZETA

7	1-	3	182	28
7	2-	1	3003	504
7	4-	55	21	252
7	5-	1	5005	56
7	6	1	2145	2520
7	7	73	1	630
8	3-	1	385	12
8	6-	1	15	90
8	7-	1	143	180
8	8	1	1	18
9	1	1	330	20
9	2-	11	5	90
9	3-	7	33	72
9	4-	1	715	18
9	6-	1	7	84
9	7-	1	15015	2520
9	8	1	105	90
9	9	1	1	12
10	2-	13	385	126
10	3-	1	21	36
10	4-	1	455	63
10	5-	1	231	42
10	6	1	11	42
10	7	11	195	1260
10	8-	1	165	45
10	9-	1	77	42
10	10	2	1	21
11	2-	5	6006	504
11	4-	5	42	252
11	5	1	10010	56
11	6-	43	4290	2520
11	7	121	2	315
11	8	1	286	180
11	9	1	30030	2520
11	10-	23	390	1260
11	11	29	1	63
12	3-	7	35	24
12	6-	7	165	90
12	7	77	13	360
12	8	1	11	18
12	9	1	1155	90
12	10-	1	15	9
12	11	31	26	360
12	12	11	1	18
13	3	1	65	8
13	6	1	15015	210
13	7	209	7	840
13	8-	1	1001	30
13	9	1	2145	30
13	10-	1	1365	105
13	11	19	14	840
13	12	1	91	30
13	13-	3	1	10
14	2-	5	385	126
14	3-	2	21	9

14	4	1	455	63
14	5	1	231	14
14	6-	13	11	42
14	7	22	195	315
14	8	1	165	45
14	9	1	77	42
14	10-	8	1	21
14	11-	17	390	630
14	12	11	15	45
14	13-	1	1365	105
14	14	2	1	21
15	2-	5	546	168
15	4	5	462	84
15	5-	1	910	56
15	6-	11	390	840
15	7-	19	22	105
15	8-	11	26	60
15	9-	11	2730	840
15	10	1	4290	420
15	11-	13	11	105
15	12-	1	286	120
15	13	19	154	280
15	14-	1	4290	210
15	15-	1	1	35
16	8	3	1001	55
16	9	2	2145	55
16	16-	7	1	5
17	6	8	385	99
17	8-	16	231	495
17	9	8	55	495
17	10	1	35	9
17	12-	2	21	9
17	14-	1	35	9
17	16-	1	39	10
17	17-	1	1	10
18	6	4	1430	495
18	7-	8	6	15
18	8	8	858	495
18	9-	4	10010	495
18	10	1	130	90
18	11	1	3	15
18	12-	7	78	180
18	13	1	42	20
18	14	4	130	45
18	15	1	33	5
18	18-	1	1	10
19	6	8	15015	3465
19	7	64	7	105
19	9-	8	2145	495
19	10	1	1365	315
19	11-	4	14	105
19	13-	2	1	5
19	14-	1	1365	315
19	15	4	154	35
19	16-	13	1	10

19	17-	1	39	30
19	18	1	42	15
19	19-	1	1	2
20	6	1	231	99
20	8	2	385	165
20	9-	1	33	99
20	10	7	21	18
20	12-	1	35	15
20	14-	1	21	18
20	17	1	15	3
20	19	1	65	30
20	20	7	1	6
21	6	43	390	990
21	7-	1	22	55
21	8	1	26	165
21	9-	1	2730	990
21	10-	23	4290	1980
21	11-	65	11	110
21	12-	31	286	1320
21	13	3	154	440
21	14-	17	4290	990
21	15	3	1	10
21	18	2	33	15
21	19	1	154	165
21	21	7	1	6
22	6-	1	10010	330
22	7	2	42	15
22	9	1	1430	330
22	10	1	910	84
22	11-	31	21	105
22	13	1	6	10
22	14-	11	910	420
22	15	1	231	35
22	17	1	26	6
22	18	7	7	30
22	19	1	6	12
22	20-	1	390	90
22	21-	31	231	990
22	22-	11	1	12
23	6	1	85085	2310
23	7-	2	357	315
23	8	2	51051	495
23	9	1	12155	330
23	10	1	7735	420
23	11	1	714	630
23	12	1	4641	90
23	13-	4	51	15
23	14	1	7735	420
23	15	1	7854	210
23	18	1	238	20
23	19-	13	51	60
23	21-	1	7854	660
23	22-	13	34	120
23	23-	59	1	120
24	6	7	13	66

