Convolutional Codes

Klaus von der Heide

Convolutional codes encode a stream of symbols into n streams of symbols. 1/n = R is called the ***code rate***. A second important parameter is the ***constraint length*** **L**. This is the length of the patterns the information stream is convolved with. With both parameters, n and L, the convolutional codes form a large homogeneous class of mathematically well-understood codes.

Encoding

Example: convolutional code (5 , 1/3)

constraint length L = 5
code rate R = 1/3

1/R polynomials of length L:

```
10101
11011
11111
```

k information bits `00010110000000100`

For each of the n polynomials do: write the polynomial starting at all places of a `1` in the information bits. Then add all these bits column-wise by EXCLUSIVE OR. Add leading zeros for leading zeros in the information bits, and add trailing zeros up to a code length of k + L - 1.

```
   10101
     10101
      10101
              10101
  ------------------------
```

code of 1st polynomial `000100101110010101000000`
code of 2nd polynomial `000111101010011011000000`
code of 3rd polynomial `000110110010011111000000`

Decoding

There are two different decoding algorithms to decode convolutional codes: The ***sequential tree-decoding*** and the maximum-likelihood ***Viterbi algorithm***. The latter finds the codeword that best fits into the received soft bits. Unfortunately, this algorithm only is practicable up to moderate constraint lengths. In contrast, the sequential algorithms do work for large constraint lengths. But the search time is not predictable. For details of the algorithms see the literature.

Quality of a Convolutional Code

Usually, convolutional codes are concatenated with a Reed-Solomon code which corrects most of the remaining decoding failures of the convolutional code. The quality of the convolutional code depends on this environment. The ***free distance*** **FD** of the code is a raw measure of it's quality. But codes of lower free distance may be better than a given code of maximum distance, especially if the code is run at a relatively high error rate. This usually is done in radio amateur practise.

The codes of the list presented further down are examined by a second value: the ***Block-Error-Rate*** for the special case of small blocks of $k = 64$ information bits determined at the highly-corrupted case of $E_b/N_0 = 0$ dB (by the Viterbi-soft decoding). This is the case, the codes are optimized for.

The block error rates mainly depend on the two parameters L and n. The error rates of all possible non-catastrophic codes with mutually different polynomials do not differ very much, if L and n are large. Example: There exist no more than 28 different convolutional codes with $L = 5$ and $n = 6$ with mutually different polynomials. All these codes are not catastrophic. Fig. 1 shows their block error rates for transport of 64 information bits at $E_b/N_0 = 0$ dB over their free distance. The lowest block error rate is at the largest free distance 23. But the error rates of the best codes of the sets with lower free distance are nearly equal. The difference in E_b/N_0 is negligible. Fig. 2 shows the block error rates of these 28 codes over E_b/N_0 in the range of 0 ... 4 dB. Note that there exist codes of larger free distance if polynomials may occur twice. Thes codes are worse.

Usually the demands of the environment restrict the code rate. And the constraint length is limited by realtime-demands of the decoder. If all these restrictions do not exist, then convolutional codes with the best relation of BlockErrorRate to decoding complexity (Viterbi) are those within (L,2/L) and (L,1/L). Codes with $n > 2^{L-2}$ are *not better* than $(L,2^{2-L})$. Codes with $n = 2$ are not efficient, especially at large constraint length L, but often the bandwidth demands do not allow larger n.

Searching for Good Codes

There are two ways to find good codes: the exhaustive search and the Monte-Carlo method. The computational effort to find the optimum code by exhaustive search increases exponentially with n*(L-2). But fortunately, the difference between the optimal code and a suboptimal one taken by random, decreases with n*(L-2).

Smaller codes of the following list are found by exhaustive search. All others were found by generating some 1000 codes with total number of ones in the range `FDE ... FDE+2` with `FDE = floor( 0.572*(L+2)*n )`, computing the free distances and the distance spectra, sorting by free distance, and taking the best spectra in each distance group. Finally the block error rates of the selected codes were evaluated at $E_b/N_0 = 0$ dB for the special case of blocks of 64 information bits.

These block error rates of all 210 codes of the following list are shown in figure 2 as a function of n (abscissa) and L (parameter). It is obvious that there only is a small fluctuation in the values of the error rates. They are caused by (1) not optimal codes, and (2) statistical deviations of the computation (only 100000 transmissions per value).

