

The "Link Chords"

Readers of the second edition of David Schiff's *The Music of Elliott Carter* (London: Faber; Ithaca: Cornell University Press, 1998) may have wondered about the "Link Chords," mentioned by Schiff in connection with Carter's orchestral triptych *Symphonia--Sum Fluxae Pretium Spei* and several other works of the 1990s. The "Link Chords" are all-interval twelve-note chords, each of which contains one or more instances of the all-trichord hexachord [0,1,2,4,7,8] as a contiguous subset. Both all-interval twelve-note rows and the all-trichord hexachord are well known. In 1965 Stefan Bauer-Mengelberg and Melvin Ferentz published an algorithm for generating all-interval twelve-tone rows (*Perspectives of New Music* 3, no. 2). I came across their work when I was in college in the early 1980s and got my friend Tim Vontz to write up a version of the Bauer-Mengelberg and Ferentz algorithm in BASIC. (It took about 12 hours to run on my mother's PC!) When I was in graduate school in 1987 Frank Wilhoit and I wrote a version of this algorithm in the 'C' programming language, and in 1992 I wrote a simple 'C' program that searched the Bauer-Mengelberg list for interval strings that produce the all-trichord hexachord.

In June of 1992 I sent a copy of the list I had produced to Elliott Carter. He was working on *Partita* at the time, and was in the process of collecting exactly the type of all-interval chords I had found. It must have been a laborious process to search for them by hand, and my list provided a welcome shortcut. The next time I saw him he thanked me for the list and said it had been very useful. I later found an autograph sketch dated June 20th, 1992 in the Elliott Carter collection of the Paul Sacher foundation. It is labeled "since Link" and consists of a three-page list of "Link Chords" written out in music notation.

There are 194 all-interval series (AIS) that contain the all-trichord hexachord (ATH) as a contiguous subset. Forty-four of these contain two all-trichord hexachords, so counting each one separately gives a total of 238.* Each of the "Link Chords" generates three others via the canonical operations R, I, and RI.

John Link
January, 2005

*My thanks to Hee-Seng Kye for pointing out the incompleteness of an earlier version of this list.

No.	AIS Intervals	ATH Intervals
1	1,2,5,6,3,4,10,9,7,11,8	2,5,6,3,4
2	1,3,4,11,7,8,5,2,6,10,9	1,3,4,11,7
3a	1,3,4,11,7,9,10,6,2,5,8	1,3,4,11,7
3b	1,3,4,11,7,9,10,6,2,5,8	11,7,9,10,6
4	1,3,6,7,10,8,9,11,2,5,4	8,9,11,2,5
5	1,3,7,11,5,4,2,8,9,6,10	7,11,5,4,2
6	1,3,7,11,9,8,2,4,5,6,10	7,11,9,8,2
7	1,4,2,9,6,5,8,3,7,11,10	2,9,6,5,8
8	1,4,2,9,7,3,8,5,6,11,10	8,5,6,11,10
9	1,4,2,9,7,3,8,11,6,5,10	8,11,6,5,10
10	1,4,2,9,7,10,11,6,8,5,3	11,6,8,5,3
11	1,4,5,6,3,8,11,7,2,9,10	8,11,7,2,9
12	1,4,5,6,10,7,2,9,11,8,3	7,2,9,11,8
13	1,4,5,6,10,9,8,2,11,7,3	9,8,2,11,7
14	1,4,5,9,2,7,11,8,3,6,10	9,2,7,11,8
15	1,4,5,9,8,11,6,3,10,7,2	8,11,6,3,10
16	1,4,6,8,9,10,7,11,2,5,3	7,11,2,5,3
17	1,4,6,9,11,2,7,10,8,5,3	7,10,8,5,3
18	1,4,9,2,7,8,3,5,6,11,10	7,8,3,5,6
19	1,4,9,2,7,8,3,11,6,5,10	7,8,3,11,6
20	1,4,9,6,2,5,8,10,7,3,11	5,8,10,7,3
21	1,4,9,6,11,3,5,8,10,7,2	3,5,8,10,7
22	1,4,9,7,2,8,3,6,11,5,10	2,8,3,6,11
23	1,4,9,7,2,11,6,3,8,5,10	2,11,6,3,8
24	1,4,9,7,10,8,5,3,11,6,2	7,10,8,5,3
25	1,4,11,3,7,9,10,6,5,2,8	7,9,10,6,5
26	1,4,11,6,10,7,8,3,5,2,9	7,8,3,5,2
27	1,7,2,11,6,8,5,3,10,9,4	11,6,8,5,3
28	1,7,3,5,6,11,10,8,2,9,4	5,6,11,10,8
29	1,7,3,8,10,5,4,2,11,6,9	4,2,11,6,9
30	1,7,3,11,6,5,10,8,2,9,4	11,6,5,10,8
31	1,7,6,3,10,4,9,5,2,11,8	4,9,5,2,11
32	1,7,6,8,5,2,11,3,4,10,9	5,2,11,3,4
33a	1,7,9,2,3,6,11,8,10,5,4	2,3,6,11,8
33b	1,7,9,2,3,6,11,8,10,5,4	3,6,11,8,10
34	1,7,9,2,3,11,6,8,5,10,4	3,11,6,8,5
35	1,7,9,2,4,5,10,8,11,6,3	10,8,11,6,3
36	1,7,9,2,4,10,5,8,6,11,3	5,8,6,11,3
37	1,7,9,10,6,5,2,3,4,11,8	7,9,10,6,5
38a	1,7,9,10,8,11,6,3,2,5,4	10,8,11,6,3
38b	1,7,9,10,8,11,6,3,2,5,4	8,11,6,3,2
39a	1,8,2,5,11,4,3,7,9,6,10	2,5,11,4,3
39b	1,8,2,5,11,4,3,7,9,6,10	5,11,4,3,7
40a	1,8,2,5,11,7,9,10,3,6,4	2,5,11,7,9

