

# Les automates cellulaires élémentaires

## Notes

- Les trois tableaux sous un diagramme indiquent la règle selon les notations de [S. Wolfram](#), binaire et de [N. Fatès](#). L'accès direct fonctionne pour les deux. La notation de N. Fatès contient une lettre du tableau suivant si et seulement si la configuration correspondante fait changer d'état la cellule centrale :

A	B	C	D	E	F	G	H
000	001	100	101	010	011	110	111

- Un tableau contient :

règle de numéro minimal pour la notation Wolfram	règle symétrique
règle conjuguée	règle symétrique conjuguée

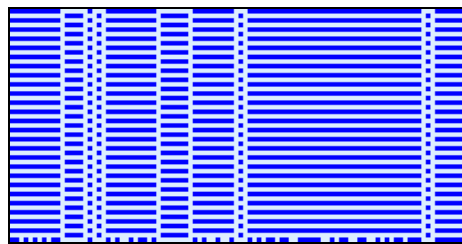
- Un automate est dit *captif* si chaque transition mène à un état déjà présent dans le voisinage avant la transition. Pour les automates élémentaires, cela revient à dire que la configuration 000 mène à 0 et que la configuration 111 mène à 1.
- Le temps va de bas en haut.
- Les vignettes représentent 100 cellules pendant 51 étapes (donc 50 transitions).
- Voir aussi <http://lma.homelinux.org/~twiki/bin/view/CellularAutomata>

## La table

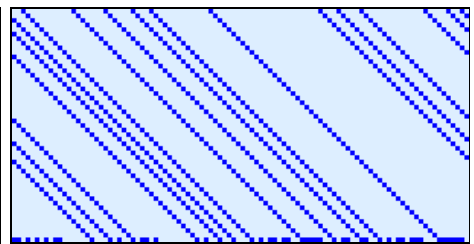


<b>0</b>	0	00000000	00000000	EFGH	EFGH
255	255	11111111	11111111	ABCD	ABCD

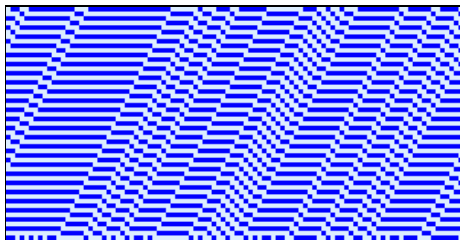
linéaire affine « zéro »



<b>1</b>	1	00000001	00000001	AEFGH	AEFGH
127	127	01111111	01111111	ABCDH	ABCDH



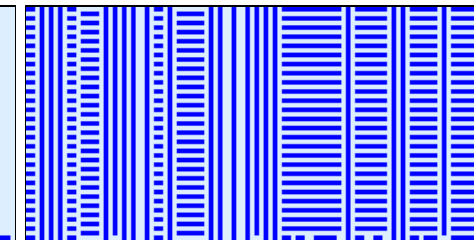
<b>2</b>	16	00000010	00010000	BEFGH	CEFGH
191	247	10111111	11110111	ABCDG	ABCDF



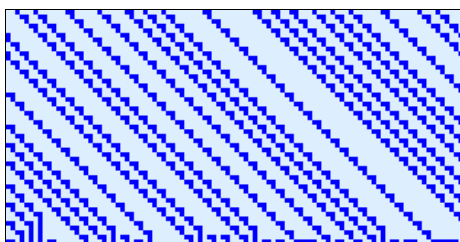
<b>3</b>	17	00000011	00010001	ABEFGH	ACEFGH
63	119	00111111	01110111	ABCDGH	ABCDFH



<b>4</b>	4	00000100	00000100	FGH	FGH
223	223	11011111	11011111	ABC	ABC



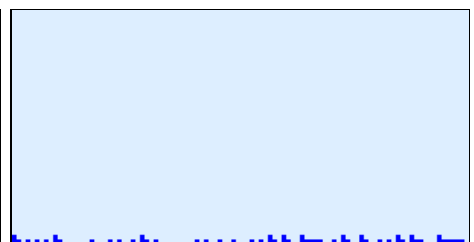
<b>5</b>	5	00000101	00000101	AFGH	AFGH
95	95	01011111	01011111	ABCH	ABCH



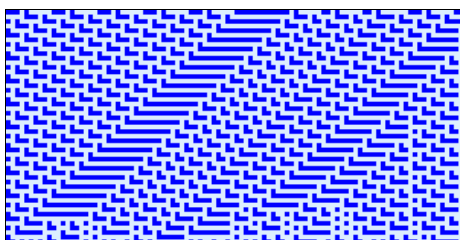
<b>6</b>	20	00000110	00010100	BFGH	CFGH
159	215	10011111	11010111	ABCG	ABCF



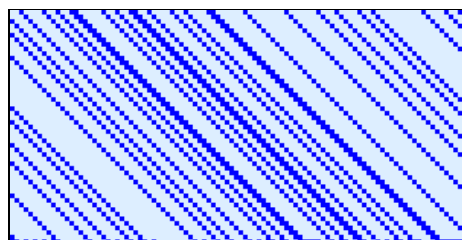
<b>7</b>	21	00000111	00010101	ABFGH	ACFGH
31	87	00011111	01010111	ABCGH	ABCFH



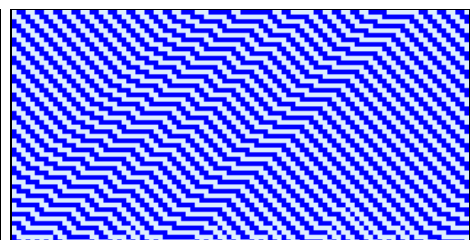
<b>8</b>	64	00001000	01000000	EGH	EFH
239	253	11101111	11111101	ABD	ACD