24	7-	14	165	495
24	8-	2	195	99
24	9	7	91	66
24	10	7	143	132
24	11	7	330	990
24	12-	1	2145	198
24	13-	1	1155	165
24	14	7	143	132
24	15	7	30	30
24	18-	1	110	20
24	19	1	1155	132
24	21	1	30	60
24	22+	1	770	264
24	23-	13	6545	1320
24	24-	23	1	24
25	6	1	462	33
25	8	1	770	55
25	9	1	66	33
25	10	1	42	6
25	12	1	70	5
25	14	1	42	6
25	17-	1	30	4
25	19	1	130	20
25	20-	1	2	2
25	22	1	195	15
26	6	1	4290	330
26	7-	3	2	5
26	8-	1	286	55
26	9	1	30030	330
26	10	1	390	60
26	11	3	1	10
26	12	1	26	40
26	13	9	14	40
26	14-	1	390	30
26	15	3	11	10
26	18	2	3	5
26	19-	1	14	5
26	21	1	11	10
26	22	1	21	30
26	23-	1	714	20
26	24	1	330	20
26	26-	9	1	10
27	17	1	15015	132
27	18-	1	330	66
27	19	1	385	44
27	20-	1	1001	132
27	21	43	10	66
27	22	7	2310	264
27	23-	1	19635	264
27	24	19	3	264
27	25-	1	2002	44
27	26	1	110	22
27	27-	1	1	4
28	16-	1	1155	55
28	17-	1	5005	165

28	18-	2	110	33
28	20-	1	3003	99
28	21	2	30	99
28	23-	1	6545	66
28	24-	107	1	66
28	25-	1	6006	66
28	26-	2	330	33
28	27	1	3	6
28	28-	7	1	6
29	16-	3	55	55
29	17	1	2145	660
29	18	1	2310	66
29	19-	7	55	44
29	20	1	143	132
29	21-	1	70	66
29	22-	7	330	264
29	23-	7	2805	264
29	24	19	21	264
29	25-	1	286	44
29	26	1	770	22
29	27	1	7	4
29	28-	1	21	6
29	29-	7	1	4

J = 11/2 ENERGY MATRIX OF F5

26 RANK OF MATRIX

1	1	0	1	1	110,10,6F	E1
2	2	5	1	1	211,20,4G	
3	3	5	1	1	211,21,4G	
4	4	5	1	1	211,30,4G	
5	5	9	1	1	111,20,4G	
6	6	0	1	1	110,11,6H	
7	7	5	1	1	211,11,4H	
8	8	5	1	1	211,21,4H	
9	9	5	1	1	211,30,4H	
10	10	8	1	1	221,11,2H	
11	11	8	1	1	221,21,2H	
12	12	8	1	1	221,30,2H	
13	13	8	1	1	221,31,2H	
14	14	8	1	1	221,31,2H*	
15	15	12	1	1	210,11,2H	
16	16	12	1	1	210,21,2H	
17	17	5	1	1	211,20,4I	
18	18	5	1	1	211,30,4I	
19	19	9	1	1	111,20,4I	
20	20	8	1	1	221,20,2I	
21	21	8	1	1	221,30,2I	
22	22	8	1	1	221,31,2I	
23	23	8	1	1	221,31,2I*	
24	24	12	1	1	210,20,2I	
25	25	5	1	1	211,21,4K	
26	26	5	1	1	211,30,4K	
2	2-	1040	1	7		E2
3	2-	48	2145	21		
3	3	3267	1	21		
4	2	156	15	3		
4	3-	16	143	1		
4	4	312	1	3		
8	7-	10	182	1		
8	8	197	1	1		
9	7-	30	39	3		
9	8-	22	42	1		
9	9-	176	1	1		
11	10	14	10010	11		
11	11-	977	1	11		
12	10	2	390	1		
12	11	10	231	1		
12	12-	44	1	1		
13	10	2	3315	1		
13	11	31	7854	11		
13	12-	240	34	8		
13	13-	92	1	1		
14	10-	600	3003	132		
14	11	103	30	11		
14	12-	528	770	88		
14	13-	192	6545	88		
14	14	10720	1	88		
16	16	21	1	1		
17	17	40	1	1		