40b	1,8,2,5,11,7,9,10,3,6,4	5,11,7,9,10
41	1,8,5,2,11,4,3,7,6,9,10	11,4,3,7,6
42	1,8,5,2,11,7,9,4,6,3,10	11,7,9,4,6
43	1,8,5,6,2,9,10,11,7,4,3	9,10,11,7,4
44	1,8,5,6,3,4,7,9,10,11,2	4,7,9,10,11
45	1,8,5,6,3,11,7,10,4,9,2	11,7,10,4,9
46a	1,8,7,3,4,11,5,2,9,6,10	7,3,4,11,5
46b	1,8,7,3,4,11,5,2,9,6,10	3,4,11,5,2
47a	1,8,7,11,2,5,9,4,3,6,10	8,7,11,2,5
47b	1,8,7,11,2,5,9,4,3,6,10	11,2,5,9,4
48	1,8,10,3,5,2,11,7,9,6,4	3,5,2,11,7
49	1,8,10,4,9,7,11,3,5,6,2	10,4,9,7,11
50a	1,8,10,9,7,11,5,2,3,6,4	10,9,7,11,5
50b	1,8,10,9,7,11,5,2,3,6,4	9,7,11,5,2
51a	1,8,11,6,3,10,7,9,4,5,2	8,11,6,3,10
51b	1,8,11,6,3,10,7,9,4,5,2	10,7,9,4,5
52	1,9,4,7,6,5,3,8,10,11,2	7,6,5,3,8
53	1,9,4,7,10,8,5,3,6,11,2	7,10,8,5,3
54	1,9,5,4,7,6,3,10,8,11,2	4,7,6,3,10
55	1,9,7,4,2,5,3,8,11,6,10	9,7,4,2,5
56	1,9,7,4,2,5,10,6,11,8,3	9,7,4,2,5
57	1,9,7,4,10,8,11,6,3,5,2	10,8,11,6,3
58	1,9,7,10,8,5,3,2,11,6,4	7,10,8,5,3
59	1,10,5,11,7,9,2,8,3,6,4	5,11,7,9,2
60	1,10,6,3,11,8,7,4,2,5,9	7,4,2,5,9
61	1,10,6,11,3,8,5,2,4,7,9	5,2,4,7,9
62	1,10,8,3,5,2,11,4,6,7,9	8,3,5,2,11
63	1,10,9,7,4,2,5,3,11,6,8	9,7,4,2,5
64	2,1,4,3,6,7,10,11,9,8,5	4,3,6,7,10
65a	2,1,4,3,7,6,5,9,8,11,10	4,3,7,6,5
65b	2,1,4,3,7,6,5,9,8,11,10	7,6,5,9,8
66	2,1,4,3,11,8,6,5,9,7,10	11,8,6,5,9
67	2,1,4,9,5,8,6,11,3,7,10	5,8,6,11,3
68a	2,1,4,9,7,6,5,3,8,11,10	4,9,7,6,5
68b	2,1,4,9,7,6,5,3,8,11,10	7,6,5,3,8
69	2,1,6,7,3,4,11,10,9,8,5	6,7,3,4,11
70	2,1,6,7,4,3,11,9,10,8,5	2,1,6,7,4
71	2,1,7,6,3,4,10,11,9,8,5	7,6,3,4,10
72	2,1,10,8,11,9,5,6,3,4,7	1,10,8,11,9
73	2,1,10,9,6,5,8,3,11,4,7	10,9,6,5,8
74	2,3,4,10,1,5,9,6,11,8,7	3,4,10,1,5
75a	2,3,5,1,8,9,11,6,4,7,10	5,1,8,9,11
75b	2,3,5,1,8,9,11,6,4,7,10	1,8,9,11,6
76	2,3,6,8,9,11,7,10,1,4,5	6,8,9,11,7
77a	2,3,6,11,9,8,1,5,4,7,10	6,11,9,8,1
77b	2,3,6,11,9,8,1,5,4,7,10	11,9,8,1,5