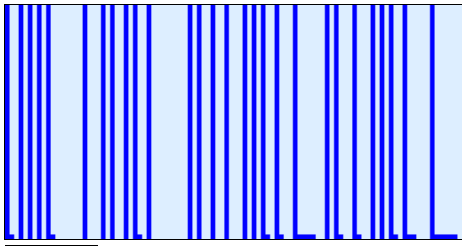
<b>9</b>	65	00001001	01000001	AEGH	AEFH
111	125	01101111	01111101	ABDH	ACDH



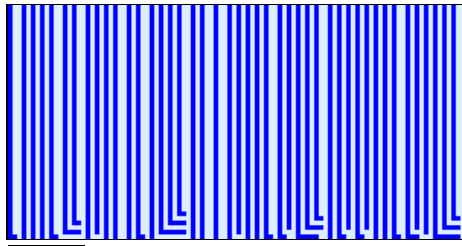
<b>10</b>	80	00001010	01010000	BEGH	CEFH
175	245	10101111	11110101	ABDG	ACDF



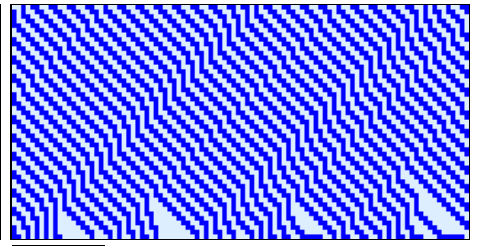
<b>11</b>	81	00001011	01010001	ABEGH	ACEFH
47	117	00101111	01110101	ABDGH	ACDFH



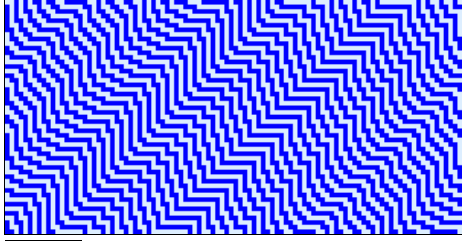
<b>12</b>	68	00001100 01000100	GHFH
207	221	11001111 11011101	AB AC



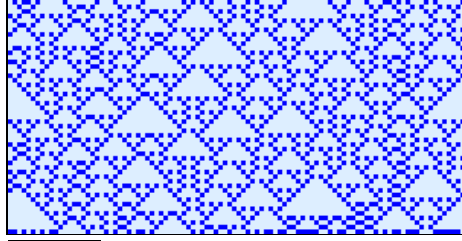
<b>13</b>	69	00001101 01000101	AGH AFH
79	93	01001111 01011101	ABH ACH



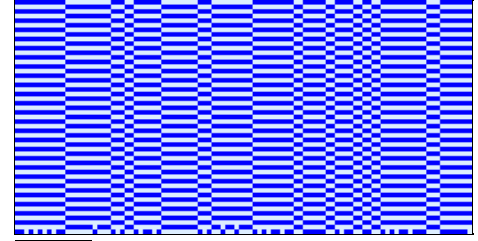
<b>14</b>	84	00001110 01010100	BGH CFH
143	213	10001111 11010101	ABG ACF



<b>15</b>	85	00001111 01010101	ABGH ACFH
15	85	00001111 01010101	ABGH ACFH

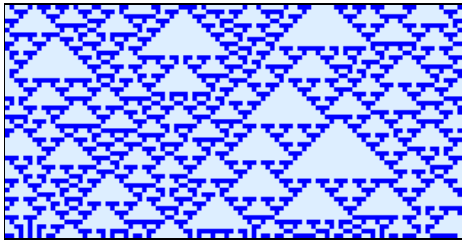


<b>18</b>	18	00010010 00010010	BCEFGH BCEFGH
183	183	10110111 10110111	ABCDGF ABCDGF

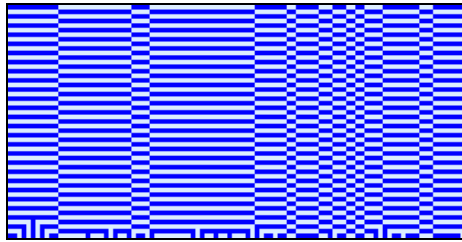


<b>19</b>	19	00010011 00010011	ABCEFGH ABCEFGH
55	55	00110111 00110111	ABCDGFH ABCDGFH

affine « shift+non »

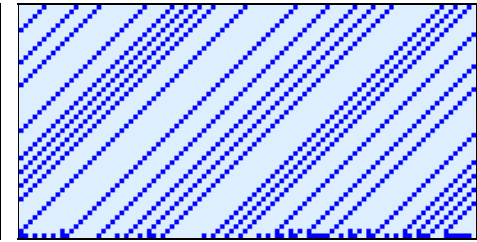


<b>22</b>	22	00010110 00010110	BCFGH BCFGH
151	151	10010111 10010111	ABCFG ABCFG

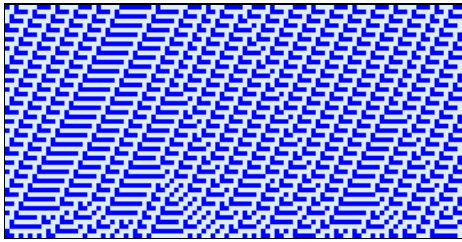


<b>23</b>	23	00010111 00010111	ABCFGH ABCFGH
23	23	00010111 00010111	ABCFGH ABCFGH

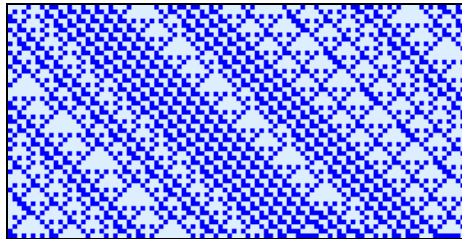
« minorité »