18	17-	120	3	1
18	18-	50	1	1
20	20	10	1	1
21	20	30	3	1
21	21-	25	1	2
22	20	270	1	1
22	21-	171	3	2
22	22-	1151	1	10
23	21	27	102	1
23	22-	153	34	5
23	23	788	1	5
24	24-	30	1	1
25	25-	219	1	1
26	25	8	17	1
26	26	188	1	1
2	2	8	1	7
3	2	5	2145	21
3	3	11	1	21
4	2	4	15	3
4	3	2	143	3
4	4	22	1	3
5	2-	12	7	7
5	3	1	15015	7
5	4-	4	105	1
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9	8	4	42	3
9	9	14	1	1
10	10-	11	1	2
11	11-	59	1	11
12	10-	5	390	12
12	11	29	231	33
12	12	41	1	4
13	10-	1	3315	12
13	11-	1	7854	66
13	12	1	34	8
13	13	13	1	8
14	10-	11	3003	132
14	11-	37	30	66
14	12	31	770	88
14	13-	5	6545	88
14	14	2199	1	88
15	10	9	2	2
15	12	3	195	2
15	13-	1	6630	4
15	14-	1	6006	4
15	15-	6	1	1
16	11-	45	11	11
16	12	3	21	1
16	13-	1	714	2
16	14-	37	330	22
16	16	21	1	1
17	17-	2	1	1

E3

18	17	2	3	1
18	18-	11	1	1
19	17	3	7	1
19	18-	6	21	1
20	20	4	1	1
21	20	4	3	1
21	21-	1	1	2
22	21	15	3	2
22	22-	11	1	10
23	22	12	34	5
23	23	53	1	5
24	20	3	1	1
24	21-	12	3	1
24	24-	12	1	1
25	25-	13	1	3
26	25	8	17	3
26	26	16	1	3
1	1+	3	1	2
2	1+	1	462	14
2	2+	1	1	7
3	1-	1	910	14
3	2+	1	2145	210
3	3+	146	1	105
4	2-	2	15	15
4	3-	1	143	15
4	4+	2	1	3
5	1+	1	66	6
5	2-	1	7	7
5	3-	1	15015	210
5	4+	2	105	15
5	5+	1	1	1
6	4+	7	286	110
6	5+	1	30030	165
6	6-	3	1	10
7	2+	1	10010	66
7	4-	1	6006	165
7	5+	1	1430	330
7	6-	3	21	20
7	7+	1	1	45
8	2+	13	55	330
8	3-	1	39	5
8	4+	13	33	165
8	5-	13	385	330
8	8+	1	1	45
9	2+	13	2310	2310
9	3	4	182	35
9	5-	13	330	330
9	6-	3	91	20
9	7+	1	39	135
9	8-	2	42	135
9	9+	1	1	9
10	2+	1	385	66
10	4+	1	231	33
10	5-	1	55	66
10	7+	5	26	18

ZETA

10	9+	13	6	108
10	10-	35	1	36
11	2+	43	26	132
11	3-	1	330	110
11	4+	1	390	330
11	5-	1	182	132
11	8+	1	1430	45
11	9+	1	15015	1485
11	11-	35	1	36
12	2-	1	6006	132
12	3	1	70	5
12	5+	1	858	132
12	7+	13	15	54
12	8+	7	2730	540
12	9+	1	65	36
12	10+	1	390	108
12	11+	31	231	1188
12	12+	55	1	72
13	2+	1	51051	924
13	3-	1	595	105
13	4+	1	85085	165
13	5+	1	7293	132
13	8+	1	23205	180
13	9-	13	2210	360
13	11+	1	7854	792
13	12+	13	34	144
13	13+	59	1	144
14	2+	7	195	132
14	3-	7	11	33
14	4-	5	13	33
14	5+	7	1365	132
14	8-	1	429	36
14	9+	5	2002	792
14	11-	1	30	72
14	12-	5	770	1584
14	13	13	6545	1584
14	14+	115	1	144
15	2+	1	770	22
15	4+	1	462	22
15	5+	1	110	22
15	7-	5	13	12
15	9+	13	3	36
15	10+	5	2	12
15	12-	1	195	18
16	2+	1	286	44
16	3-	3	30	10
16	4-	1	4290	110
16	5+	1	2002	44
16	8+	1	130	15
16	9-	1	1365	45
16	11-	1	11	12
16	12-	1	21	36
16	13+	1	714	24
16	14-	1	330	24
16	16+	3	1	4