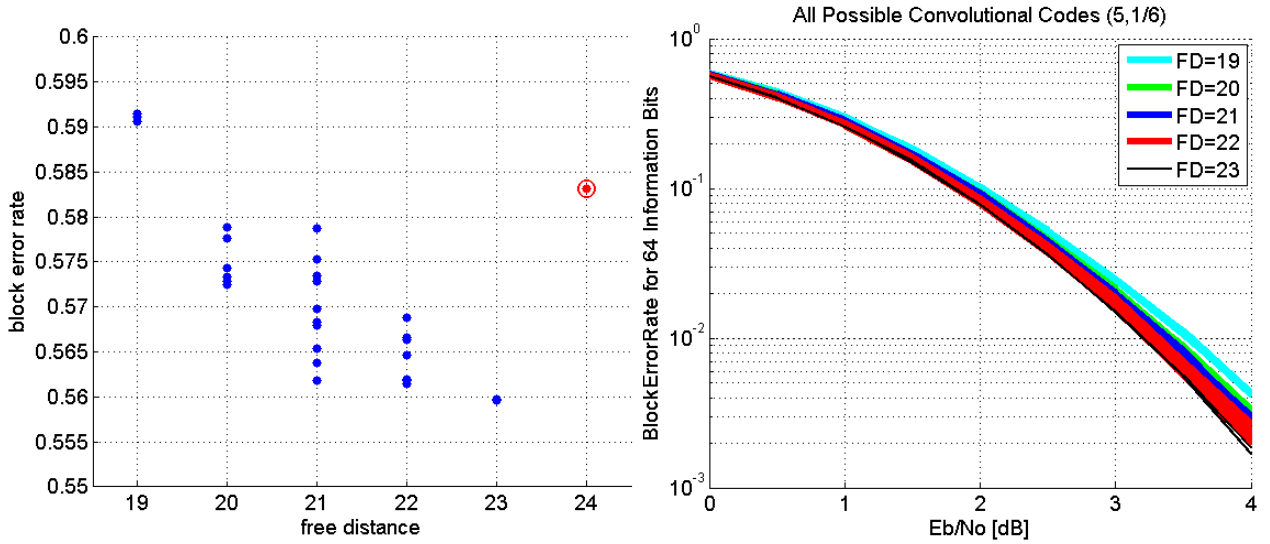

Figure 1. Behavior of all possible convolutional codes with L = 5 and n = 6 with mutually different polynomials in a transmission of 64 information bits.

Left: the block error rates at $E_b/N_0 = 0$ dB (Viterbi-soft decoding) over the free distance of the 28 different codes (blue dots). If polynomials may occur twice, then a free distance of 24 easily is reached. But these codes are bad (red dot).

Right: the block error rates over $E_b/N_0 = 0 \ldots 4$ dB.

Both figures show that there are good codes with free distances 23, 22, and 21. The quality of codes with lower free distance decreases at higher E_b/N_0 .

