

**Solving 7x7 Hex:
Virtual Connections and
Game-State Reduction**

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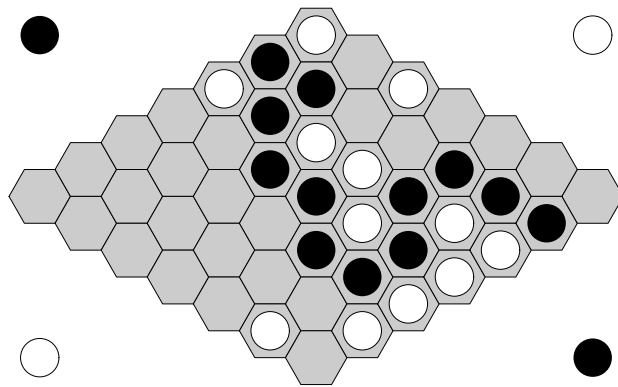
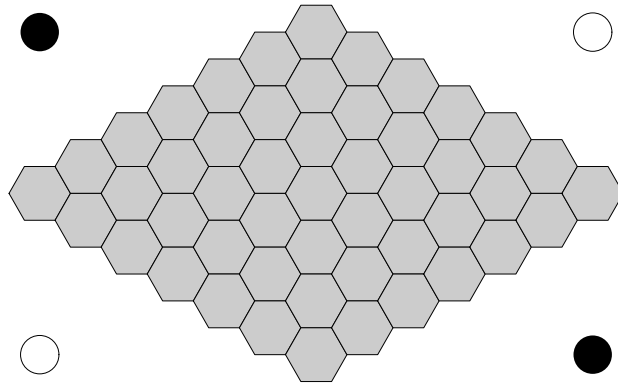
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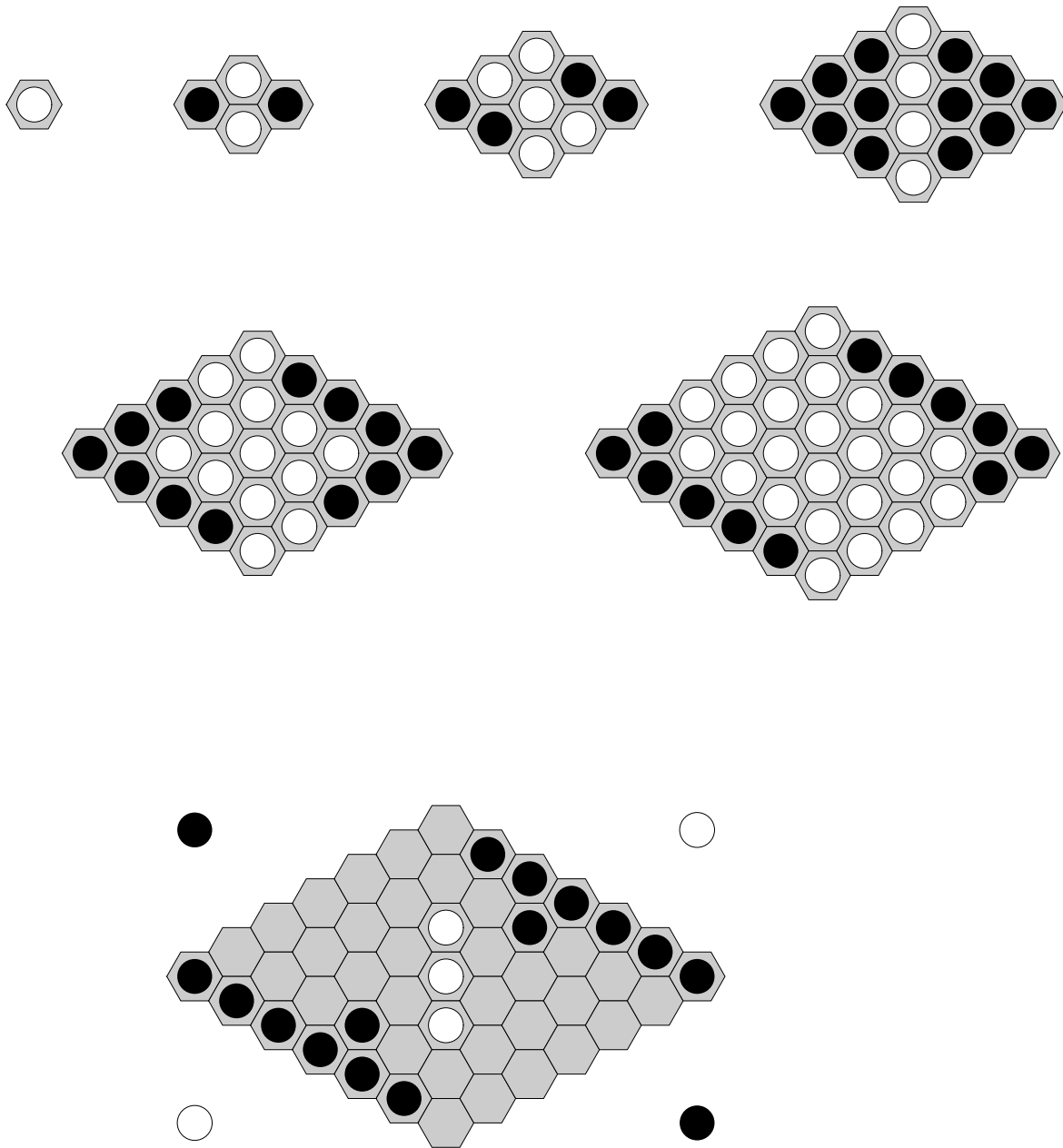
- **virtual-connection:**
cells of a
2nd-player-win
cell-to-cell subgame
 - **semi-connection:**
cells of a
1st-player-win
cell-to-cell subgame
 - **we use**
 - fixed game-state vc/sc combining rules
(Anshelevich)
 - dynamic game-state vc/sc combining rules
(Van Rijswijck)
 - search restriction (“mustplay region”)
(Berge)
 - game-state reduction
(H.)
 - a computer
- to find**
- all opening winning 7x7 Hex moves