17	7+	35	11	99
17	8−	10	2002	1287
17	9+	35	429	1287
17	10−	7	286	792
17	11+	43	35	198
17	12+	49	165	792
17	13−	7	5610	1584
17	14+	19	42	1584
17	15−	7	143	132
17	16+	1	385	66
17	17−	5	1	42
18	6−	3	77	22
18	7−	28	33	297
18	8−	40	6006	3861
18	10−	7	858	594
18	11+	2	105	297
18	13−	7	1870	396
18	14−	107	14	396
18	15−	7	429	198
18	16−	2	1155	99
18	17+	5	3	63
18	18−	5	1	9
19	6−	3	33	22
19	7+	1	77	99
19	8+	70	286	1287
19	9−	35	3003	1287
19	10+	1	2002	792
19	11−	7	5	198
19	12−	7	1155	792
19	13−	7	39270	1584
19	14+	133	6	1584
19	15−	1	1001	132
19	16	7	55	66
19	17+	5	7	42
19	18−	5	21	63
19	19−	5	1	6
20	7−	5	7	36
20	8+	5	26	234
20	9−	5	273	468
20	10+	7	182	72
20	11+	23	55	198
20	12+	5	105	72
20	13+	1	3570	144
20	14−	19	66	1584
20	15+	1	91	12
20	16−	1	5	6
20	17+	1	77	84
20	18−	1	231	126
20	19−	1	11	12
20	20−	1	1	6
21	7+	5	21	27
21	8−	35	78	702
21	10−	1	546	54
21	11	31	165	594
21	13	1	1190	72

21	14+	107	22	792
21	15+	1	273	9
21	16-	1	15	18
21	17-	1	231	36
21	18+	1	77	36
21	19+	1	33	36
21	20+	5	3	36
21	21-	77	1	72
22	8+	5	455	546
22	9+	5	390	234
22	11-	5	154	924
22	12+	5	6	36
22	13-	5	51	18
22	14-	4	1155	693
22	16-	5	14	28
22	17-	1	110	21
22	18+	17	330	252
22	19-	1	770	21
22	20-	1	70	21
22	21+	17	210	504
22	22-	5	1	12
23	8-	1	15470	273
23	9-	2	3315	117
23	11+	1	1309	231
23	12-	1	51	9
23	13-	11	6	72
23	14+	59	39270	5544
23	16+	1	119	7
23	17-	1	935	84
23	18-	1	2805	252
23	19-	1	6545	84
23	20-	1	595	84
23	21-	1	1785	504
23	22-	5	34	24
23	23-	7	1	24
24	7+	5	7	36
24	8+	20	26	117
24	9+	5	273	468
24	10-	1	182	72
24	11+	34	55	198
24	12-	11	105	72
24	13+	1	3570	144
24	14-	19	66	1584
24	15+	1	91	12
24	16+	1	5	3
24	17-	13	77	84
24	18+	1	231	126
24	19+	1	11	12
24	20+	2	1	3
24	21-	11	3	36
24	22-	1	70	21
24	23-	1	595	84
24	24-	1	1	6
25	17-	1	4290	273
25	18+	3	1430	91

25	19+	1	30030	273
25	20-	1	2730	273
25	21-	3	910	52
25	22+	29	39	182
25	23-	5	1326	364
25	24-	8	2730	273
25	25-	29	1	21
26	17+	1	72930	546
26	19-	1	510510	546
26	20+	1	46410	546
26	22+	1	663	91
26	23-	25	78	91
26	24-	1	46410	546
26	25+	4	17	21
26	26-	4	1	3