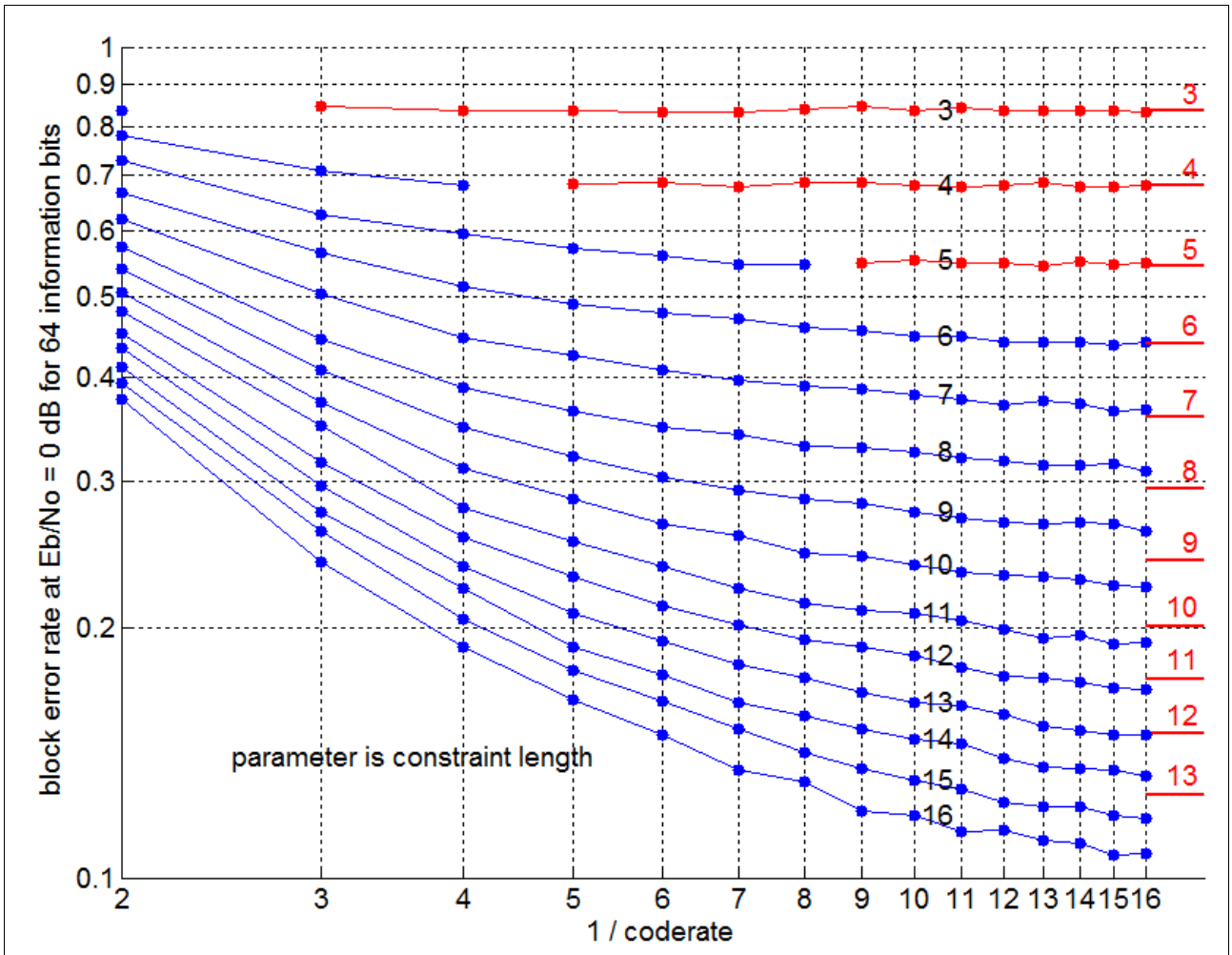

Figure 2. The block error rates of the 210 convolutional codes listed here computed for the special case $E_b/N_0 = 0$ dB and encoding of 64 information bits. At the right, the lowest block error rate for a given L is marked in red color. These values are computed using all possible 2^{L-2} different binary patterns between two colums of 2^{L-2} ones as polynomials. If n is larger than 2^{L-2} then polynomials must be used repeatedly. No further gain can be achieved by repetition (the red lines for L = 3,4,5).

List of 210 Convolutional Codes sorted by n

The Free Distance FD of a convolutional code can well be estimated by
`FD = floor( 0.572*(L+2)*n ).`
But as mentioned above, a good code need not to have maximum free distance.

Table of maximum Free Distance in the List

L \ n:	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
3	5	8	10	13	16	18	21	24	26	29	32	34	37	40	42
4	6	10	13	16	20	23	26	30	33	36	40	43	46	50	53
5	7	12	16	20	24	28	32	36	40	44	48	52	56	60	64
6	8	13	18	22	27	32	36	40	45	50	54	59	64	68	72
7	10	15	20	25	30	36	40	46	51	56	61	66	72	76	82
8	10	16	22	28	34	40	45	51	56	62	68	74	80	85	91
9	12	18	24	31	37	44	50	56	62	68	75	81	88	94	100
10	12	20	26	34	40	48	54	61	68	75	82	88	96	102	109
11	14	22	29	36	44	52	59	66	74	81	88	96	104	111	118
12	15	24	32	40	48	56	64	72	80	88	96	104	112	120	128
13	16	24	33	42	50	59	68	76	84	93	102	110	119	128	136
14	16	26	36	44	53	62	72	80	90	98	108	116	126	136	144
15	18	27	36	46	56	66	76	84	94	104	113	124	134	142	152
16	17	27	36	46	58	69	78	87	99	108	117	127	139	147	160

Table of Block Error Rates at E_b/N_0 = 0 dB for 64 Information Bits

L \ n:	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
3	.836	.849	.837	.838	.835	.834	.841	.849	.839	.844	.838	.839	.837	.839	.835
4	.781	.708	.681	.685	.686	.679	.688	.686	.680	.679	.681	.685	.678	.679	.680
5	.730	.627	.595	.571	.559	.547	.547	.549	.554	.549	.548	.545	.551	.547	.548
6	.668	.564	.514	.489	.479	.470	.459	.456	.448	.447	.441	.441	.440	.438	.441
7	.621	.504	.446	.424	.408	.397	.390	.386	.380	.377	.371	.374	.372	.364	.365
8	.575	.444	.389	.364	.347	.341	.331	.329	.325	.319	.317	.313	.314	.314	.308
9	.539	.408	.348	.321	.303	.292	.285	.282	.275	.271	.267	.266	.268	.266	.261
10	.507	.373	.311	.286	.266	.257	.245	.244	.238	.233	.231	.230	.228	.225	.224
11	.479	.349	.278	.253	.237	.222	.213	.209	.208	.204	.198	.193	.195	.191	.191
12	.452	.316	.256	.230	.212	.201	.193	.189	.185	.179	.175	.174	.172	.169	.168
13	.433	.295	.236	.208	.192	.180	.174	.167	.162	.161	.157	.152	.150	.148	.148
14	.411	.275	.223	.189	.175	.162	.156	.150	.146	.144	.139	.136	.135	.134	.132
15	.393	.261	.204	.177	.162	.150	.141	.135	.130	.128	.123	.121	.121	.118	.118
16	.375	.239	.189	.163	.148	.134	.130	.120	.118	.113	.114	.111	.110	.106	.107

List of Convolutional Codes

==========

L means the constraint length
FD means the free distance
BlockErrorRate is determined for 64 information bits, tail-ended, E_b/N_0 = 0 dB