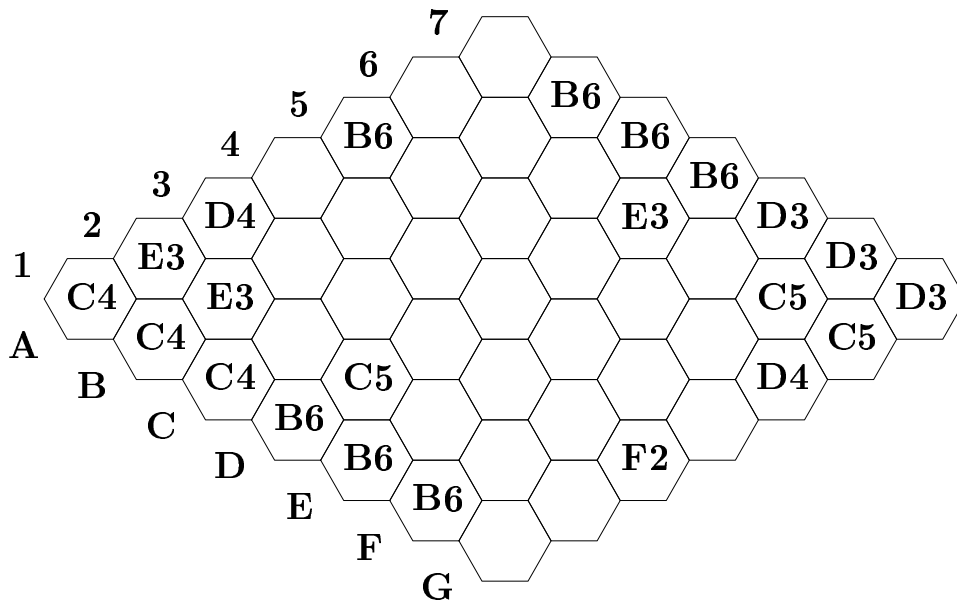
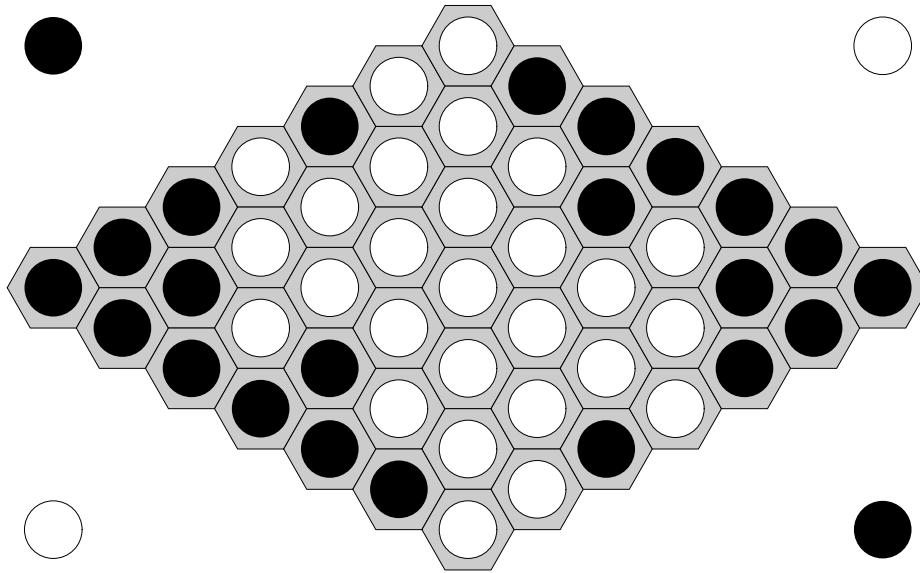
the game of Hex

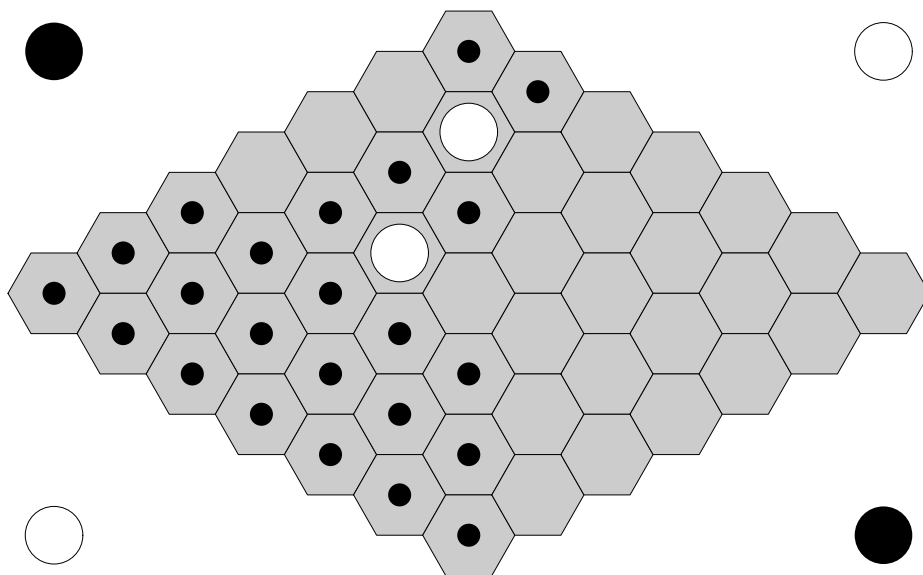
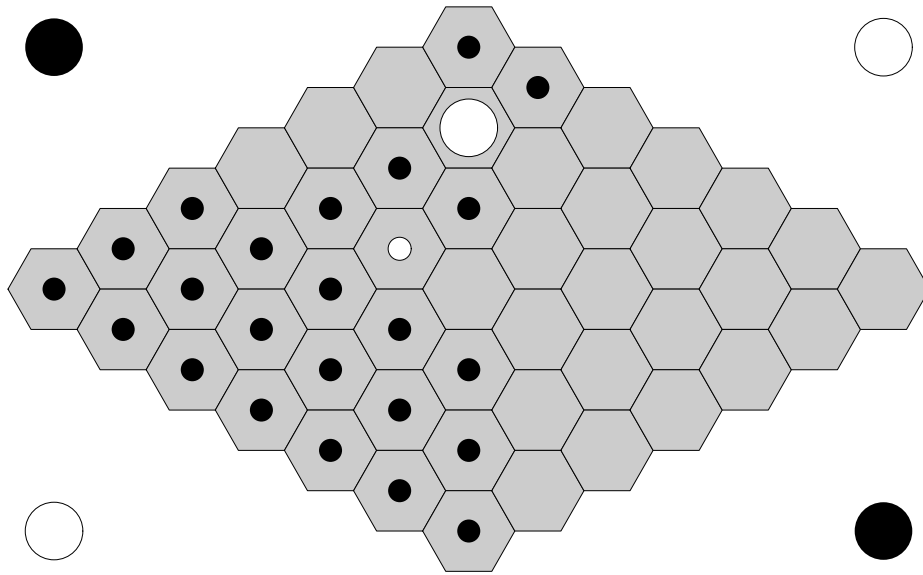