J = 13/2 ENERGY MATRIX OF F5

20	RANK OF MATRIX					
1	1	0	1	1	110,11,6H	E1
2	2	5	1	1	211,11,4H	
3	3	5	1	1	211,21,4H	
4	4	5	1	1	211,30,4H	
5	5	5	1	1	211,20,4I	
6	6	5	1	1	211,30,4I	
7	7	9	1	1	111,20,4I	
8	8	8	1	1	221,20,2I	
9	9	8	1	1	221,30,2I	
10	10	8	1	1	221,31,2I	
11	11	8	1	1	221,31,2I*	
12	12	12	1	1	210,20,2I	
13	13	5	1	1	211,21,4K	
14	14	5	1	1	211,30,4K	
15	15	8	1	1	221,21,2K	
16	16	8	1	1	221,30,2K	
17	17	8	1	1	221,31,2K	
18	18	8	1	1	221,31,2K*	
19	19	12	1	1	210,21,2K	
20	20	5	1	1	211,21,4L	
3	2-	10	182	1		E2
3	3	197	1	1		
4	2-	30	39	3		
4	3-	22	42	1		
4	4-	176	1	1		
5	5	40	1	1		
6	5-	120	3	1		
6	6-	50	1	1		
8	8	10	1	1		
9	8	30	3	1		
9	9-	25	1	2		
10	8	270	1	1		
10	9-	171	3	2		
10	10-	1151	1	10		
11	9	27	102	1		
11	10-	153	34	5		
11	11	788	1	5		
12	12-	30	1	1		
13	13-	219	1	1		
14	13	8	17	1		
14	14	188	1	1		
15	15	6273	1	33		
16	15-	20	374	11		
16	16	47	1	1		
17	15-	156	14858	253		
17	16-	741	4807	253		
17	17	61753	1	253		
18	15-	2016	759	253		
18	16	216	2346	46		
18	17	72	21318	253		
18	18-	3868	1	23		
19	19-	135	1	1		
20	20	85	1	1		

1	1-	9	1	1
2	2-	4	1	1
3	3	26	1	1
4	2-	5	39	3
4	3	4	42	3
4	4	14	1	1
5	5-	2	1	1
6	5	2	3	1
6	6-	11	1	1
7	5	3	7	1
7	6-	6	21	1
8	8	4	1	1
9	8	4	3	1
9	9-	1	1	2
10	9	15	3	2
10	10-	11	1	10
11	10	12	34	5
11	11	53	1	5
12	8	3	1	1
12	9-	12	3	1
12	12-	12	1	1
13	13-	13	1	3
14	13	8	17	3
14	14	16	1	3
15	15-	281	1	33
16	15-	29	374	33
16	16-	5	1	3
17	15-	7	14858	253
17	16	23	4807	253
17	17	2675	1	253
18	15	21	759	253
18	17	24	21318	253
18	18-	32	1	23
19	15-	6	11	11
19	16	3	34	1
19	17-	21	16348	253
19	18	63	69	23
19	19-	5	1	1
20	20-	23	1	1
1	1	1	1	1
2	1-	1	6	4
2	2	1	1	6
3	3	1	1	6
4	1-	1	26	4
4	2	1	39	18
4	3-	1	42	9
4	4	5	1	6
5	2	5	7	12
5	3-	5	26	78
5	4	5	273	156
5	5	1	1	28
6	1-	1	14	2
6	2-	1	21	9
6	3-	10	78	117
6	5-	1	3	42