78	2,3,10,5,1,4,6,9,7,11,8	3,10,5,1,4
79	2,5,1,3,6,4,7,11,10,9,8	4,7,11,10,9
80a	2,5,1,8,9,10,11,7,4,6,3	2,5,1,8,9
80b	2,5,1,8,9,10,11,7,4,6,3	9,10,11,7,4
81	2,5,4,6,11,9,8,1,10,7,3	6,11,9,8,1
82	2,5,6,9,1,10,8,11,4,7,3	9,1,10,8,11
83	2,5,6,9,11,8,10,1,4,3,7	9,11,8,10,1
84	2,5,8,10,7,3,11,6,1,4,9	5,8,10,7,3
85	2,5,8,10,9,6,1,4,11,3,7	10,9,6,1,4
86	2,5,10,3,1,4,9,6,11,8,7	5,10,3,1,4
87	2,5,10,8,9,11,6,1,4,3,7	8,9,11,6,1
88	2,6,1,8,10,4,9,7,11,3,5	10,4,9,7,11
89	2,6,3,4,7,11,10,9,1,8,5	4,7,11,10,9
90a	2,6,3,8,9,1,10,7,11,4,5	8,9,1,10,7
90b	2,6,3,8,9,1,10,7,11,4,5	1,10,7,11,4
91	2,6,5,3,11,7,1,8,10,4,9	11,7,1,8,10
92a	2,6,5,4,10,1,7,8,3,11,9	10,1,7,8,3
92b	2,6,5,4,10,1,7,8,3,11,9	1,7,8,3,11
93a	2,6,5,4,11,3,8,7,1,10,9	11,3,8,7,1
93b	2,6,5,4,11,3,8,7,1,10,9	3,8,7,1,10
94a	2,6,5,4,11,7,10,1,9,8,3	4,11,7,10,1
94b	2,6,5,4,11,7,10,1,9,8,3	7,10,1,9,8
95	2,6,5,8,1,9,10,11,7,4,3	9,10,11,7,4
96	2,6,5,9,11,8,10,1,3,4,7	9,11,8,10,1
97	2,6,7,4,3,1,10,8,11,9,5	1,10,8,11,9
98	2,6,9,4,10,8,1,7,11,3,5	10,8,1,7,11
99a	2,6,9,10,1,7,8,3,11,4,5	10,1,7,8,3
99b	2,6,9,10,1,7,8,3,11,4,5	1,7,8,3,11
100a	2,6,9,11,3,8,7,1,10,4,5	11,3,8,7,1
100b	2,6,9,11,3,8,7,1,10,4,5	3,8,7,1,10
101a	2,6,11,4,5,1,10,7,3,8,9	4,5,1,10,7
101b	2,6,11,4,5,1,10,7,3,8,9	1,10,7,3,8
102a	2,6,11,4,5,9,8,1,7,10,3	5,9,8,1,7
102b	2,6,11,4,5,9,8,1,7,10,3	9,8,1,7,10
103a	2,6,11,4,10,7,1,8,9,5,3	10,7,1,8,9
103b	2,6,11,4,10,7,1,8,9,5,3	7,1,8,9,5
104	2,6,11,8,7,3,10,5,1,4,9	3,10,5,1,4
105	2,6,11,9,5,1,3,4,10,8,7	5,1,3,4,10
106	2,6,11,9,5,1,7,8,10,4,3	5,1,7,8,10
107a	2,7,4,3,1,6,11,9,8,5,10	4,3,1,6,11
107b	2,7,4,3,1,6,11,9,8,5,10	1,6,11,9,8
108	2,7,4,3,11,8,6,5,9,1,10	11,8,6,5,9
109a	2,7,4,9,1,6,11,3,8,5,10	4,9,1,6,11
109b	2,7,4,9,1,6,11,3,8,5,10	1,6,11,3,8
110	2,7,4,9,5,8,6,11,3,1,10	5,8,6,11,3
111	2,7,6,1,3,4,11,10,9,8,5	6,1,3,4,11

112	2,7,6,1,4,3,11,9,10,8,5	2,7,6,1,4
113	2,7,11,3,4,1,6,9,10,8,5	4,1,6,9,10
114a	2,9,6,5,3,8,7,11,4,1,10	6,5,3,8,7
114b	2,9,6,5,3,8,7,11,4,1,10	5,3,8,7,11
115	2,9,6,11,3,8,7,10,1,4,5	6,11,3,8,7
116	2,9,10,11,7,4,3,6,1,8,5	9,10,11,7,4
117	2,9,10,11,7,4,6,3,1,5,8	9,10,11,7,4
118a	2,9,11,7,8,3,5,6,4,1,10	11,7,8,3,5
118b	2,9,11,7,8,3,5,6,4,1,10	7,8,3,5,6
119a	2,11,4,3,1,10,9,6,5,8,7	11,4,3,1,10
119b	2,11,4,3,1,10,9,6,5,8,7	10,9,6,5,8
120	2,11,4,6,5,3,8,7,10,1,9	6,5,3,8,7
121	2,11,6,3,7,10,8,5,4,1,9	3,7,10,8,5
122a	2,11,7,8,3,10,5,1,4,6,9	2,11,7,8,3
122b	2,11,7,8,3,10,5,1,4,6,9	3,10,5,1,4
123	2,11,7,9,6,4,1,5,10,3,8	4,1,5,10,3
124	2,11,8,10,1,9,5,6,7,4,3	11,8,10,1,9
125	2,11,9,6,5,8,10,4,1,3,7	9,6,5,8,10
126	3,1,4,2,11,8,9,5,6,10,7	3,1,4,2,11
127	3,1,4,2,11,10,7,9,6,8,5	3,1,4,2,11
128	3,1,4,5,6,10,9,7,2,11,8	5,6,10,9,7
129	3,1,4,6,7,2,11,9,10,8,5	3,1,4,6,7
130a	3,1,5,2,6,8,9,10,11,7,4	5,2,6,8,9
130b	3,1,5,2,6,8,9,10,11,7,4	9,10,11,7,4
131	3,1,5,2,11,9,10,8,7,6,4	1,5,2,11,9
132a	3,1,5,8,6,2,9,10,11,7,4	5,8,6,2,9
132b	3,1,5,8,6,2,9,10,11,7,4	9,10,11,7,4
133	3,1,6,4,5,2,11,9,8,10,7	5,2,11,9,8
134	3,1,7,11,10,5,6,2,8,9,4	5,6,2,8,9
135	3,1,7,11,10,9,2,6,8,5,4	9,2,6,8,5
136	3,1,7,11,10,9,8,6,2,5,4	9,8,6,2,5
137	3,1,9,7,6,5,10,4,2,11,8	7,6,5,10,4
138	3,1,9,8,2,6,5,10,11,7,4	9,8,2,6,5
139	3,1,10,5,2,4,7,9,6,11,8	5,2,4,7,9
140	3,1,10,5,6,7,9,4,2,11,8	5,6,7,9,4
141	3,1,10,7,11,2,9,4,6,8,5	3,1,10,7,11
142a	3,2,5,11,7,9,10,8,1,6,4	2,5,11,7,9
142b	3,2,5,11,7,9,10,8,1,6,4	5,11,7,9,10
143	3,2,6,5,9,8,1,10,11,7,4	6,5,9,8,1
144a	3,2,9,11,7,1,10,4,5,6,8	2,9,11,7,1
144b	3,2,9,11,7,1,10,4,5,6,8	9,11,7,1,10
145	3,2,11,9,8,1,10,6,5,4,7	2,11,9,8,1
146	3,4,7,6,2,1,10,8,11,9,5	1,10,8,11,9
147	3,4,7,9,10,11,2,6,1,8,5	4,7,9,10,11
148	3,4,10,9,11,7,1,2,5,6,8	10,9,11,7,1
149a	3,5,1,4,6,10,9,2,7,11,8	1,4,6,10,9