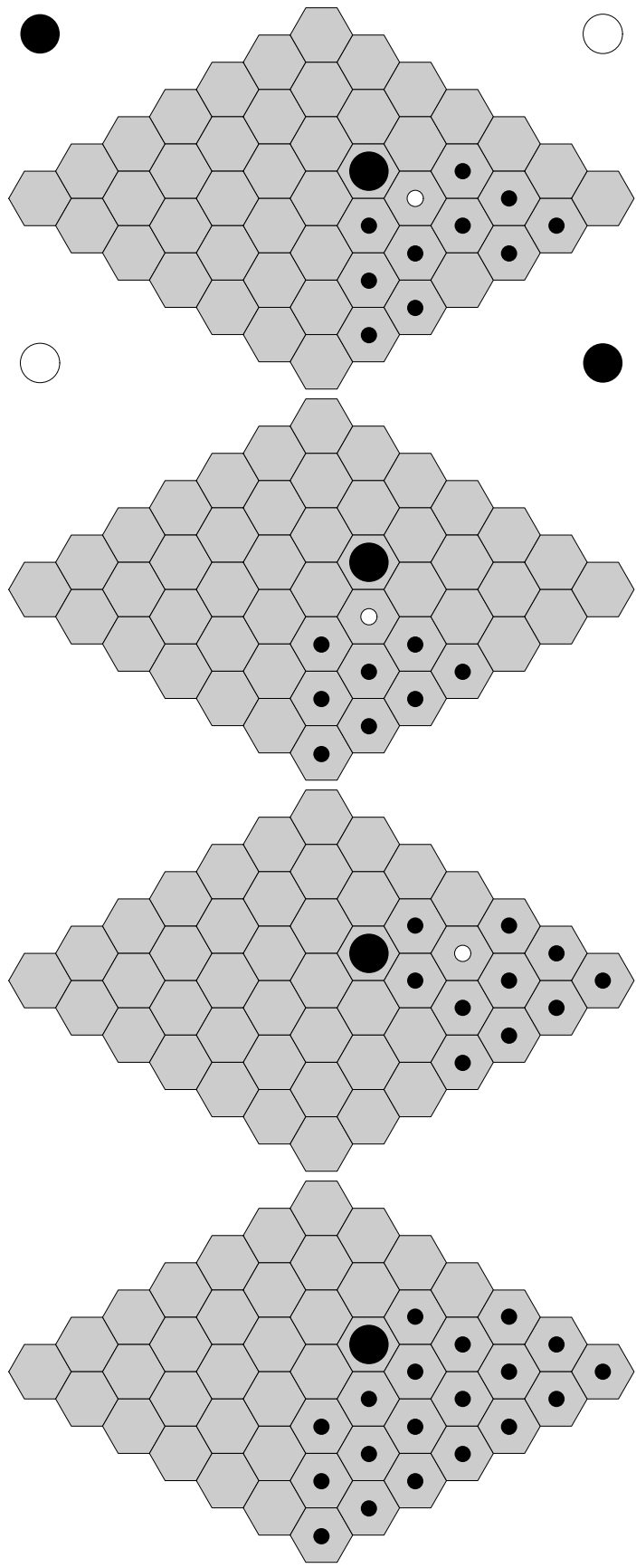
opening winning moves: previous results

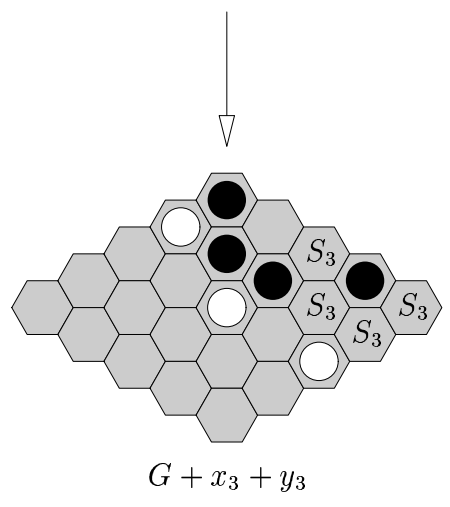
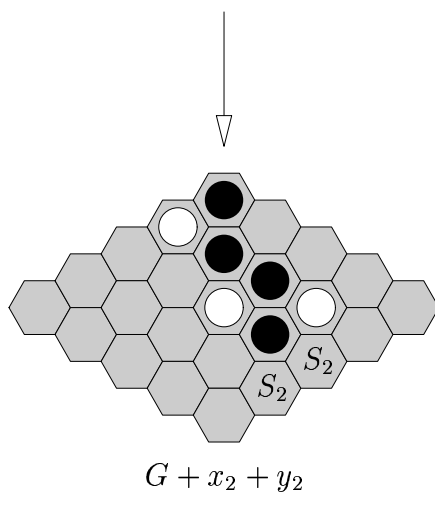
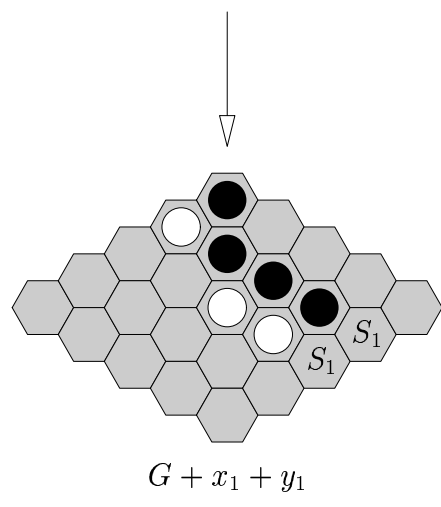
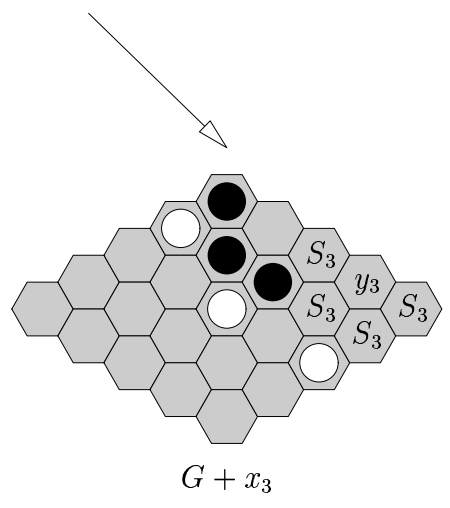
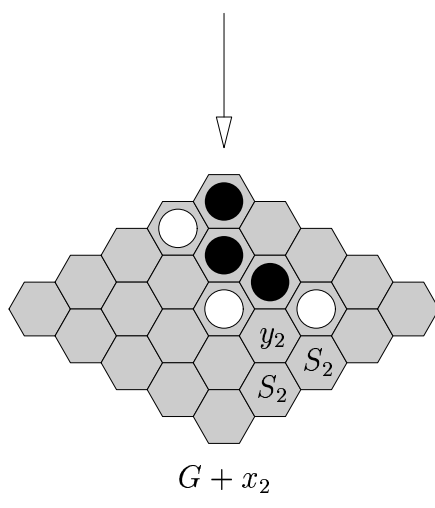
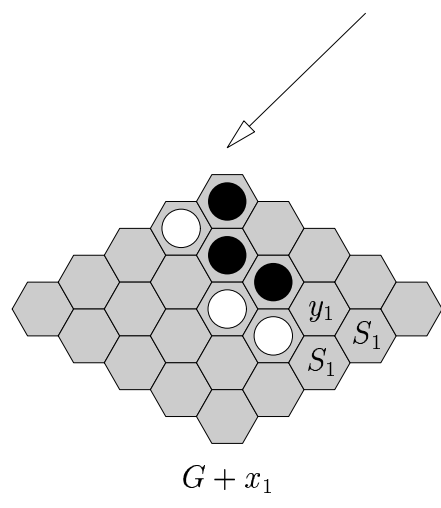
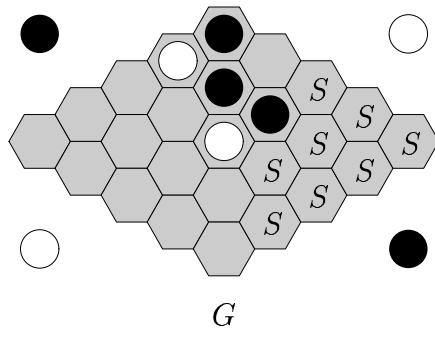