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6	6	1	1	6
7	1-	1	6	2
7	2	1	1	12
7	3	5	182	78
7	4-	35	39	156
7	5-	1	7	28
7	6	1	21	42
7	7	1	1	4
8	2-	1	70	12
8	3	1	65	39
8	4-	1	2730	156
8	5	1	10	28
8	6-	1	30	42
8	7-	1	70	28
8	8	1	1	7
9	2	1	210	9
9	3-	7	195	117
9	5-	1	30	12
9	6	1	10	12
9	7	1	210	84
9	8-	5	3	42
9	9	11	1	12
10	3	5	182	182
10	4	5	39	39
10	5-	10	7	49
10	6	85	21	294
10	7-	10	1	7
10	8	2	70	49
10	9-	17	210	588
10	10	5	1	14
11	3-	2	1547	91
11	4-	2	1326	39
11	5-	5	238	196
11	6-	5	714	588
11	7-	5	34	28
11	8	1	595	98
11	9	1	1785	588
11	10	5	34	28
11	11	1	1	4
12	2	1	70	12
12	3	8	65	39
12	4	1	2730	156
12	5-	13	10	28
12	6	1	30	42
12	7	1	70	28
12	8-	4	1	7
12	9	11	3	42
12	10	2	70	49
12	11	1	595	98
12	12	1	1	7
13	5-	16	26	273
13	6	16	78	91
13	7	16	182	273
13	8-	4	65	273
13	9-	1	195	13

13	10	29	182	637
13	11-	5	1547	637
13	12-	32	65	273
13	13-	319	1	504
14	5	8	442	273
14	7-	8	3094	273
14	8	2	1105	273
14	10	2	3094	637
14	11-	100	91	637
14	12-	2	1105	273
14	13	11	17	126
14	14-	11	1	18
15	5-	43	22	231
15	6	1	66	77
15	7	1	154	231
15	8	23	55	231
15	9-	31	165	308
15	10	29	154	2156
15	11-	5	1309	2156
15	12	34	55	231
15	13	223	143	2772
15	14	1	2431	693
15	15	635	1	1386
16	5-	1	17	6
16	7	1	119	42
16	8	5	170	84
16	10-	1	119	98
16	11	25	14	98
16	12-	11	170	84
16	13	1	442	36
16	14	1	26	18
16	15-	31	374	1386
16	16-	11	1	9
17	5	67	1463	7546
17	6-	4	4389	3773
17	7	67	209	1078
17	8	67	14630	15092
17	9-	1	43890	3773
17	10	9	209	1078
17	11-	15	7106	1078
17	12	67	14630	15092
17	13	47	38038	15092
17	14-	9	646646	7546
17	15-	47	266	7546
17	16-	9	24871	3773
17	17-	2113	1	3773
18	5	2	714	343
18	6	30	238	343
18	7	2	102	49
18	8	2	1785	343
18	9	15	595	343
18	10	1	102	49
18	11	25	3	49
18	12	2	1785	343
18	13-	19	4641	4116

18	14-	53	273	1029
18	15	19	3927	22638
18	16-	53	42	1029
18	17-	25	21318	3773
18	18	54	1	343
19	5-	1	2	7
19	6-	3	6	7
19	7-	1	14	7
19	8-	1	5	7
19	9	3	15	28
19	10	87	14	196
19	11-	15	119	196
19	12	2	5	7
19	13-	1	13	84
19	14-	1	221	21
19	15	85	11	462
19	16	1	34	42
19	17-	141	2926	7546
19	18	19	357	686
19	19-	9	1	14
20	13-	1	663	24
20	14	1	39	6
20	15	1	561	132
20	16-	7	6	12
20	17	3	149226	2156
20	18-	79	7	196
20	19	1	51	4
20	20-	15	1	8

J = 15/2 ENERGY MATRIX OF F5

16 RANK OF MATRIX

1	1	0	1	1	110,11,6H	E1
2	2	5	1	1	211,20,4I	
3	3	5	1	1	211,30,4I	
4	4	9	1	1	111,20,4I	
5	5	5	1	1	211,21,4K	
6	6	5	1	1	211,30,4K	
7	7	8	1	1	221,21,2K	
8	8	8	1	1	221,30,2K	
9	9	8	1	1	221,31,2K	
10	10	8	1	1	221,31,2K*	
11	11	12	1	1	210,21,2K	
12	12	5	1	1	211,21,4L	
13	13	8	1	1	221,21,2L	
14	14	8	1	1	221,31,2L	
15	15	12	1	1	210,21,2L	
16	16	5	1	1	211,30,4M	
2	2	40	1	1		E2
3	2-	120	3	1		
3	3-	50	1	1		
5	5-	219	1	1		
6	5	8	17	1		
6	6	188	1	1		
7	7	6273	1	33		
8	7-	60	374	33		
8	8	47	1	1		
9	7-	156	14858	253		
9	8-	741	4807	253		
9	9	61753	1	253		
10	7-	2016	759	253		
10	8	216	2346	46		
10	9	72	21318	253		
10	10-	3868	1	23		
11	11-	135	1	1		
12	12	85	1	1		
13	13-	1285	1	11		
14	13-	144	95	11		
14	14-	2356	1	11		
15	15	105	1	1		
16	16-	50	1	1		
1	1-	9	1	1		E3
2	2-	2	1	1		
3	2	2	3	1		
3	3-	11	1	1		
4	2	3	7	1		
4	3-	6	21	1		
5	5-	13	1	3		
6	5	8	17	3		
6	6	16	1	3		
7	7-	281	1	33		
8	7-	29	374	33		
8	8-	5	1	3		
9	7-	7	14858	253		
9	8	23	4807	253		