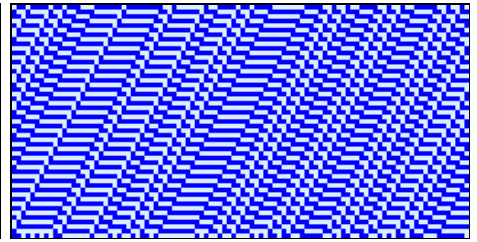
<b>24</b>	66	00011000 01000010	CEGH BEFH
231	189	11100111 10111101	ABDF ACDG



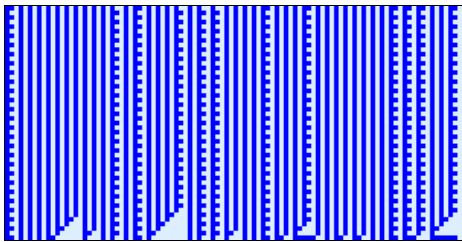
<b>25</b>	67	00011001 01000011	ACEGH ABEFH
103	61	01100111 00111101	ABDFH ACDGH



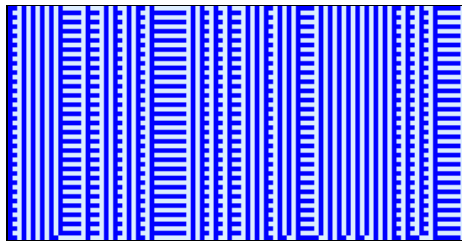
<b>26</b>	82	00011010 01010010	BCEGH BCEFH
167	181	10100111 10110101	ABDFG ACDFG



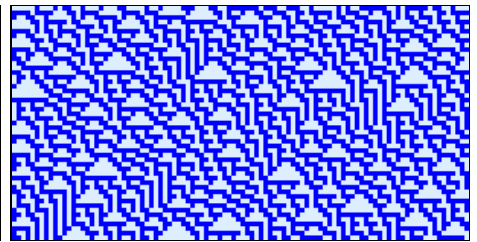
<b>27</b>	83	00011011 01010011	ABCEGH ABCEFH
39	53	00100111 00110101	ABDFGH ACDFGH



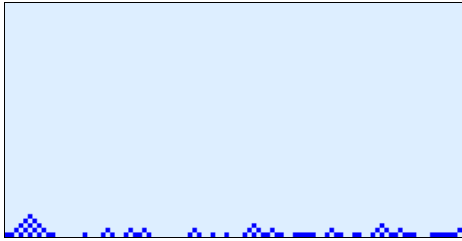
<b>28</b>	70	00011100 01000110	CGH BFH
199	157	11000111 10011101	ABF ACG



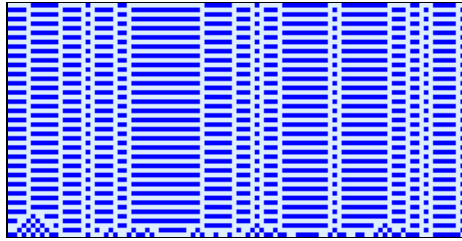
<b>29</b>	71	00011101 01000111	ACGH ABFH
71	29	01000111 00011101	ABFH ACGH



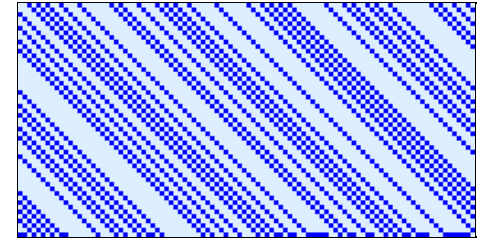
<b>30</b>	86	00011110 01010110	BCGH BCFH
135	149	10000111 10010101	ABFG ACFG



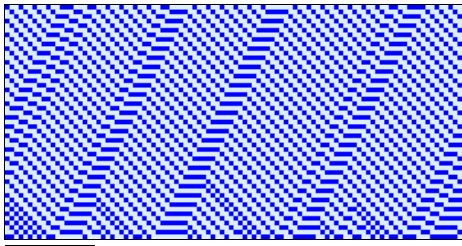
<b>32</b>	32	00100000 00100000	DEFGH DEFGH
251	251	11111011 11111011	ABCDE ABCDE



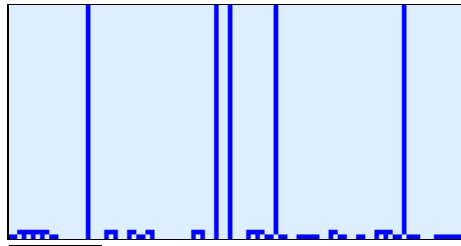
<b>33</b>	33	00100001 00100001	ADEFGH ADEFGH
123	123	01111011 01111011	ABCDEH ABCDEH



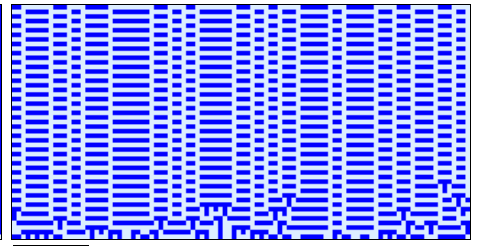
<b>34</b>	48	00100010 00110000	BDEFGH CDEFGH
187	243	10111011 11111001	ABCDEG ABCDEF