149b	3,5,1,4,6,10,9,2,7,11,8	9,2,7,11,8
150a	3,5,1,10,6,4,9,2,7,11,8	1,10,6,4,9
150b	3,5,1,10,6,4,9,2,7,11,8	9,2,7,11,8
151	3,5,1,10,7,9,2,4,11,6,8	5,1,10,7,9
152	3,5,2,1,6,11,9,8,10,7,4	1,6,11,9,8
153	3,5,2,1,10,8,11,9,6,7,4	1,10,8,11,9
154	3,5,8,1,6,2,9,11,10,7,4	1,6,2,9,11
155	3,5,9,4,10,6,1,2,7,11,8	9,4,10,6,1
156	3,5,9,11,6,1,2,8,10,7,4	11,6,1,2,8
157	3,5,11,7,2,1,6,10,4,9,8	1,6,10,4,9
158	3,5,11,7,2,9,4,6,10,1,8	9,4,6,10,1
159	3,5,11,7,2,9,10,6,4,1,8	9,10,6,4,1
160a	3,6,2,5,1,8,9,10,11,7,4	2,5,1,8,9
160b	3,6,2,5,1,8,9,10,11,7,4	9,10,11,7,4
161	3,6,5,2,4,11,10,8,9,1,7	3,6,5,2,4
162	3,6,7,4,2,1,8,10,9,11,5	3,6,7,4,2
163a	3,6,10,1,5,4,9,2,7,11,8	10,1,5,4,9
163b	3,6,10,1,5,4,9,2,7,11,8	9,2,7,11,8
164	3,7,6,4,1,2,8,10,9,11,5	3,7,6,4,1
165	3,8,2,9,7,11,5,10,1,6,4	2,9,7,11,5
166	3,8,11,7,2,9,10,6,1,4,5	8,11,7,2,9
167a	3,10,1,7,11,9,2,4,5,6,8	10,1,7,11,9
167b	3,10,1,7,11,9,2,4,5,6,8	1,7,11,9,2
168	3,10,4,9,5,2,11,8,6,1,7	4,9,5,2,11
169	3,10,6,1,9,4,5,2,7,11,8	6,1,9,4,5
170	3,10,6,2,11,8,1,5,4,9,7	1,5,4,9,7
171a	3,10,9,7,11,5,2,8,1,6,4	10,9,7,11,5
171b	3,10,9,7,11,5,2,8,1,6,4	9,7,11,5,2
172	3,11,2,4,1,8,5,9,6,10,7	3,11,2,4,1
173	3,11,7,10,4,9,2,6,1,8,5	11,7,10,4,9
174	4,1,6,3,5,2,11,7,10,9,8	3,5,2,11,7
175a	4,1,10,6,2,9,11,7,8,3,5	6,2,9,11,7
175b	4,1,10,6,2,9,11,7,8,3,5	11,7,8,3,5
176	4,3,2,8,10,5,6,11,9,1,7	8,10,5,6,11
177	4,3,2,8,10,11,6,5,9,1,7	8,10,11,6,5
178	4,3,10,9,11,8,6,5,2,1,7	9,11,8,6,5
179	4,6,3,1,5,2,11,9,10,8,7	1,5,2,11,9
180	4,6,5,2,9,11,8,10,1,3,7	9,11,8,10,1
181	4,6,7,3,1,10,8,11,9,2,5	1,10,8,11,9
182a	4,6,9,2,11,5,1,3,10,8,7	2,11,5,1,3
182b	4,6,9,2,11,5,1,3,10,8,7	11,5,1,3,10
183	4,6,9,8,2,3,1,5,11,10,7	2,3,1,5,11
184a	4,6,9,10,3,1,5,11,2,8,7	10,3,1,5,11
184b	4,6,9,10,3,1,5,11,2,8,7	3,1,5,11,2
185	4,7,6,9,11,2,5,1,10,3,8	9,11,2,5,1
186	4,7,8,3,10,1,6,2,9,11,5	1,6,2,9,11