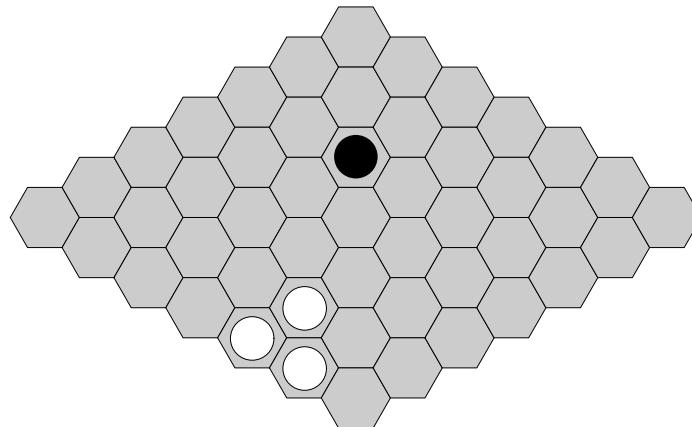
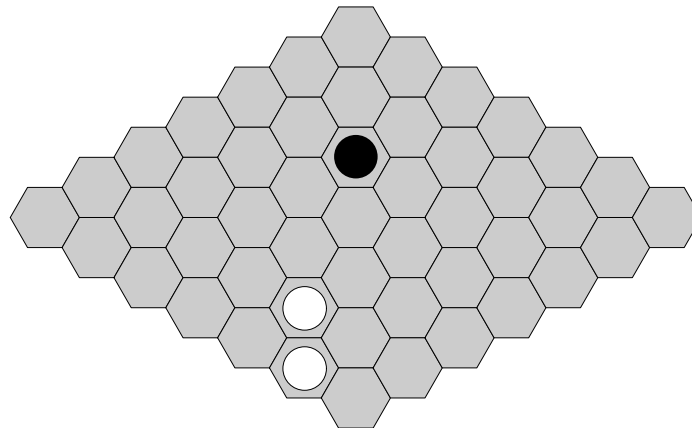
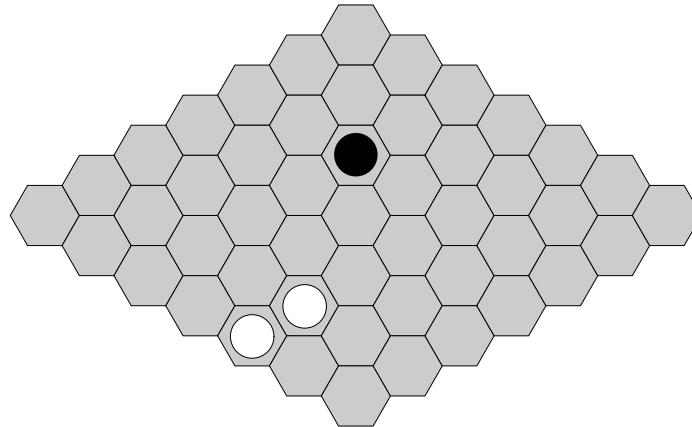
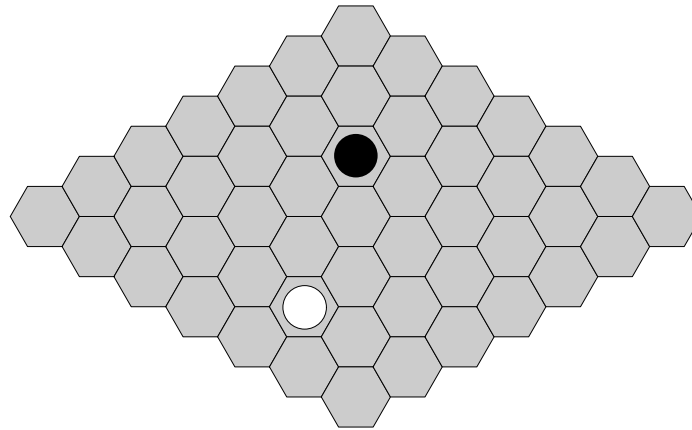
new results