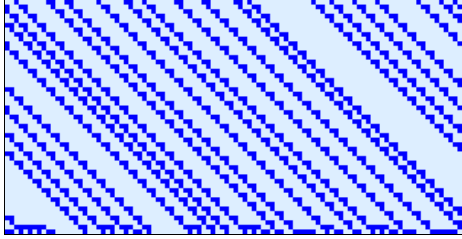
<b>35</b>	49	00100011	00110001	ABDEFGH	ACDEFGH
59	115	00111011	01110011	ABCDEGH	ABCDEFH



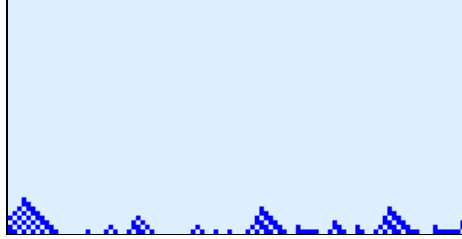
<b>36</b>	36	00100100	00100100	DFGH	DFGH
219	219	11011011	11011011	ABCE	ABCE



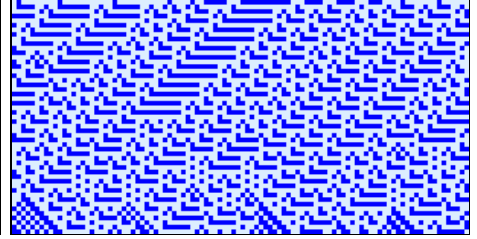
<b>37</b>	37	00100101	00100101	ADFGH	ADFGH
91	91	01011011	01011011	ABCEH	ABCEH



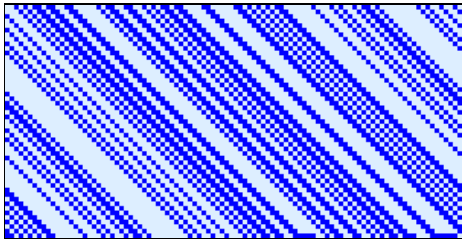
<b>38</b>	52	00100110	00110100	BDFGH	CDFGH
155	211	10011011	11010011	ABCEG	ABCEF



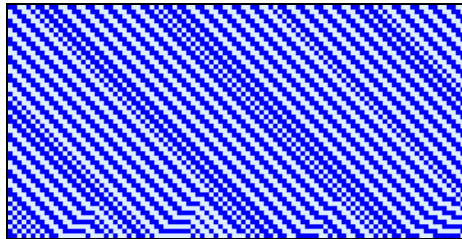
<b>40</b>	96	00101000	01100000	DEGH	DEFH
235	249	11101011	11111001	ABDE	ACDE



<b>41</b>	97	00101001	01100001	ADEGH	ADEFH
107	121	01101011	01111001	ABDEH	ACDEH



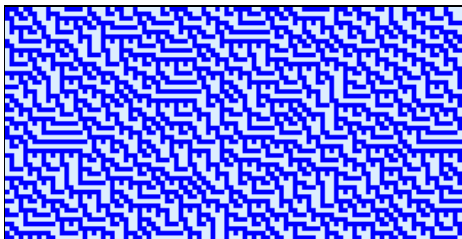
<b>42</b>	112	00101010	01110000	BDEGH	CDEFH
171	241	10101011	11110001	ABDEG	ACDEF



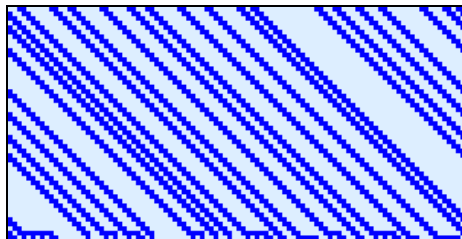
<b>43</b>	113	00101011	01110001	ABDEGH	ACDEFH
43	113	00101011	01110001	ABDEGH	ACDEFH



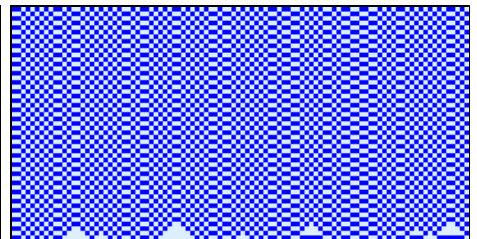
<b>44</b>	100	00101100	01100100	DGH	DFH
203	217	11001011	11011001	ABE	ACE



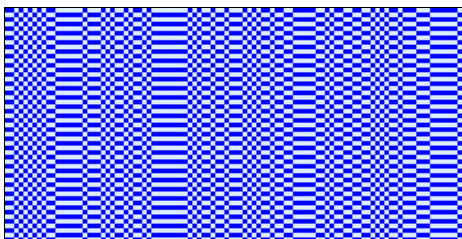
<b>45</b>	101	00101101	01100101	ADGH	ADFH
75	89	01001011	01011001	ABEH	ACEH