187	4,7,10,1,9,8,2,3,6,11,5	7,10,1,9,8
188	4,7,11,9,2,8,3,6,1,10,5	8,3,6,1,10
189	4,10,1,6,2,9,11,3,7,8,5	1,6,2,9,11
190	4,10,11,8,6,5,9,2,3,1,7	11,8,6,5,9
191	4,11,2,5,3,8,10,1,6,9,7	11,2,5,3,8
192a	4,11,2,9,6,5,8,10,3,1,7	2,9,6,5,8
192b	4,11,2,9,6,5,8,10,3,1,7	9,6,5,8,10
193a	4,11,10,8,5,6,9,2,3,1,7	10,8,5,6,9
193b	4,11,10,8,5,6,9,2,3,1,7	8,5,6,9,2
194	5,8,9,6,10,1,4,2,11,3,7	1,4,2,11,3

ATH Intervals	AIS Intervals	No.
1,3,4,11,7	1,3,4,11,7,8,5,2,6,10,9	2
1,3,4,11,7	1,3,4,11,7,9,10,6,2,5,8	3a
1,4,2,11,3	5,8,9,6,10,1,4,2,11,3,7	194
1,4,6,10,9	3,5,1,4,6,10,9,2,7,11,8	149a
1,5,2,11,9	3,1,5,2,11,9,10,8,7,6,4	131
1,5,2,11,9	4,6,3,1,5,2,11,9,10,8,7	179
1,5,4,9,7	3,10,6,2,11,8,1,5,4,9,7	170
1,6,2,9,11	3,5,8,1,6,2,9,11,10,7,4	154
1,6,2,9,11	4,7,8,3,10,1,6,2,9,11,5	186
1,6,2,9,11	4,10,1,6,2,9,11,3,7,8,5	189
1,6,10,4,9	3,5,11,7,2,1,6,10,4,9,8	157
1,6,11,3,8	2,7,4,9,1,6,11,3,8,5,10	109b
1,6,11,9,8	2,7,4,3,1,6,11,9,8,5,10	107b
1,6,11,9,8	3,5,2,1,6,11,9,8,10,7,4	152
1,7,8,3,11	2,6,5,4,10,1,7,8,3,11,9	92b
1,7,8,3,11	2,6,9,10,1,7,8,3,11,4,5	99b
1,7,11,9,2	3,10,1,7,11,9,2,4,5,6,8	167b
1,8,9,11,6	2,3,5,1,8,9,11,6,4,7,10	75b
1,10,6,4,9	3,5,1,10,6,4,9,2,7,11,8	150a
1,10,7,3,8	2,6,11,4,5,1,10,7,3,8,9	101b
1,10,7,11,4	2,6,3,8,9,1,10,7,11,4,5	90b
1,10,8,11,9	2,1,10,8,11,9,5,6,3,4,7	72
1,10,8,11,9	2,6,7,4,3,1,10,8,11,9,5	97
1,10,8,11,9	3,4,7,6,2,1,10,8,11,9,5	146
1,10,8,11,9	3,5,2,1,10,8,11,9,6,7,4	153
1,10,8,11,9	4,6,7,3,1,10,8,11,9,2,5	181
2,1,6,7,4	2,1,6,7,4,3,11,9,10,8,5	70
2,3,1,5,11	4,6,9,8,2,3,1,5,11,10,7	183
2,3,6,11,8	1,7,9,2,3,6,11,8,10,5,4	33a
2,5,1,8,9	2,5,1,8,9,10,11,7,4,6,3	80a
2,5,1,8,9	3,6,2,5,1,8,9,10,11,7,4	160a
2,5,6,3,4	1,2,5,6,3,4,10,9,7,11,8	1