coderate = 1/ 2

==========

cl = 3 FD = 5 BlockErrorRate = 0.837

1 0 1
1 1 1

```
cl =  4   FD =  6   BlockErrorRate = 0.781

    1 0 1 1
    1 1 1 1


cl =  5   FD =  7   BlockErrorRate = 0.730

    1 0 1 1 1
    1 1 0 0 1


cl =  6   FD =  8   BlockErrorRate = 0.669

    1 0 1 1 1 1
    1 1 1 1 0 1


cl =  7   FD = 10   BlockErrorRate = 0.621

    1 0 0 1 1 1 1
    1 1 0 1 1 0 1


cl =  8   FD = 10   BlockErrorRate = 0.575

    1 0 1 1 0 1 1 1
    1 1 1 1 1 1 0 1


cl =  9   FD = 12   BlockErrorRate = 0.540

    1 0 0 1 0 1 1 1 1
    1 1 1 1 0 1 1 0 1


cl = 10   FD = 12   BlockErrorRate = 0.507

    1 0 0 0 1 1 1 1 1 1
    1 1 0 1 1 0 1 1 0 1


cl = 11   FD = 14   BlockErrorRate = 0.480

    1 0 1 1 0 1 1 1 0 0 1
    1 1 1 1 0 1 0 0 0 1 1


cl = 12   FD = 13   BlockErrorRate = 0.453

    1 0 1 0 1 1 0 1 1 1 0 1
    1 1 0 1 1 1 1 1 0 0 1 1

cl = 12   FD = 15   BlockErrorRate = 0.462

    1 0 1 1 1 0 1 1 0 0 0 1
    1 1 0 0 1 0 1 1 1 1 0 1
```

```
cl = 13   FD = 16   BlockErrorRate = 0.433

    1 0 1 1 0 0 1 1 0 1 1 1 1
    1 1 0 1 0 0 1 1 1 1 1 0 1


cl = 14   FD = 16   BlockErrorRate = 0.412

    1 0 0 1 1 0 1 1 1 0 1 1 1 1
    1 1 1 1 1 1 1 0 1 1 0 1 0 1


cl = 15   FD = 18   BlockErrorRate = 0.393

    1 0 0 0 1 1 1 1 1 0 1 1 1 1 1
    1 1 0 1 1 0 1 0 1 0 0 1 1 0 1


cl = 16   FD = 17   BlockErrorRate = 0.376

    1 0 1 0 0 1 0 1 1 0 1 0 1 0 1 1
    1 1 0 1 1 0 1 0 0 1 1 1 0 1 0 1



coderate = 1/ 3
===============

cl =  3   FD =  8   BlockErrorRate = 0.849

    1 0 1
    1 1 1
    1 1 1


cl =  4   FD = 10   BlockErrorRate = 0.708

    1 0 1 1
    1 1 0 1
    1 1 1 1


cl =  5   FD = 12   BlockErrorRate = 0.627

    1 0 1 0 1
    1 1 0 1 1
    1 1 1 1 1


cl =  6   FD = 13   BlockErrorRate = 0.564

    1 0 0 1 1 1
    1 0 1 0 1 1
    1 1 1 1 0 1
```

```
cl =  7   FD = 15   BlockErrorRate = 0.504

    1  0  0  1  1  1  1
    1  0  1  0  1  1  1
    1  1  0  1  1  0  1


cl =  8   FD = 16   BlockErrorRate = 0.444

    1  0  0  0  1  0  1  1
    1  0  1  1  1  1  1  1
    1  1  1  0  0  1  0  1


cl =  9   FD = 18   BlockErrorRate = 0.408

    1  0  1  0  0  1  0  1  1
    1  1  0  1  1  1  1  1  1
    1  1  1  0  0  1  0  0  1


cl = 10   FD = 20   BlockErrorRate = 0.374

    1  0  0  1  1  1  1  0  1  1
    1  0  1  0  1  1  1  1  0  1
    1  1  0  1  1  1  1  0  0  1


cl = 11   FD = 22   BlockErrorRate = 0.349

    1  0  0  1  1  1  0  1  1  0  1
    1  0  1  1  1  1  1  0  0  1  1
    1  1  0  1  0  1  1  1  0  0  1


cl = 12   FD = 24   BlockErrorRate = 0.317

    1  0  1  0  1  1  0  1  0  0  1  1
    1  1  0  0  1  0  1  1  1  1  0  1
    1  1  1  0  1  1  1  1  1  0  0  1


cl = 13   FD = 24   BlockErrorRate = 0.296

    1  0  0  1  0  1  0  0  1  1  1  1  1
    1  0  1  1  0  1  1  1  1  0  1  0  1
    1  1  1  1  1  1  0  0  1  1  0  0  1


cl = 14   FD = 26   BlockErrorRate = 0.275

    1  0  0  1  1  1  1  0  0  1  0  0  0  1
    1  1  0  0  1  1  0  0  1  1  0  1  1  1
    1  1  1  1  1  0  1  0  1  0  1  1  0  1
```

```
cl = 15   FD = 27   BlockErrorRate = 0.262

    1  0  0  1  0  0  1  1  1  0  0  0  1  0  1
    1  0  1  0  1  1  1  0  0  1  1  0  1  0  1
    1  1  1  1  0  0  0  1  1  1  1  1  0  1  1


cl = 16   FD = 26   BlockErrorRate = 0.239

    1  0  0  1  1  1  0  0  0  1  1  1  1  0  0  1
    1  1  0  0  1  1  1  1  1  0  1  1  0  0  1  1
    1  1  1  0  0  0  1  1  0  0  1  0  1  1  0  1

cl = 16   FD = 27   BlockErrorRate = 0.242

    1  0  0  1  0  1  1  1  1  0  0  0  0  0  0  1
    1  1  0  0  1  0  1  1  1  0  1  0  0  1  0  1
    1  1  1  0  0  0  1  1  1  1  0  1  1  1  0  1



coderate = 1/ 4
===============

cl =  3   FD = 10   BlockErrorRate = 0.838

    1  0  1
    1  0  1
    1  1  1
    1  1  1


cl =  4   FD = 12   BlockErrorRate = 0.681

    1  0  0  1
    1  0  1  1
    1  1  0  1
    1  1  1  1

cl =  4   FD = 13   BlockErrorRate = 0.723

    1  0  1  1
    1  0  1  1
    1  1  0  1
    1  1  1  1


cl =  5   FD = 16   BlockErrorRate = 0.595

    1  0  1  0  1
    1  0  1  1  1
    1  1  0  1  1
    1  1  1  1  1
```

```
cl =  6   FD = 18   BlockErrorRate = 0.515

    1 0 0 1 0 1
    1 0 1 1 1 1
    1 1 0 1 1 1
    1 1 1 1 0 1


cl =  7   FD = 20   BlockErrorRate = 0.446

    1 0 0 1 0 0 1
    1 0 1 1 1 0 1
    1 1 0 1 0 1 1
    1 1 1 1 1 1 1


cl =  8   FD = 22   BlockErrorRate = 0.390

    1 0 1 0 0 1 1 1
    1 0 1 1 1 0 0 1
    1 1 0 1 1 0 1 1
    1 1 1 1 1 1 0 1


cl =  9   FD = 24   BlockErrorRate = 0.348

    1 0 0 1 1 1 1 1 1
    1 0 1 0 1 1 1 0 1
    1 1 0 1 1 1 0 1 1
    1 1 1 1 0 1 0 0 1


cl = 10   FD = 26   BlockErrorRate = 0.311

    1 0 0 1 1 1 1 1 0 1
    1 0 1 1 1 0 1 1 1 1
    1 1 0 1 0 1 1 0 1 1
    1 1 1 0 0 1 0 0 0 1


cl = 11   FD = 29   BlockErrorRate = 0.278

    1 0 0 1 0 1 1 0 1 1 1
    1 0 1 0 0 1 1 1 1 0 1
    1 1 0 0 1 1 1 1 0 0 1
    1 1 1 0 1 0 1 1 0 1 1


cl = 12   FD = 32   BlockErrorRate = 0.257

    1 0 1 0 1 1 0 1 0 0 1 1
    1 0 1 1 0 1 0 0 1 1 1 1
    1 1 0 0 1 0 1 1 1 1 0 1
    1 1 1 0 1 1 1 1 1 0 0 1
```