<b>46</b>	116	00101110	01110100	BDGH	CDFH
139	209	10001011	11010001	ABEG	ACEF

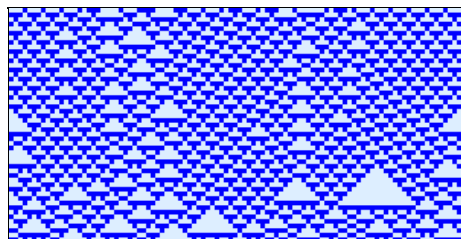


<b>50</b>	50	00110010	00110010	BCDEFGH	BCDEFGH
179	179	10110011	10110011	ABCDEFHG	ABCDEFHG



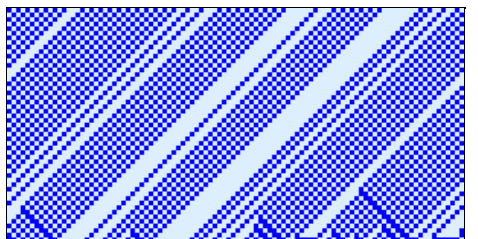
<b>51</b>	51	00110011	00110011	ABCDEFGH	ABCDEFGH
51	51	00110011	00110011	ABCDEFGH	ABCDEFGH

affine « non »

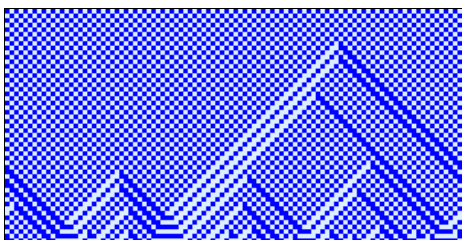


<b>54</b>	54	00110110	00110110	BCDFGH	BCDFGH
147	147	10010011	10010011	ABCEFG	ABCEFG

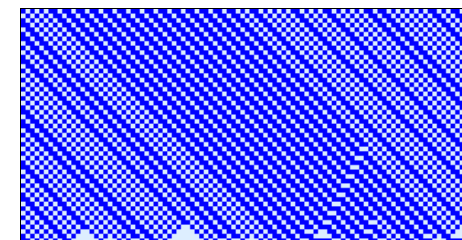
« universel ? »



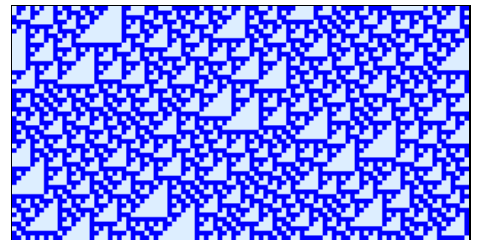
<b>56</b>	98	00111000	01100010	CDEGH	BDEFH
227	185	11100011	10111001	ABDEF	ACDEG



<b>57</b>	99	00111001	01100011	ACDEGH	ABDEFH
99	57	01100011	00111001	ABDEFH	ACDEGH

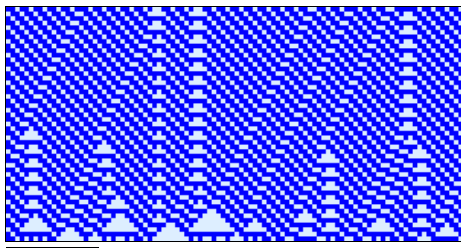


<b>58</b>	114	00111010	01110010	BCDEGH	BCDEFH
163	177	10100011	10110001	ABDEFG	ACDEFG

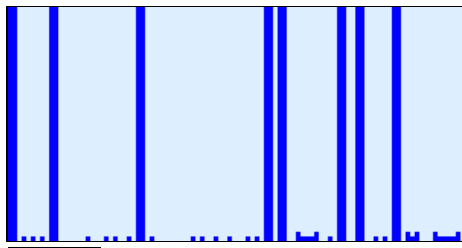


<b>60</b>	102	00111100	01100110	CDGH	BDFH
195	153	11000011	10011001	ABEF	ACEG

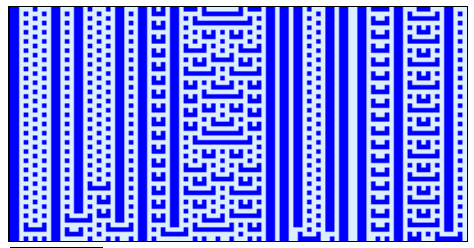
linéaire affine « xor(x<sub>n-1</sub>,x<sub>n</sub>) »



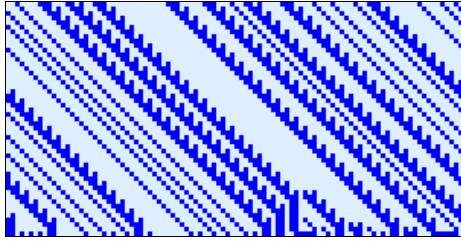
<b>62</b>	118	00111110 01110110	BCDGH BCDFH
131	145	10000011 10010001	ABEFG ACEFG



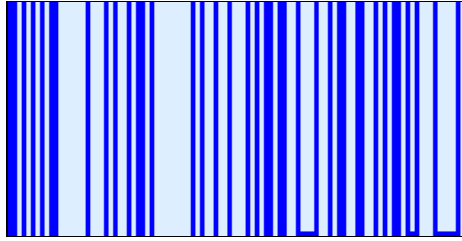
<b>72</b>	72	01001000 01001000	EH EH
237	237	11101101 11101101	AD AD



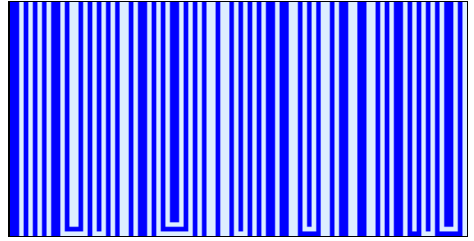
<b>73</b>	73	01001001 01001001	AEH AEH
109	109	01101101 01101101	ADH ADH