2,5,11,4,3	1,8,2,5,11,4,3,7,9,6,10	39a
2,5,11,7,9	1,8,2,5,11,7,9,10,3,6,4	40a
2,5,11,7,9	3,2,5,11,7,9,10,8,1,6,4	142a
2,7,6,1,4	2,7,6,1,4,3,11,9,10,8,5	112
2,8,3,6,11	1,4,9,7,2,8,3,6,11,5,10	22
2,9,6,5,8	1,4,2,9,6,5,8,3,7,11,10	7
2,9,6,5,8	4,11,2,9,6,5,8,10,3,1,7	192a
2,9,7,11,5	3,8,2,9,7,11,5,10,1,6,4	165
2,9,11,7,1	3,2,9,11,7,1,10,4,5,6,8	144a
2,11,5,1,3	4,6,9,2,11,5,1,3,10,8,7	182a
2,11,6,3,8	1,4,9,7,2,11,6,3,8,5,10	23
2,11,7,8,3	2,11,7,8,3,10,5,1,4,6,9	122a
2,11,9,8,1	3,2,11,9,8,1,10,6,5,4,7	145
3,1,4,2,11	3,1,4,2,11,8,9,5,6,10,7	126
3,1,4,2,11	3,1,4,2,11,10,7,9,6,8,5	127
3,1,4,6,7	3,1,4,6,7,2,11,9,10,8,5	129
3,1,5,11,2	4,6,9,10,3,1,5,11,2,8,7	184b
3,1,10,7,11	3,1,10,7,11,2,9,4,6,8,5	141
3,4,10,1,5	2,3,4,10,1,5,9,6,11,8,7	74
3,4,11,5,2	1,8,7,3,4,11,5,2,9,6,10	46b
3,5,2,11,7	1,8,10,3,5,2,11,7,9,6,4	48
3,5,2,11,7	4,1,6,3,5,2,11,7,10,9,8	174
3,5,8,10,7	1,4,9,6,11,3,5,8,10,7,2	21
3,6,5,2,4	3,6,5,2,4,11,10,8,9,1,7	161
3,6,7,4,2	3,6,7,4,2,1,8,10,9,11,5	162
3,6,11,8,10	1,7,9,2,3,6,11,8,10,5,4	33b
3,7,6,4,1	3,7,6,4,1,2,8,10,9,11,5	164
3,7,10,8,5	2,11,6,3,7,10,8,5,4,1,9	121
3,8,7,1,10	2,6,5,4,11,3,8,7,1,10,9	93b
3,8,7,1,10	2,6,9,11,3,8,7,1,10,4,5	100b
3,10,5,1,4	2,3,10,5,1,4,6,9,7,11,8	78
3,10,5,1,4	2,6,11,8,7,3,10,5,1,4,9	104
3,10,5,1,4	2,11,7,8,3,10,5,1,4,6,9	122b
3,11,2,4,1	3,11,2,4,1,8,5,9,6,10,7	172
3,11,6,8,5	1,7,9,2,3,11,6,8,5,10,4	34
4,1,5,10,3	2,11,7,9,6,4,1,5,10,3,8	123
4,1,6,9,10	2,7,11,3,4,1,6,9,10,8,5	113
4,2,11,6,9	1,7,3,8,10,5,4,2,11,6,9	29
4,3,1,6,11	2,7,4,3,1,6,11,9,8,5,10	107a
4,3,6,7,10	2,1,4,3,6,7,10,11,9,8,5	64
4,3,7,6,5	2,1,4,3,7,6,5,9,8,11,10	65a
4,5,1,10,7	2,6,11,4,5,1,10,7,3,8,9	101a
4,7,6,3,10	1,9,5,4,7,6,3,10,8,11,2	54
4,7,9,10,11	1,8,5,6,3,4,7,9,10,11,2	44
4,7,9,10,11	3,4,7,9,10,11,2,6,1,8,5	147
4,7,11,10,9	2,5,1,3,6,4,7,11,10,9,8	79

4,7,11,10,9	2,6,3,4,7,11,10,9,1,8,5	89
4,9,1,6,11	2,7,4,9,1,6,11,3,8,5,10	109a
4,9,5,2,11	1,7,6,3,10,4,9,5,2,11,8	31
4,9,5,2,11	3,10,4,9,5,2,11,8,6,1,7	168
4,9,7,6,5	2,1,4,9,7,6,5,3,8,11,10	68a
4,11,7,10,1	2,6,5,4,11,7,10,1,9,8,3	94a
5,1,3,4,10	2,6,11,9,5,1,3,4,10,8,7	105
5,1,7,8,10	2,6,11,9,5,1,7,8,10,4,3	106
5,1,8,9,11	2,3,5,1,8,9,11,6,4,7,10	75a
5,1,10,7,9	3,5,1,10,7,9,2,4,11,6,8	151
5,2,4,7,9	1,10,6,11,3,8,5,2,4,7,9	61
5,2,4,7,9	3,1,10,5,2,4,7,9,6,11,8	139
5,2,6,8,9	3,1,5,2,6,8,9,10,11,7,4	130a
5,2,11,3,4	1,7,6,8,5,2,11,3,4,10,9	32
5,2,11,9,8	3,1,6,4,5,2,11,9,8,10,7	133
5,3,8,7,11	2,9,6,5,3,8,7,11,4,1,10	114b
5,6,2,8,9	3,1,7,11,10,5,6,2,8,9,4	134
5,6,7,9,4	3,1,10,5,6,7,9,4,2,11,8	140
5,6,10,9,7	3,1,4,5,6,10,9,7,2,11,8	128
5,6,11,10,8	1,7,3,5,6,11,10,8,2,9,4	28
5,8,6,2,9	3,1,5,8,6,2,9,10,11,7,4	132a
5,8,6,11,3	1,7,9,2,4,10,5,8,6,11,3	36
5,8,6,11,3	2,1,4,9,5,8,6,11,3,7,10	67
5,8,6,11,3	2,7,4,9,5,8,6,11,3,1,10	110
5,8,10,7,3	1,4,9,6,2,5,8,10,7,3,11	20
5,8,10,7,3	2,5,8,10,7,3,11,6,1,4,9	84
5,9,8,1,7	2,6,11,4,5,9,8,1,7,10,3	102a
5,10,3,1,4	2,5,10,3,1,4,9,6,11,8,7	86
5,11,4,3,7	1,8,2,5,11,4,3,7,9,6,10	39b
5,11,7,9,2	1,10,5,11,7,9,2,8,3,6,4	59
5,11,7,9,10	1,8,2,5,11,7,9,10,3,6,4	40b
5,11,7,9,10	3,2,5,11,7,9,10,8,1,6,4	142b
6,1,3,4,11	2,7,6,1,3,4,11,10,9,8,5	111
6,1,9,4,5	3,10,6,1,9,4,5,2,7,11,8	169
6,2,9,11,7	4,1,10,6,2,9,11,7,8,3,5	175a
6,5,3,8,7	2,9,6,5,3,8,7,11,4,1,10	114a
6,5,3,8,7	2,11,4,6,5,3,8,7,10,1,9	120
6,5,9,8,1	3,2,6,5,9,8,1,10,11,7,4	143
6,7,3,4,11	2,1,6,7,3,4,11,10,9,8,5	69
6,8,9,11,7	2,3,6,8,9,11,7,10,1,4,5	76
6,11,3,8,7	2,9,6,11,3,8,7,10,1,4,5	115
6,11,9,8,1	2,3,6,11,9,8,1,5,4,7,10	77a
6,11,9,8,1	2,5,4,6,11,9,8,1,10,7,3	81
7,1,8,9,5	2,6,11,4,10,7,1,8,9,5,3	103b
7,2,9,11,8	1,4,5,6,10,7,2,9,11,8,3	12
7,3,4,11,5	1,8,7,3,4,11,5,2,9,6,10	46a