cl = 13   FD = 33   BlockErrorRate = 0.237

```
    1 0 0 1 1 1 0 1 1 0 0 1 1
    1 0 1 0 1 0 1 1 1 1 0 0 1
    1 1 0 1 1 1 0 1 0 1 1 1 1
    1 1 1 1 0 1 0 0 0 1 0 0 1
```

cl = 14   FD = 34   BlockErrorRate = 0.223

```
    1 0 0 1 0 0 1 1 1 0 1 1 1 1
    1 0 0 1 0 1 1 1 1 1 0 0 1 1
    1 1 1 0 1 1 0 1 0 1 1 0 0 1
    1 1 1 1 1 0 1 0 1 0 0 1 0 1
```

cl = 14   FD = 36   BlockErrorRate = 0.235

```
    1 0 1 1 1 1 1 0 0 1 1 0 0 1
    1 1 0 1 0 0 1 0 0 1 0 0 0 1
    1 1 1 0 1 0 1 0 1 1 0 1 1 1
    1 1 1 1 1 0 1 0 1 1 0 1 1 1
```

cl = 15   FD = 36   BlockErrorRate = 0.204

```
    1 0 0 0 1 0 1 0 0 1 0 0 1 0 1
    1 0 1 1 1 1 0 0 0 1 1 1 1 1 1
    1 1 1 0 1 0 1 1 1 0 1 0 0 1 1
    1 1 1 1 0 0 1 0 0 1 0 1 0 1 1
```

cl = 16   FD = 36   BlockErrorRate = 0.189

```
    1 0 1 0 1 1 0 0 1 1 0 1 1 1 1 1
    1 0 1 1 0 1 0 0 1 1 1 1 1 0 0 1
    1 1 0 0 1 0 1 1 0 1 1 1 0 0 1 1
    1 1 1 0 1 1 0 1 1 1 1 0 0 1 0 1
```