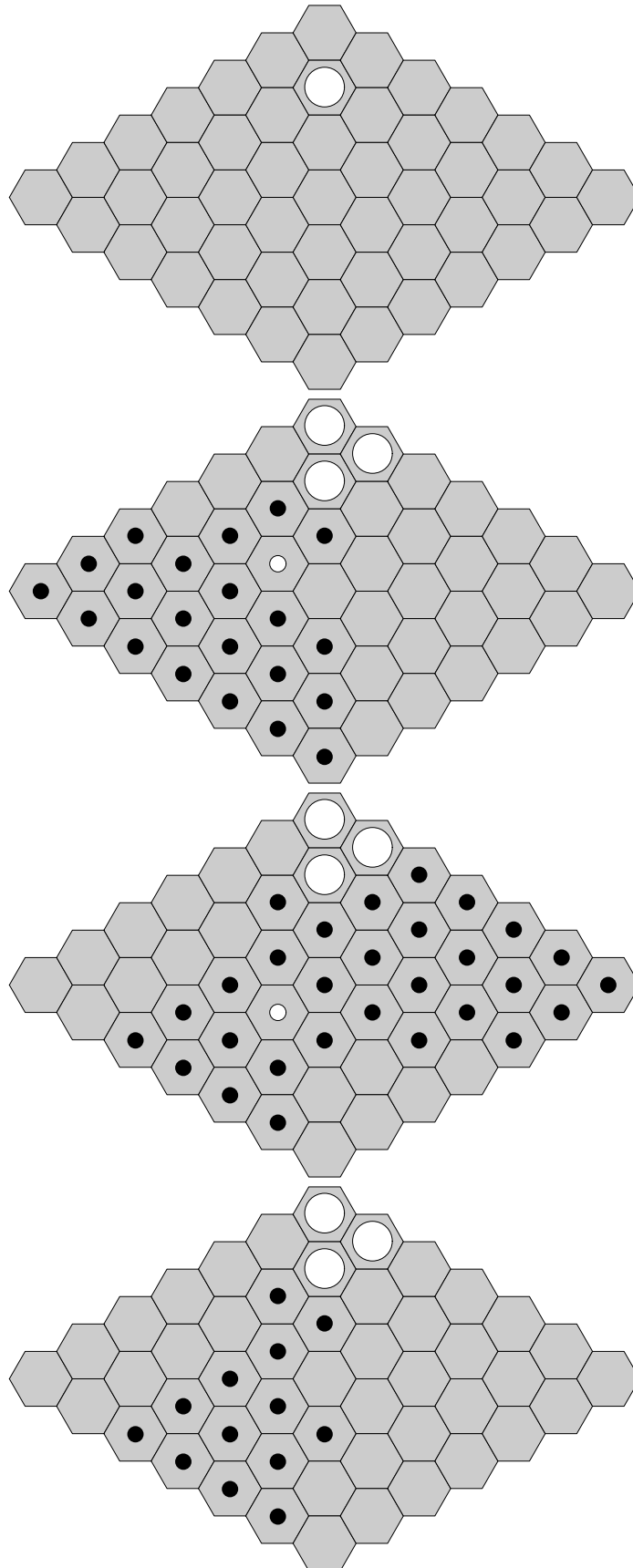


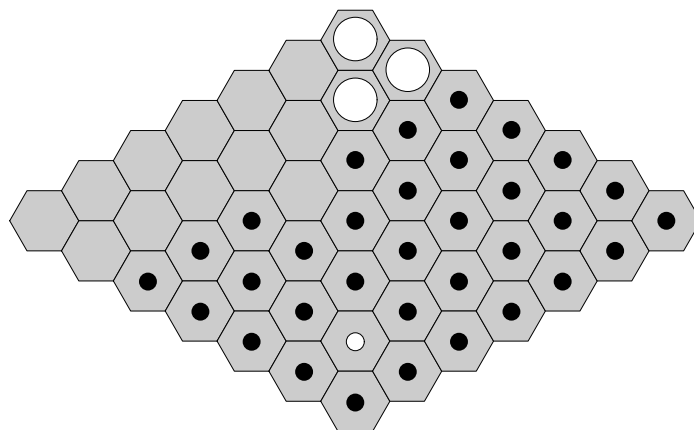
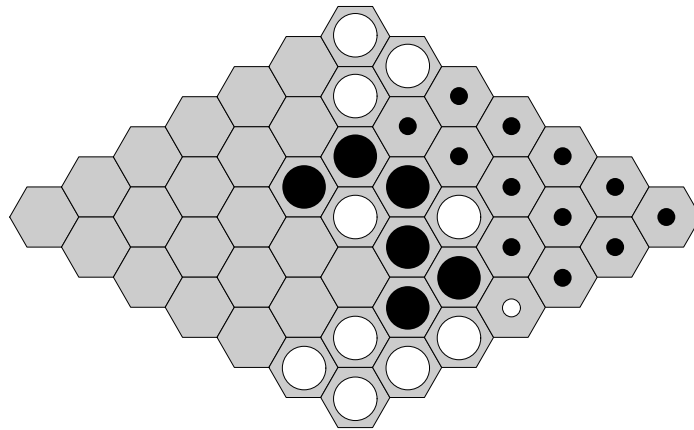
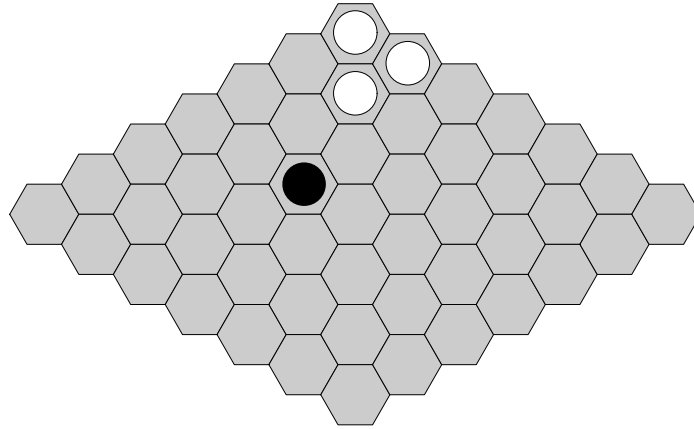


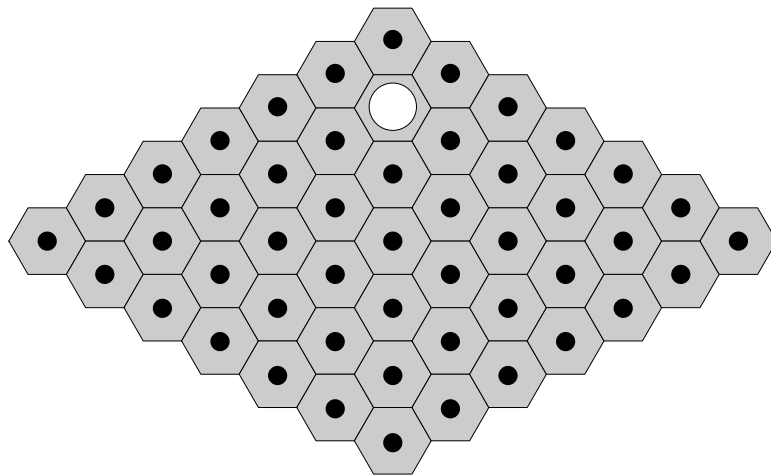
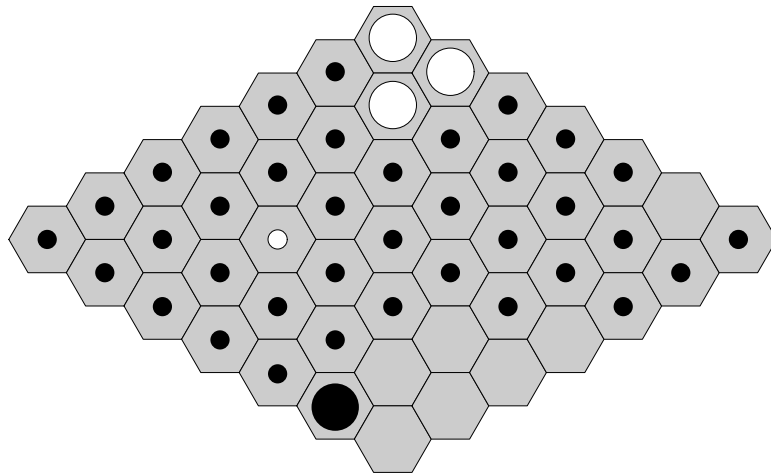