9	9	2675	1	253
10	7	21	759	253
10	9	24	21318	253
10	10-	32	1	23
11	7-	6	11	11
11	8	3	34	1
11	9-	21	16348	253
11	10	63	69	23
11	11-	5	1	1
12	12-	23	1	1
13	13-	115	1	11
14	13-	3	95	11
14	14-	160	1	11
15	13	18	11	11
15	14-	9	1045	11
15	15-	21	1	1
16	16-	23	1	1
1	1	5	1	2
2	2	3	1	14
3	1-	1	7	1
3	2-	1	3	7
3	3	1	1	1
4	1-	1	3	1
4	2-	3	7	14
4	3	1	21	7
4	4	3	1	2
5	2-	1	34	21
5	3	1	102	7
5	4	1	238	21
5	5	29	1	126
6	2	17	2	42
6	4-	17	14	42
6	5-	2	17	63
6	6	2	1	9
7	2-	43	77	231
7	3	1	231	77
7	4	1	11	33
7	5	223	2618	11088
7	6	17	154	2772
7	7-	635	1	1584
8	2-	1	238	12
8	4	1	34	12
8	5	17	7	72
8	6	1	119	36
8	7	31	374	1584
8	8	77	1	72
9	2	67	418	2156
9	3-	2	1254	539
9	4	67	2926	2156
9	5	47	3553	4312
9	6-	153	209	2156
9	7	47	266	8624
9	8	9	24871	4312
9	9	2113	1	4312
10	2	2	51	49

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10	3	30	17	49
10	4	2	357	49
10	5-	323	6	2352
10	6-	53	102	588
10	7-	19	3927	25872
10	8	53	42	1176
10	9	25	21318	4312
10	10-	27	1	196
11	2-	1	7	7
11	3-	3	21	7
11	4-	1	1	1
11	5-	1	238	336
11	6-	17	14	84
11	7-	85	11	528
11	8-	1	34	48
11	9	141	2926	8624
11	10-	19	357	784
11	11	9	1	16
12	5-	1	7	2
12	6	2	119	17
12	7	1	374	176
12	8-	7	1	8
12	9	9	24871	4312
12	10-	79	42	784
12	11	3	34	16
12	12-	5	1	6
13	5-	1	2310	528
13	6	1	39270	2244
13	7-	65	255	528
13	8-	31	330	528
13	9	3	67830	8624
13	10-	79	385	8624
13	11	1	2805	176
13	12	31	330	528
13	13	35	1	176
14	5-	1	8778	176
14	6	1	149226	748
14	7	1	969	176
14	8	1	1254	88
14	9-	261	714	4312
14	10-	117	1463	2156
14	11	3	10659	176
14	12	5	1254	528
14	13-	1	95	176
14	14	5	1	44
15	5-	1	210	16
15	6-	1	3570	68
15	7	1	2805	176
15	8	1	30	16
15	9	9	746130	8624
15	10-	237	35	784
15	11	1	255	16
15	12-	1	30	16
15	13	39	11	176
15	14-	3	1045	176

15	15-	9	1	16
16	12	1	3230	51
16	13-	1	10659	561
16	14	26	2805	561
16	15	1	969	17
16	16-	5	1	3