7,4,2,5,9	1,10,6,3,11,8,7,4,2,5,9	60
7,6,3,4,10	2,1,7,6,3,4,10,11,9,8,5	71
7,6,5,3,8	1,9,4,7,6,5,3,8,10,11,2	52
7,6,5,3,8	2,1,4,9,7,6,5,3,8,11,10	68b
7,6,5,9,8	2,1,4,3,7,6,5,9,8,11,10	65b
7,6,5,10,4	3,1,9,7,6,5,10,4,2,11,8	137
7,8,3,5,2	1,4,11,6,10,7,8,3,5,2,9	26
7,8,3,5,6	1,4,9,2,7,8,3,5,6,11,10	18
7,8,3,5,6	2,9,11,7,8,3,5,6,4,1,10	118b
7,8,3,11,6	1,4,9,2,7,8,3,11,6,5,10	19
7,9,10,6,5	1,4,11,3,7,9,10,6,5,2,8	25
7,9,10,6,5	1,7,9,10,6,5,2,3,4,11,8	37
7,10,1,9,8	2,6,5,4,11,7,10,1,9,8,3	94b
7,10,1,9,8	4,7,10,1,9,8,2,3,6,11,5	187
7,10,8,5,3	1,4,6,9,11,2,7,10,8,5,3	17
7,10,8,5,3	1,4,9,7,10,8,5,3,11,6,2	24
7,10,8,5,3	1,9,4,7,10,8,5,3,6,11,2	53
7,10,8,5,3	1,9,7,10,8,5,3,2,11,6,4	58
7,11,2,5,3	1,4,6,8,9,10,7,11,2,5,3	16
7,11,5,4,2	1,3,7,11,5,4,2,8,9,6,10	5
7,11,9,8,2	1,3,7,11,9,8,2,4,5,6,10	6
8,3,5,2,11	1,10,8,3,5,2,11,4,6,7,9	62
8,3,6,1,10	4,7,11,9,2,8,3,6,1,10,5	188
8,5,6,9,2	4,11,10,8,5,6,9,2,3,1,7	193b
8,5,6,11,10	1,4,2,9,7,3,8,5,6,11,10	8
8,7,11,2,5	1,8,7,11,2,5,9,4,3,6,10	47a
8,9,1,10,7	2,6,3,8,9,1,10,7,11,4,5	90a
8,9,11,2,5	1,3,6,7,10,8,9,11,2,5,4	4
8,9,11,6,1	2,5,10,8,9,11,6,1,4,3,7	87
8,10,5,6,11	4,3,2,8,10,5,6,11,9,1,7	176
8,10,11,6,5	4,3,2,8,10,11,6,5,9,1,7	177
8,11,6,3,2	1,7,9,10,8,11,6,3,2,5,4	38b
8,11,6,3,10	1,4,5,9,8,11,6,3,10,7,2	15
8,11,6,3,10	1,8,11,6,3,10,7,9,4,5,2	51a
8,11,6,5,10	1,4,2,9,7,3,8,11,6,5,10	9
8,11,7,2,9	1,4,5,6,3,8,11,7,2,9,10	11
8,11,7,2,9	3,8,11,7,2,9,10,6,1,4,5	166
9,1,10,8,11	2,5,6,9,1,10,8,11,4,7,3	82
9,2,6,8,5	3,1,7,11,10,9,2,6,8,5,4	135
9,2,7,11,8	1,4,5,9,2,7,11,8,3,6,10	14
9,2,7,11,8	3,5,1,4,6,10,9,2,7,11,8	149b
9,2,7,11,8	3,5,1,10,6,4,9,2,7,11,8	150b
9,2,7,11,8	3,6,10,1,5,4,9,2,7,11,8	163b
9,4,6,10,1	3,5,11,7,2,9,4,6,10,1,8	158
9,4,10,6,1	3,5,9,4,10,6,1,2,7,11,8	155
9,6,5,8,10	2,11,9,6,5,8,10,4,1,3,7	125