coderate = 1/ 5
==========

cl = 3   FD = 13   BlockErrorRate = 0.839

```
    1 0 1
    1 0 1
    1 1 1
    1 1 1
    1 1 1
```

```
cl =  4   FD = 16   BlockErrorRate = 0.685

    1  0  0  1
    1  0  1  1
    1  1  0  1
    1  1  1  1
    1  1  1  1


cl =  5   FD = 20   BlockErrorRate = 0.571

    1  0  1  0  1
    1  0  1  1  1
    1  1  0  1  1
    1  1  1  0  1
    1  1  1  1  1


cl =  6   FD = 22   BlockErrorRate = 0.489

    1  0  0  1  0  1
    1  0  1  1  1  1
    1  1  0  0  1  1
    1  1  0  1  1  1
    1  1  1  1  0  1


cl =  7   FD = 25   BlockErrorRate = 0.425

    1  0  0  1  0  1  1
    1  0  1  0  1  1  1
    1  1  0  0  1  0  1
    1  1  0  1  1  0  1
    1  1  1  1  1  1  1


cl =  8   FD = 28   BlockErrorRate = 0.364

    1  0  0  1  0  1  0  1
    1  0  1  1  1  0  0  1
    1  1  0  0  1  1  0  1
    1  1  1  0  1  1  1  1
    1  1  1  1  1  0  1  1


cl =  9   FD = 31   BlockErrorRate = 0.321

    1  0  0  1  0  1  1  0  1
    1  0  1  1  1  1  0  1  1
    1  1  0  0  1  0  1  1  1
    1  1  0  1  0  1  1  1  1
    1  1  1  1  0  1  0  0  1
```

cl = 10 FD = 34 BlockErrorRate = 0.286

```
1 0 0 1 0 0 1 1 1 1
1 0 1 0 1 1 1 1 0 1
1 0 1 1 0 1 1 0 1 1
1 1 0 1 1 1 1 0 0 1
1 1 1 0 1 0 0 1 1 1
```

cl = 11 FD = 34 BlockErrorRate = 0.253

```
1 0 0 1 0 1 0 0 1 1 1
1 0 1 1 0 0 1 1 0 1 1
1 0 1 1 1 1 1 0 0 1 1
1 1 0 1 0 1 0 1 1 0 1
1 1 1 1 1 0 1 1 0 0 1
```

cl = 11 FD = 36 BlockErrorRate = 0.256

```
1 0 0 1 1 1 1 1 1 1 1
1 0 1 0 0 0 1 0 1 0 1
1 0 1 1 1 0 1 0 0 1 1
1 1 0 1 1 0 0 1 1 0 1
1 1 1 1 0 0 1 0 1 1 1
```

cl = 12 FD = 38 BlockErrorRate = 0.230

```
1 0 0 1 0 0 1 1 0 1 1 1
1 0 0 1 1 1 0 0 1 0 1 1
1 0 1 0 1 0 1 0 1 1 1 1
1 1 0 0 1 1 1 1 0 1 0 1
1 1 1 1 0 1 1 0 1 0 0 1
```

cl = 12 FD = 40 BlockErrorRate = 0.231

```
1 0 0 1 0 1 0 1 0 0 1 1
1 0 1 0 0 1 1 1 0 1 1 1
1 0 1 1 1 1 1 1 0 1 1 1
1 1 0 1 1 0 0 1 0 0 1 1
1 1 1 1 1 0 1 0 1 1 0 1
```

cl = 13 FD = 42 BlockErrorRate = 0.208

```
1 0 0 1 1 0 0 1 1 1 0 1 1
1 0 1 1 0 1 0 1 0 0 1 1 1
1 1 0 1 0 1 1 0 1 1 0 0 1
1 1 1 0 1 1 1 1 1 0 0 0 1
1 1 1 1 1 1 0 1 0 0 1 0 1
```

```
cl = 14   FD = 44   BlockErrorRate = 0.190

    1 0 0 1 1 0 1 1 1 0 1 1 1 1
    1 0 1 0 1 0 0 1 1 1 1 0 0 1
    1 0 1 1 0 1 0 1 1 1 1 1 0 1
    1 1 1 0 1 1 0 0 1 1 0 0 1 1
    1 1 1 1 1 1 1 0 1 1 0 1 0 1


cl = 15   FD = 46   BlockErrorRate = 0.178

    1 0 0 1 0 0 1 1 1 0 0 0 1 0 1
    1 0 0 1 1 1 1 1 1 0 1 1 1 1 1
    1 0 1 0 1 1 0 0 0 1 1 0 1 0 1
    1 1 0 1 1 0 1 0 1 0 0 1 1 0 1
    1 1 1 1 0 0 0 1 1 1 1 1 0 1 1


cl = 16   FD = 46   BlockErrorRate = 0.163

    1 0 0 0 1 1 1 0 1 0 0 0 1 1 1 1
    1 0 0 1 1 0 0 1 1 1 1 0 1 1 0 1
    1 0 1 1 1 1 1 0 1 0 1 0 0 0 1 1
    1 1 0 0 1 1 1 1 0 1 1 1 0 0 0 1
    1 1 1 0 0 1 1 0 0 1 0 1 0 1 1 1



coderate = 1/ 6
===============

cl =  3   FD = 15   BlockErrorRate = 0.835

    1 0 1
    1 0 1
    1 0 1
    1 1 1
    1 1 1
    1 1 1

cl =  3   FD = 16   BlockErrorRate = 0.848

    1 0 1
    1 0 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1


cl =  4   FD = 19   BlockErrorRate = 0.687

    1 0 0 1
    1 0 1 1
    1 0 1 1
    1 1 0 1
    1 1 1 1
    1 1 1 1
```

```
cl =  4   FD = 20   BlockErrorRate = 0.709

    1 0 1 1
    1 0 1 1
    1 1 0 1
    1 1 0 1
    1 1 1 1
    1 1 1 1


cl =  5   FD = 23   BlockErrorRate = 0.560

    1 0 0 1 1
    1 0 1 0 1
    1 0 1 1 1
    1 1 0 1 1
    1 1 1 0 1
    1 1 1 1 1

cl =  5   FD = 24   BlockErrorRate = 0.582

    1 0 1 0 1
    1 0 1 1 1
    1 0 1 1 1
    1 1 0 1 1
    1 1 1 0 1
    1 1 1 1 1


cl =  6   FD = 27   BlockErrorRate = 0.479

    1 0 0 1 1 1
    1 0 1 0 1 1
    1 0 1 1 0 1
    1 1 0 1 0 1
    1 1 0 1 1 1
    1 1 1 1 1 1


cl =  7   FD = 30   BlockErrorRate = 0.409

    1 0 0 1 0 1 1
    1 0 0 1 1 1 1
    1 0 1 0 1 1 1
    1 1 0 1 1 0 1
    1 1 1 0 1 0 1
    1 1 1 1 1 0 1


cl =  8   FD = 34   BlockErrorRate = 0.348

    1 0 0 1 0 1 0 1
    1 0 1 0 0 1 1 1
    1 0 1 1 1 0 0 1
    1 1 0 1 1 0 1 1
    1 1 1 0 1 1 1 1
    1 1 1 1 1 1 0 1
```