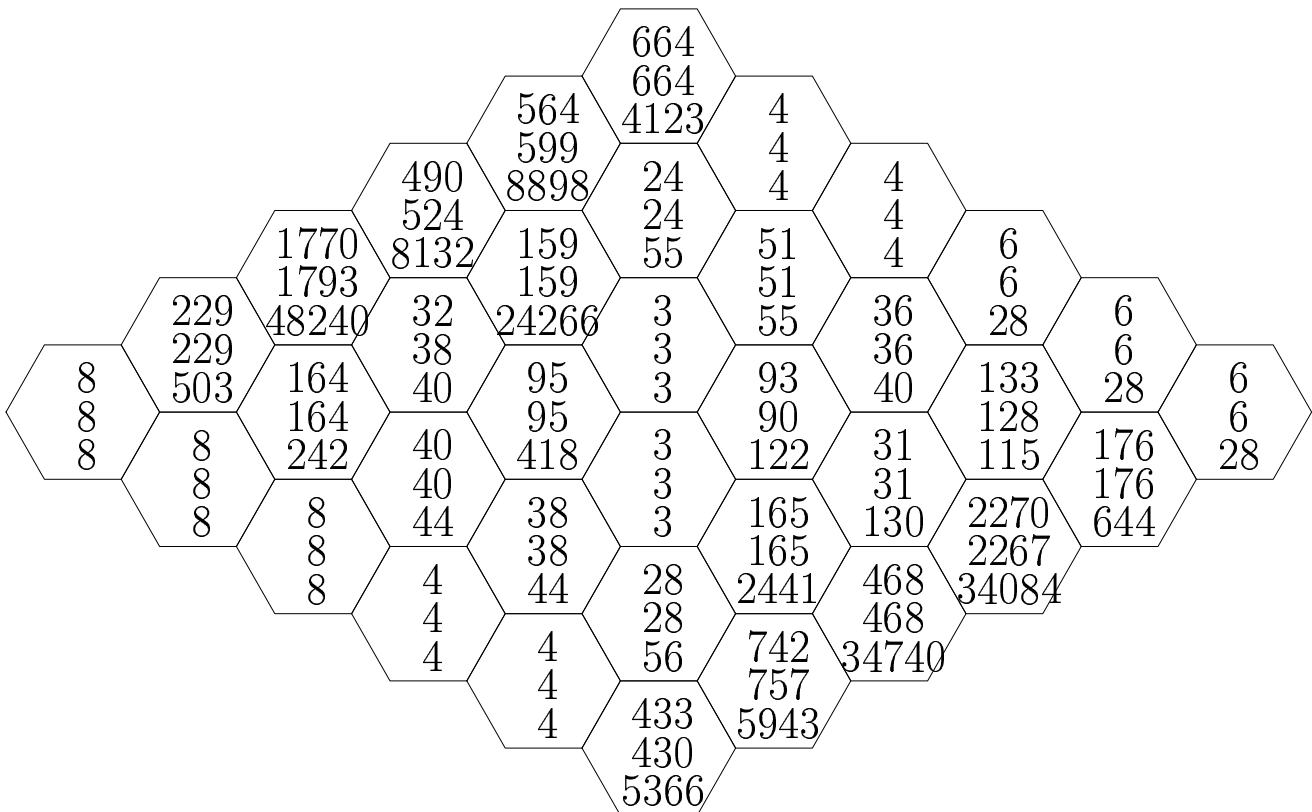
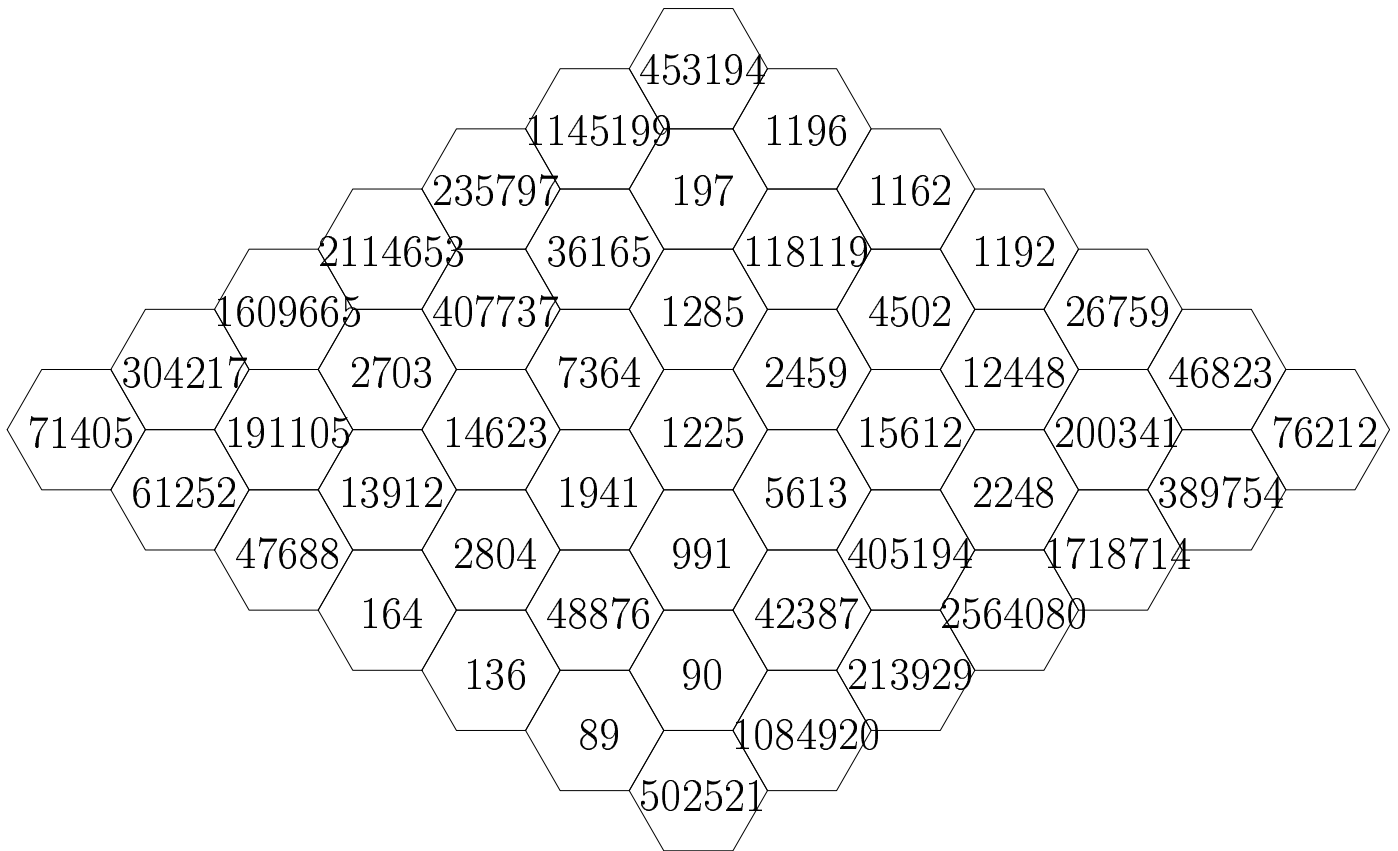