9,6,5,8,10	4,11,2,9,6,5,8,10,3,1,7	192b
9,7,4,2,5	1,9,7,4,2,5,3,8,11,6,10	55
9,7,4,2,5	1,9,7,4,2,5,10,6,11,8,3	56
9,7,4,2,5	1,10,9,7,4,2,5,3,11,6,8	63
9,7,11,5,2	1,8,10,9,7,11,5,2,3,6,4	50b
9,7,11,5,2	3,10,9,7,11,5,2,8,1,6,4	171b
9,8,1,7,10	2,6,11,4,5,9,8,1,7,10,3	102b
9,8,2,6,5	3,1,9,8,2,6,5,10,11,7,4	138
9,8,2,11,7	1,4,5,6,10,9,8,2,11,7,3	13
9,8,6,2,5	3,1,7,11,10,9,8,6,2,5,4	136
9,10,6,4,1	3,5,11,7,2,9,10,6,4,1,8	159
9,10,11,7,4	1,8,5,6,2,9,10,11,7,4,3	43
9,10,11,7,4	2,5,1,8,9,10,11,7,4,6,3	80b
9,10,11,7,4	2,6,5,8,1,9,10,11,7,4,3	95
9,10,11,7,4	2,9,10,11,7,4,3,6,1,8,5	116
9,10,11,7,4	2,9,10,11,7,4,6,3,1,5,8	117
9,10,11,7,4	3,1,5,2,6,8,9,10,11,7,4	130b
9,10,11,7,4	3,1,5,8,6,2,9,10,11,7,4	132b
9,10,11,7,4	3,6,2,5,1,8,9,10,11,7,4	160b
9,11,2,5,1	4,7,6,9,11,2,5,1,10,3,8	185
9,11,7,1,10	3,2,9,11,7,1,10,4,5,6,8	144b
9,11,8,6,5	4,3,10,9,11,8,6,5,2,1,7	178
9,11,8,10,1	2,5,6,9,11,8,10,1,4,3,7	83
9,11,8,10,1	2,6,5,9,11,8,10,1,3,4,7	96
9,11,8,10,1	4,6,5,2,9,11,8,10,1,3,7	180
10,1,5,4,9	3,6,10,1,5,4,9,2,7,11,8	163a
10,1,7,8,3	2,6,5,4,10,1,7,8,3,11,9	92a
10,1,7,8,3	2,6,9,10,1,7,8,3,11,4,5	99a
10,1,7,11,9	3,10,1,7,11,9,2,4,5,6,8	167a
10,3,1,5,11	4,6,9,10,3,1,5,11,2,8,7	184a
10,4,9,7,11	1,8,10,4,9,7,11,3,5,6,2	49
10,4,9,7,11	2,6,1,8,10,4,9,7,11,3,5	88
10,7,1,8,9	2,6,11,4,10,7,1,8,9,5,3	103a
10,7,9,4,5	1,8,11,6,3,10,7,9,4,5,2	51b
10,8,1,7,11	2,6,9,4,10,8,1,7,11,3,5	98
10,8,5,6,9	4,11,10,8,5,6,9,2,3,1,7	193a
10,8,11,6,3	1,7,9,2,4,5,10,8,11,6,3	35
10,8,11,6,3	1,7,9,10,8,11,6,3,2,5,4	38a
10,8,11,6,3	1,9,7,4,10,8,11,6,3,5,2	57
10,9,6,1,4	2,5,8,10,9,6,1,4,11,3,7	85
10,9,6,5,8	2,1,10,9,6,5,8,3,11,4,7	73
10,9,6,5,8	2,11,4,3,1,10,9,6,5,8,7	119b
10,9,7,11,5	1,8,10,9,7,11,5,2,3,6,4	50a
10,9,7,11,5	3,10,9,7,11,5,2,8,1,6,4	171a
10,9,11,7,1	3,4,10,9,11,7,1,2,5,6,8	148
11,2,5,3,8	4,11,2,5,3,8,10,1,6,9,7	191

11,2,5,9,4	1,8,7,11,2,5,9,4,3,6,10	47b
11,3,8,7,1	2,6,5,4,11,3,8,7,1,10,9	93a
11,3,8,7,1	2,6,9,11,3,8,7,1,10,4,5	100a
11,4,3,1,10	2,11,4,3,1,10,9,6,5,8,7	119a
11,4,3,7,6	1,8,5,2,11,4,3,7,6,9,10	41
11,5,1,3,10	4,6,9,2,11,5,1,3,10,8,7	182b
11,6,1,2,8	3,5,9,11,6,1,2,8,10,7,4	156
11,6,5,10,8	1,7,3,11,6,5,10,8,2,9,4	30
11,6,8,5,3	1,4,2,9,7,10,11,6,8,5,3	10
11,6,8,5,3	1,7,2,11,6,8,5,3,10,9,4	27
11,7,1,8,10	2,6,5,3,11,7,1,8,10,4,9	91
11,7,8,3,5	2,9,11,7,8,3,5,6,4,1,10	118a
11,7,8,3,5	4,1,10,6,2,9,11,7,8,3,5	175b
11,7,9,4,6	1,8,5,2,11,7,9,4,6,3,10	42
11,7,9,10,6	1,3,4,11,7,9,10,6,2,5,8	3b
11,7,10,4,9	1,8,5,6,3,11,7,10,4,9,2	45
11,7,10,4,9	3,11,7,10,4,9,2,6,1,8,5	173
11,8,6,5,9	2,1,4,3,11,8,6,5,9,7,10	66
11,8,6,5,9	2,7,4,3,11,8,6,5,9,1,10	108
11,8,6,5,9	4,10,11,8,6,5,9,2,3,1,7	190
11,8,10,1,9	2,11,8,10,1,9,5,6,7,4,3	124
11,9,8,1,5	2,3,6,11,9,8,1,5,4,7,10	77b