cl = 9   FD = 35   BlockErrorRate = 0.303

```
    1 0 0 1 0 1 1 0 1
    1 0 1 0 1 0 0 1 1
    1 0 1 1 0 1 1 1 1
    1 1 0 1 1 1 1 0 1
    1 1 1 0 1 1 0 1 1
    1 1 1 1 1 0 0 0 1
```

cl = 9   FD = 37   BlockErrorRate = 0.313

```
    1 0 1 1 0 0 1 1 1
    1 0 1 1 0 1 0 1 1
    1 0 1 1 1 1 0 1 1
    1 1 0 1 0 0 1 0 1
    1 1 0 1 1 1 1 1 1
    1 1 1 0 0 1 0 0 1
```

cl = 10   FD = 40   BlockErrorRate = 0.266

```
    1 0 0 1 1 1 1 1 0 1
    1 0 1 0 1 1 1 1 1 1
    1 0 1 1 1 0 1 1 1 1
    1 1 0 0 1 0 1 1 0 1
    1 1 0 1 0 1 1 0 1 1
    1 1 1 0 0 1 0 0 1 1
```

cl = 11   FD = 43   BlockErrorRate = 0.237

```
    1 0 1 0 1 1 1 0 1 0 1
    1 0 1 1 1 0 0 1 1 1 1
    1 1 0 0 1 0 1 1 0 1 1
    1 1 0 1 1 1 1 0 0 1 1
    1 1 1 1 0 1 0 1 0 0 1
    1 1 1 1 1 0 1 1 0 0 1
```

cl = 11   FD = 44   BlockErrorRate = 0.247

```
    1 0 0 1 1 1 0 1 0 1 1
    1 0 0 1 1 1 0 1 1 0 1
    1 0 1 1 0 1 1 1 0 0 1
    1 0 1 1 1 1 1 0 0 1 1
    1 1 0 0 1 1 1 1 1 0 1
    1 1 0 1 0 1 1 1 0 0 1
```

cl = 12   FD = 48   BlockErrorRate = 0.213

```
    1 0 1 0 0 1 0 0 1 0 0 1
    1 0 1 0 1 1 1 1 0 0 1 1
    1 0 1 1 0 0 1 1 0 1 0 1
    1 1 0 1 1 1 0 1 0 1 1 1
    1 1 1 0 1 1 0 0 1 1 0 1
    1 1 1 1 1 1 1 1 0 1 1 1
```

cl = 13   FD = 50   BlockErrorRate = 0.192

```
    1 0 0 1 0 0 0 1 0 1 1 1 1
    1 0 1 1 0 0 1 1 0 1 1 1 1
    1 0 1 1 1 1 1 0 1 0 1 0 1
    1 1 0 0 1 1 0 0 1 1 0 0 1
    1 1 0 1 0 0 1 1 1 1 1 0 1
    1 1 1 1 0 1 0 1 1 1 0 1 1
```

cl = 14   FD = 53   BlockErrorRate = 0.176

```
    1 0 0 1 1 1 1 0 0 1 0 0 0 1
    1 0 1 1 1 0 1 0 1 0 0 1 0 1
    1 0 1 1 1 1 1 0 0 1 0 0 1 1
    1 1 0 0 1 1 0 0 1 1 0 1 1 1
    1 1 0 0 1 1 1 0 1 1 0 1 1 1
    1 1 1 1 1 0 1 0 1 0 1 1 0 1
```

cl = 15   FD = 56   BlockErrorRate = 0.163

```
    1 0 0 0 1 1 1 1 1 0 1 1 1 1 1
    1 0 1 1 0 0 1 0 0 1 0 0 1 0 1
    1 0 1 1 1 1 0 0 0 1 1 1 1 1 1
    1 1 0 1 1 0 1 0 1 0 0 1 1 0 1
    1 1 1 0 1 0 1 1 1 0 1 0 0 1 1
    1 1 1 1 0 0 1 0 0 1 0 1 0 1 1
```