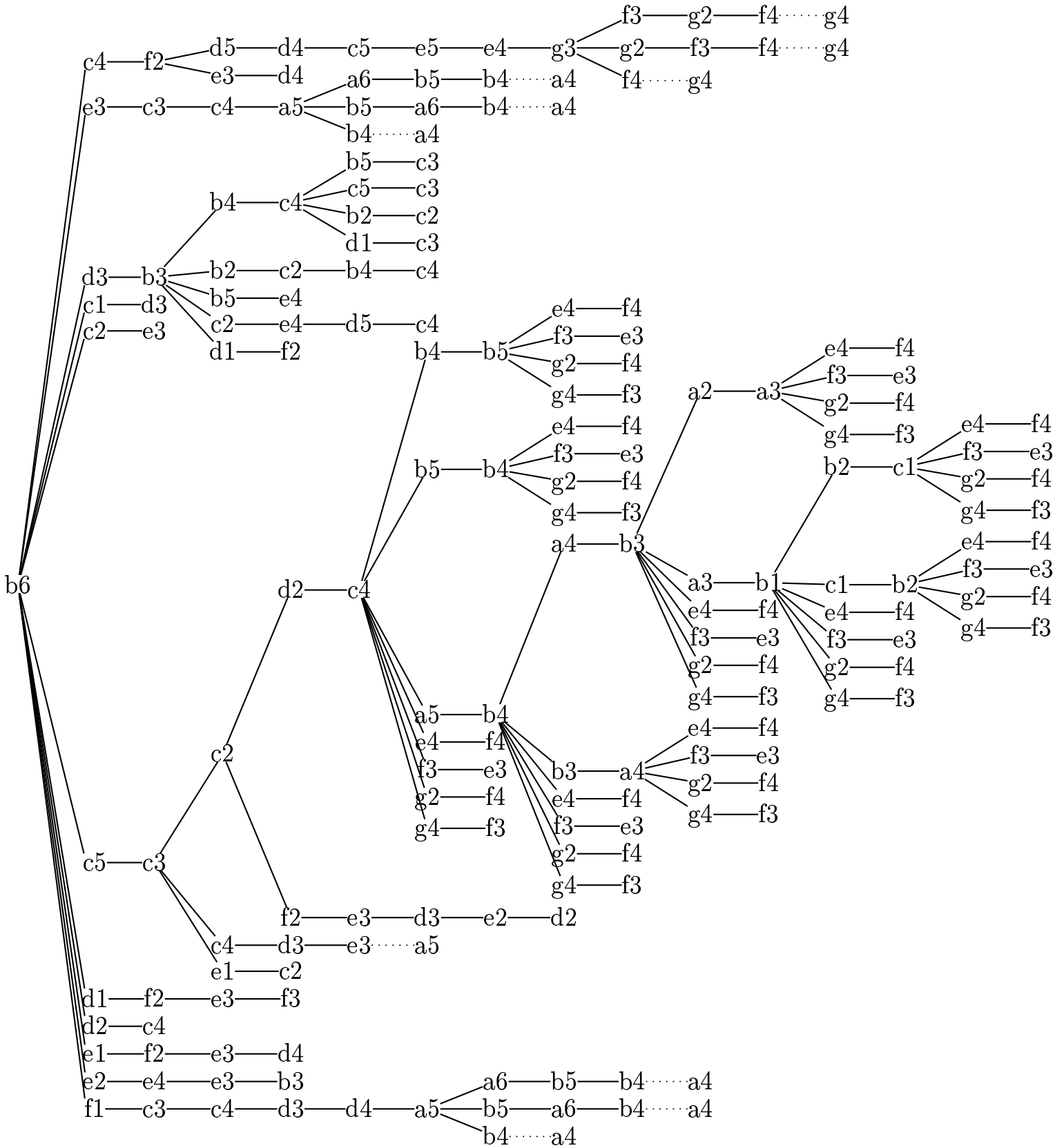


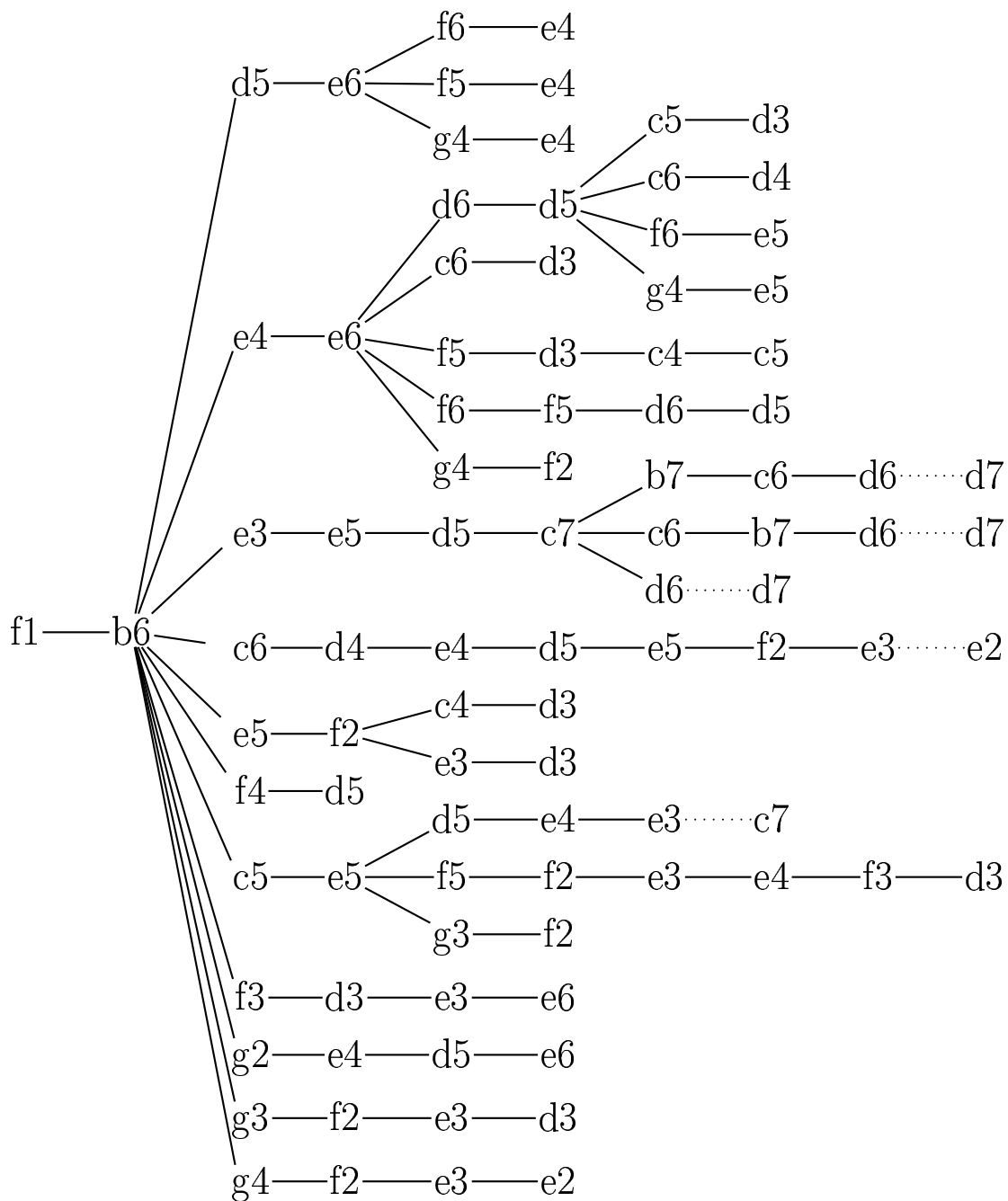












1	2	3	4	5	6	7	8	9	10	...										
a1	c4	a6	f2	d3	b6	e4	d4	e3	e5	d5	e1	e2	f1	a3	b2	c2	c3	a4	d2	...
a2	e3	f4	d5	c5	d3	g2	e6	e5	c7	d6	d7	g5	f7	e7	f6	b6	d2	c6	g1	...
a3	d4	c5	b4	c4	d2	c3	c2	b3	b1	b2	c1	e4	f2	e2	d5	d3	b7	a7	b6	...
a4	b3	d3	d5	c5	d2	c2	b7	a7	b6	a6	b5	e5	c3	a5	b1	a3	b2	e4	f1	...
a5	b6	c5	e3	f4	d5	c6	c3	d3	e1	e2	f1	g1	f2	d2	d1	g2	f3	g3	e6	...
a6	f1	c3	b5	c6	d4	c4	c5	a5	b4	a4	b3	a3	a7	b6	b1	b2	c1	c2	d1	...
a7	d5	c3	d2	c2	c4	a5	b4	a4	a6	e4	d4	e5	e3	b5	b3	a3	b1	b2	b6	...
b1	c4	a6	f2	d3	b6	e4	d4	e3	e5	d5	e1	e2	f1	a3	b2	c2	c3	a4	d2	...
b2	e3	g2	g1	a6	b3	c3	d2	f2	f1	e1	e2	c2	b5	d4	c4	d3	d5	c5	b7	...
b3	b1	c4	c3	b6	f1	b4	c2	b2	c1	d2	d3	e3	d4	e4	e2	g1	d5	e5	f2	...
b4	f1	c2	b7	a7	c3	b3	b5	c4	c5	e4	d4	e3	e5	d5	c7	b6	c6	d6	d7	...
b5	f1	c3	b6	c6	d2	c5	c1	a2	b4	c4	b2	a3	b3	c2	d1	e2	d3	e3	d4	...
b6	c4	f2	d5	d4	c5	e5	e4	g3	f3	g2	f4	g4								
b7	b6	e4	d5	e5	e3	g2	f3	g3	e6	f5	f6	c6	c5	d6	f4	d4	d3	g4	g1	...
c1	c4	a6	f2	d3	b6	e4	d4	e3	e5	d5	e1	d2	c2	a3	d1	b4	a4	b3	b1	...
c2	d5	c5	b7	a7	b6	a6	b5	a5	b3	c4	f1	b4	c3	e2	d3	e3	d4	e5	e4	...
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c4	c3	b6	d3	e3	f1	d2	e2	b3	b5	b4	c5	d4	d5	e5	e4	g3	f3	g2	g1	...
c5	d5	c2	b7	a7	b6	a6	b5	a5	b3	c4	f1	b4	c3	e2	d3	e3	d4	e5	e4	...
c6	d3	c3	c4	e3	d5	c5	d4	e5	e4	a5	b4	a4	b3	a3	b1	b2	b5	a6	a7	...