J = 17/2 ENERGY MATRIX OF F5

9 RANK OF MATRIX

1	1	5	1	1	211,21,4K	E1
2	2	5	1	1	211,30,4K	
3	3	5	1	1	211,21,4L	
4	4	8	1	1	221,21,2L	
5	5	8	1	1	221,31,2L	
6	6	12	1	1	210,21,2L	
7	7	5	1	1	211,30,4M	
8	8	8	1	1	221,30,2M	
9	9	8	1	1	221,31,2M	
1	1-	219	1	1		E2
2	1	8	17	1		
2	2	188	1	1		
3	3	85	1	1		
4	4-	1285	1	11		
5	4-	144	95	11		
5	5-	2356	1	11		
6	6	105	1	1		
7	7-	50	1	1		
8	8-	25	1	2		
9	8-	63	35	2		
9	9-	43	1	2		
1	1-	13	1	3		E3
2	1	8	17	3		
2	2	16	1	3		
3	3-	23	1	1		
4	4-	115	1	11		
5	4-	3	95	11		
5	5-	160	1	11		
6	4	18	11	11		
6	5-	9	1045	11		
6	6-	21	1	1		
7	7-	23	1	1		
8	8-	43	1	2		
9	8-	3	35	2		
9	9	11	1	2		
1	1	29	1	24		ZETA
2	1-	1	17	6		
2	2	7	1	6		
3	1-	1	95	8		
3	2	1	1615	34		
3	3	25	1	72		
4	1-	1	55	44		
4	2	1	935	187		
4	3	31	209	396		
4	4-	35	1	198		
5	1-	3	209	44		
5	2	3	3553	187		
5	3	19	55	396		
5	4	1	95	198		
5	5-	10	1	99		
6	1-	3	5	4		
6	2-	3	85	17		
6	3-	1	19	12		

6	4-	13	11	66
6	5	1	1045	66
6	6	1	1	2
7	3	16	170	153
7	4-	1	35530	1683
7	5	130	374	1683
7	6	1	3230	51
7	7-	13	1	18
8	3	7	1	9
8	4-	31	209	396
8	5-	13	55	99
8	6	1	19	12
8	7	1	170	36
8	8-	55	1	36
9	3	1	35	9
9	4-	1	7315	396
9	5	5	77	99
9	6-	1	665	12
9	7-	1	238	36
9	8-	1	35	36
9	9	11	1	36

J = 19/2 ENERGY MATRIX OF F5

5 RANK OF MATRIX

1	1	5	1	1	211,21,4L	E1
2	2	5	1	1	211,30,4M	
3	3	8	1	1	221,30,2M	
4	4	8	1	1	221,31,2M	
5	5	8	1	1	221,31,2N	
1	1	85	1	1		E2
2	2-	50	1	1		
3	3-	25	1	2		
4	3-	63	35	2		
4	4-	43	1	2		
5	5	76	1	1		
1	1-	23	1	1		E3
2	2-	23	1	1		
3	3-	43	1	2		
4	3-	3	35	2		
4	4	11	1	2		
5	5-	37	1	1		
1	1	5	1	3		ZETA
2	1	1	14	3		
2	2	1	1	3		
3	1	7	6	12		
3	2	1	21	12		
3	3	11	1	8		
4	1	1	210	12		
4	2-	7	15	60		
4	3	1	35	40		
4	4-	11	1	40		
5	2-	1	165	10		
5	3-	1	385	20		
5	4-	9	11	20		
5	5-	3	1	5		

J = 21/2 ENERGY MATRIX OF F5

3	RANK OF MATRIX					
1	1	5	1	1	211,30,4M	E1
2	2	8	1	1	221,31,2N	
3	3	8	1	1	221,31,20	
1	1-	50	1	1		E2
2	2	76	1	1		
3	3	10	1	1		
1	1-	23	1	1		E3
2	2-	37	1	1		
3	3-	26	1	1		
1	1	3	1	2		ZETA
2	1-	1	22	2		
2	2	6	1	11		
3	2	1	690	11		
3	3-	6	1	11		

J = 23/2 ENERGY MATRIX OF F5

1	RANK OF MATRIX					
1	1	8	1	1	221,31,20	E1
1	1	10	1	1		E2
1	1-	26	1	1		E3
1	1	1	1	2		ZETA

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