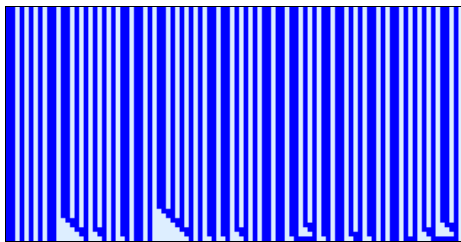
<b>74</b>	88	01001010 01011000	BEH CEH
173	229	10101101 11100101	ADG ADF



<b>76</b>	76	01001100 01001100	H H
205	205	11001101 11001101	A A



<b>77</b>	77	01001101 01001101	AH AH
77	77	01001101 01001101	AH AH

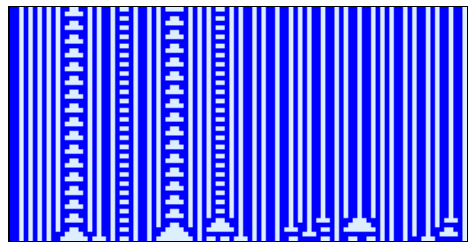


<b>78</b>	92	01001110 01011100	BH CH
141	197	10001101 11000101	AG AF

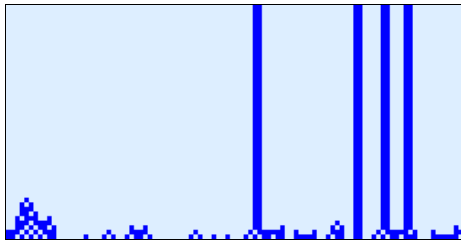


<b>90</b>	90	01011010 01011010	BCEH BCEH
165	165	10100101 10100101	ADFG ADFG

linéaire affine « xor(x<sub>n-1</sub>,x<sub>n+1</sub>) »



<b>94</b>	94	01011110 01011110	BCH BCH
133	133	10000101 10000101	AFG AFG

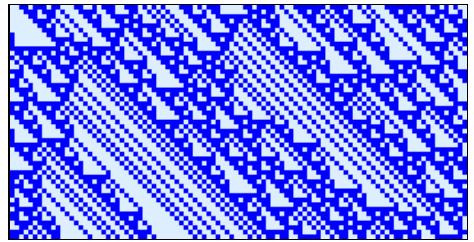


<b>104</b>	104	01101000 01101000	DEH DEH
233	233	11101001 11101001	ADE ADE

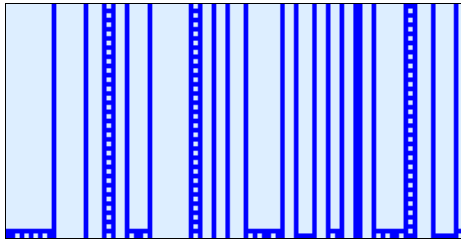


<b>105</b>	105	01101001 01101001	ADEH ADEH
105	105	01101001 01101001	ADEH ADEH

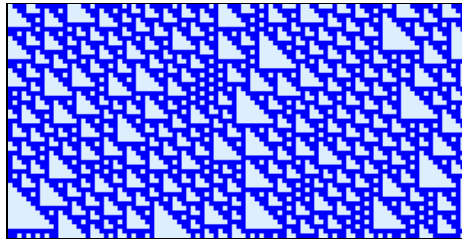
affine « non xor »



<b>106</b>	120	01101010 01111000	BDEH CDEH
169	225	10101001 11100001	ADEG ADEF

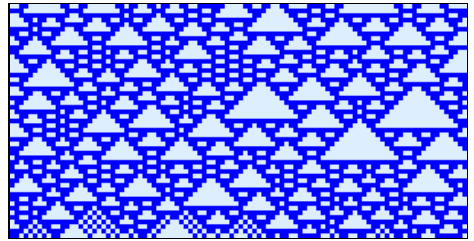


<b>108</b>	108	01101100 01101100	DH DH
201	201	11001001 11001001	AE AE

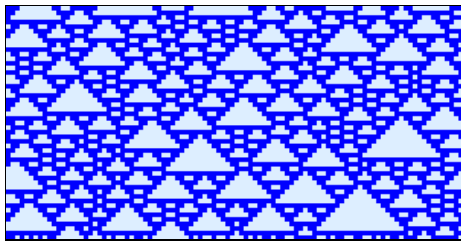


<b>110</b>	124	01101110 01111100	BDH CDH
137	193	10001001 11000001	AEG AEF

« universel »



<b>122</b>	122	01111010 01111010	BCDEH BCDEH
161	161	10100001 10100001	ADEFG ADEFG

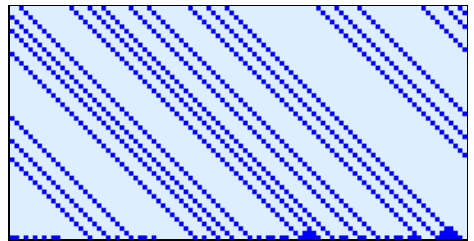


<b>126</b>	126	01111110 01111110	BCDH BCDH
129	129	10000001 10000001	AIEFG AIEFG



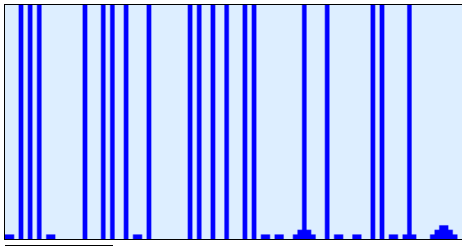
<b>128</b>	128	10000000 10000000	EFG EFG
254	254	11111110 11111110	BCD BCD

captif « et »