c7	b6	e4	d5	e5	e3	g2	f3	g3	e6	f5	f6	c6	c5	d6	f4	d4	d3	g4	g1	...
d1	b6	c6	d4	e4	d5	e5	f2	e3	e2											
d2	c5	e4	d3	f2	e5	d5	f3	e3	c7	b6	c6	b5	c3	c4	d4	a4	b2	b3	c2	...
d3	d4	b6	c4	a5	a6	b5	b3	c3	b4	e4	d5	e5	e3	g2	f3	g3	g1	f2	f1	...
d4	d3	c4	c3	e3	f1	c2	d2	e1	e2	g1	f2	f3	g2	a4	b3	a3	b1	b2	b4	...

1	...	11	12	13	14	15	16	17	18	19									
a1	c4	...	b5	a2	b3	a5	b4	a7	c5	c7	b7	c6	d6	d7					
a2	e3	...	f2	f1	e1	e2	a4	b3											
a3	d4	...	a6	b5	e3	e5	c6	c7	d6	d7									
a4	b3	...	e2	e1	g1	f2	g2	f3	g3	f4	g4	f5	g5	f7	f6	e7	e6	d7	c4
a5	b6	...	d6	e5	g5	f7	e7	f6	d4	e4									
a6	f1	...	e1	d2	e2	d3	e4	d5	e5	e3	g2	f2	g1	f3	g3	f4	g4		
a7	d5	...	c6	c5	g2	f3	g3	g1	f2	f1	e2	d3	e1	f4	g4				
b1	c4	...	b5	a2	b3	a5	b4	a7	c5	c7	b7	c6	d6	d7					
b2	e3	...	a7	b6	a5	b4	e4	e5	c6	c7	d6	d7							
b3	b1	...	g2	f3	g3	f4	g4												
b4	f1	...	e6	e7	g6	f6	g5	f5	g4	f4	g3								
b5	f1	...	e4	e1	g1	d5	e5	f2	g2	f3	g3	f4	g4						
b6	c4	...																	
b7	b6	...	c4	c3	f2	f1	e2	e1	d2	d1									
c1	c4	...	e2	b2	f1	c7	b7	c6	a7	b5	a5	c3	d6	d7					
c2	d5	...	g3	f3	g2	g1	f2	d2	e1	f4	g4								
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c4	c3	...	f2	b2	c2	f4	g4												
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c7	b6	...	c4	c3	f2	f1	e2	e1	d2	d1									
d1	b6	...																	
d2	c5	...	d6	d7															
d3	d4	...	e2	e1	c2	f4	g4												
d4	d3	...	a5																