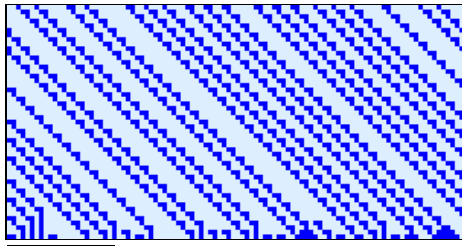
<b>130</b>	144	10000010 10010000	BEFG CEFG
190	246	10111110 11110110	BCDG BCDF

captif



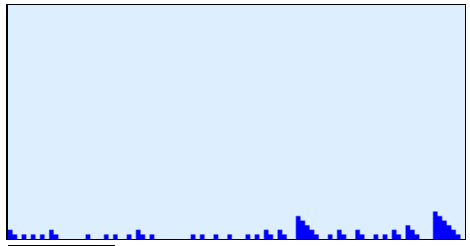
<b>132</b>	132	10000100	10000100	FG	FG
222	222	11011110	11011110	BC	BC

captif



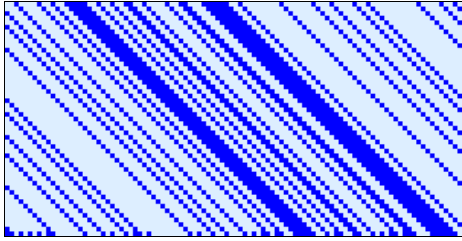
<b>134</b>	148	10000110	10010100	BFG	CFG
158	214	10011110	11010110	BCG	BCF

captif



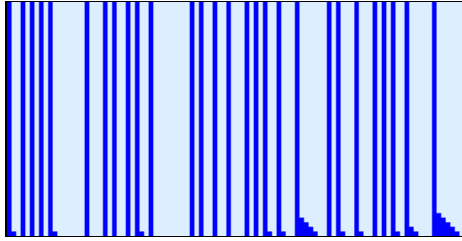
<b>136</b>	192	10001000	11000000	EG	EF
238	252	11101110	11111100	BD	CD

captif



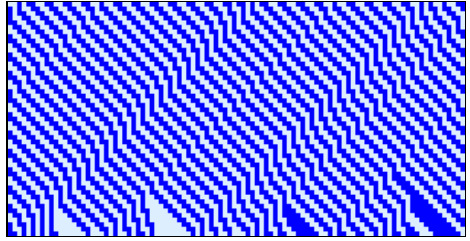
<b>138</b>	208	10001010	11010000	BEG	CEF
174	244	10101110	11110100	BDG	CDF

captif



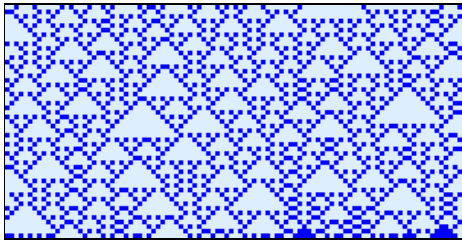
<b>140</b>	196	10001100	11000100	GF	
206	220	11001110	11011100	B	C

captif



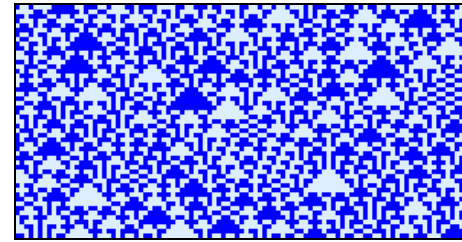
<b>142</b>	212	10001110	11010100	BG	CF
142	212	10001110	11010100	BG	CF

captif



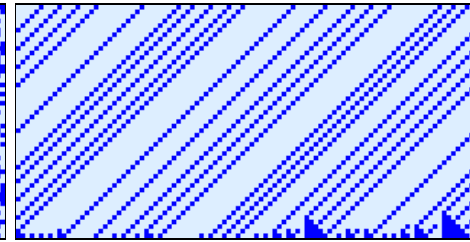
<b>146</b>	146	10010010	10010010	BCEFG	BCEFG
182	182	10110110	10110110	BCDFG	BCDFG

captif



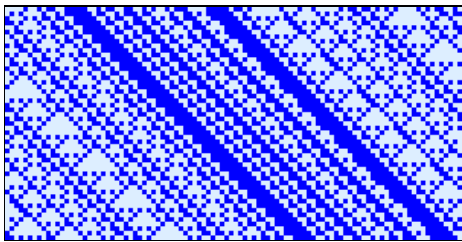
<b>150</b>	150	10010110	10010110	BCFG	BCFG
150	150	10010110	10010110	BCFG	BCFG

linéaire affine captif « xor »



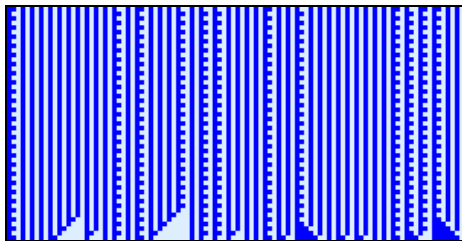
<b>152</b>	194	10011000	11000010	CEG	BEF
230	188	11100110	10111100	BDF	CDG

captif



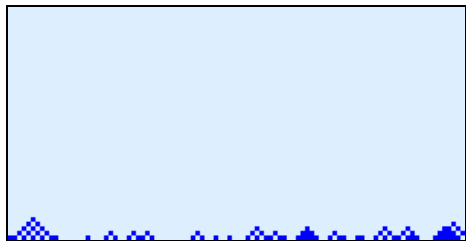
<b>154</b>	210	10011010	11010010	BCEG	BCEF
166	180	10100110	10110100	BDFG	CDFG

captif



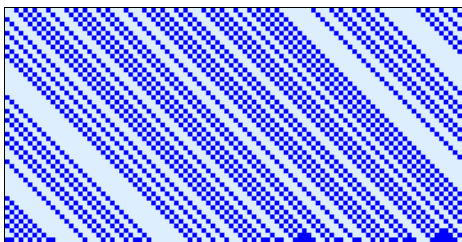
<b>156</b>	198	10011100	11000110	CG	BF
198	156	11000110	10011100	BF	CG

captif



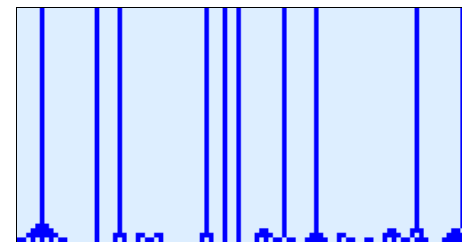
<b>160</b>	160	10100000	10100000	DEFG	DEFG
250	250	11111010	11111010	BCDE	BCDE

captif



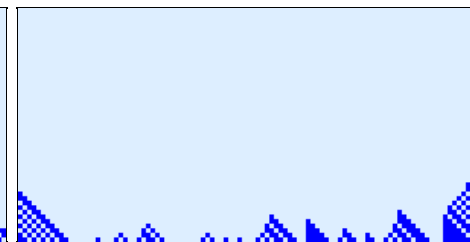
<b>162</b>	176	10100010	10110000	BDEFG	CDEFG
186	242	10111010	11110010	BCDEG	BCDEF

captif



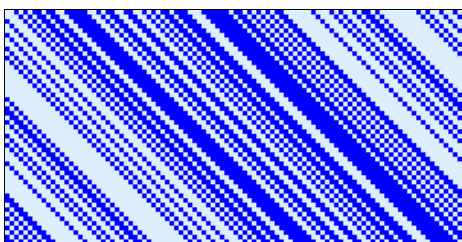
<b>164</b>	164	10100100	10100100	DFG	DFG
218	218	11011010	11011010	BCE	BCE

captif



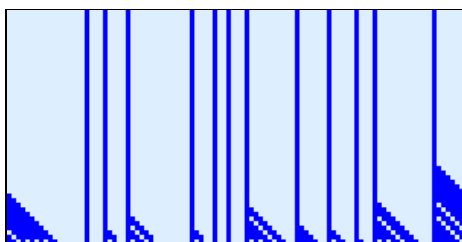
<b>168</b>	224	10101000	11100000	DEG	DEF
234	248	11101010	11111000	BDE	CDE

captif



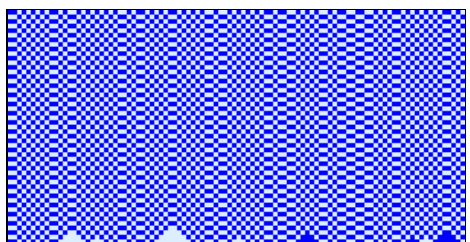
<b>170</b>	240	10101010	11110000	BDEG	CDEF
170	240	10101010	11110000	BDEG	CDEF

linéaire affine captif « shift »



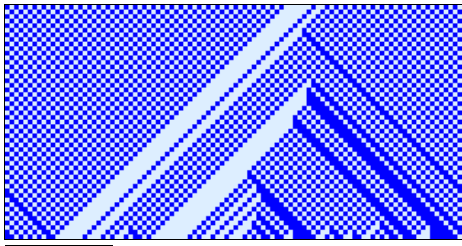
<b>172</b>	228	10101100	11100100	DG	DF
202	216	11001010	11011000	BE	CE

captif



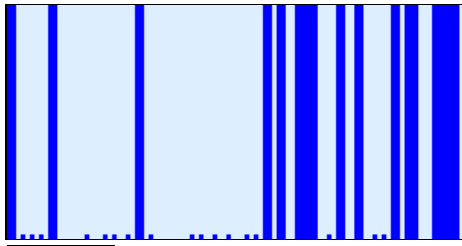
<b>178</b>	178	10110010	10110010	BCDEFG	BCDEFG
178	178	10110010	10110010	BCDEFG	BCDEFG

captif



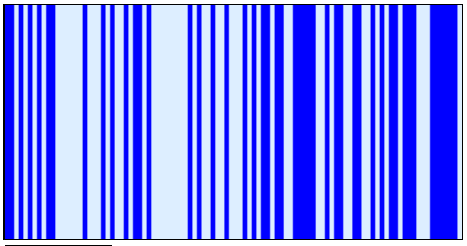
<b>184</b>	226	10111000	11100010	CDEG	BDEF
226	184	11100010	10111000	BDEF	CDEG

captif « embouteillages »



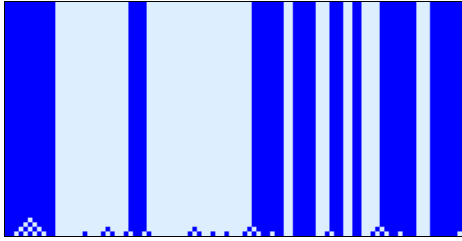
<b>200</b>	200	11001000	11001000	E	E
236	236	11101100	11101100	D	D

captif



<b>204</b>	204	11001100	11001100	⊗	⊗
204	204	11001100	11001100	⊗	⊗

linéaire affine captif « identité »



<b>232</b>	232	11101000	11101000	DE	DE
232	232	11101000	11101000	DE	DE

captif « majorité »