cl = 16   FD = 58   BlockErrorRate = 0.149

```
    1 0 0 0 1 0 1 1 1 1 1 0 1 0 0 1
    1 0 0 1 1 1 0 0 1 1 1 1 0 0 0 1
    1 0 1 1 0 1 0 1 1 0 1 1 0 1 1 1
    1 1 0 0 0 1 1 0 1 1 1 1 0 0 1 1
    1 1 1 0 1 0 0 0 1 1 0 1 1 0 0 1
    1 1 1 0 1 1 1 0 0 1 0 0 1 0 1 1
```

coderate = 1/ 7
==========

cl = 3   FD = 18   BlockErrorRate = 0.835

```
    1 0 1
    1 0 1
    1 0 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
```

```
cl =  4   FD = 22   BlockErrorRate = 0.680

    1  0  0  1
    1  0  1  1
    1  0  1  1
    1  1  0  1
    1  1  0  1
    1  1  1  1
    1  1  1  1


cl =  4   FD = 23   BlockErrorRate = 0.710

    1  0  1  1
    1  0  1  1
    1  1  0  1
    1  1  0  1
    1  1  0  1
    1  1  1  1
    1  1  1  1


cl =  5   FD = 26   BlockErrorRate = 0.547

    1  0  0  1  1
    1  0  1  0  1
    1  0  1  1  1
    1  1  0  0  1
    1  1  0  1  1
    1  1  1  0  1
    1  1  1  1  1


cl =  5   FD = 28   BlockErrorRate = 0.582

    1  0  1  0  1
    1  0  1  1  1
    1  0  1  1  1
    1  1  0  1  1
    1  1  1  0  1
    1  1  1  0  1
    1  1  1  1  1


cl =  6   FD = 32   BlockErrorRate = 0.471

    1  0  1  0  1  1
    1  0  1  1  0  1
    1  0  1  1  1  1
    1  1  0  0  1  1
    1  1  0  1  0  1
    1  1  1  1  0  1
    1  1  1  1  1  1
```

```
cl =  7   FD = 36   BlockErrorRate = 0.397

    1 0 0 1 1 1 1
    1 0 1 0 1 1 1
    1 0 1 1 0 1 1
    1 1 0 1 0 0 1
    1 1 0 1 1 0 1
    1 1 1 0 1 0 1
    1 1 1 1 1 1 1


cl =  8   FD = 40   BlockErrorRate = 0.342

    1 0 0 1 1 0 1 1
    1 0 0 1 1 1 1 1
    1 0 1 0 1 1 0 1
    1 0 1 1 1 0 0 1
    1 1 0 1 1 1 0 1
    1 1 1 0 1 1 1 1
    1 1 1 1 0 1 0 1


cl =  9   FD = 42   BlockErrorRate = 0.292

    1 0 0 1 1 1 0 1 1
    1 0 1 0 1 0 1 1 1
    1 0 1 1 1 1 0 0 1
    1 1 0 0 1 1 1 1 1
    1 1 0 1 1 1 0 0 1
    1 1 1 0 0 1 1 0 1
    1 1 1 1 1 0 1 0 1


cl =  9   FD = 44   BlockErrorRate = 0.292

    1 0 0 1 1 1 1 1 1
    1 0 1 0 1 1 1 0 1
    1 0 1 1 0 1 0 1 1
    1 1 0 1 1 1 0 1 1
    1 1 0 1 1 1 1 0 1
    1 1 1 0 0 1 0 0 1
    1 1 1 1 0 1 0 0 1


cl = 10   FD = 45   BlockErrorRate = 0.258

    1 0 0 1 0 1 1 1 1 1
    1 0 1 1 0 1 1 0 0 1
    1 0 1 1 1 1 0 1 1 1
    1 1 0 0 1 0 0 1 1 1
    1 1 0 1 1 0 1 1 0 1
    1 1 1 0 1 0 1 0 1 1
    1 1 1 1 1 1 0 0 1 1
```

cl = 10 FD = 48 BlockErrorRate = 0.261

```
1 0 0 1 1 1 1 1 0 1
1 0 1 0 1 1 1 1 0 1
1 0 1 1 1 0 1 1 1 1
1 1 0 1 0 1 1 0 1 1
1 1 0 1 1 0 0 1 1 1
1 1 1 0 0 1 0 1 0 1
1 1 1 1 0 0 1 0 0 1
```

cl = 11 FD = 51 BlockErrorRate = 0.223

```
1 0 0 1 1 1 1 0 1 1 1
1 0 0 1 1 1 1 1 0 0 1
1 0 1 0 1 1 0 1 1 0 1
1 0 1 1 0 1 0 0 1 1 1
1 1 0 1 1 0 0 1 0 1 1
1 1 1 0 1 1 1 0 0 1 1
1 1 1 1 0 1 0 1 0 0 1
```

cl = 11 FD = 52 BlockErrorRate = 0.234

```
1 0 1 0 0 1 0 1 0 0 1
1 0 1 0 1 1 0 0 1 0 1
1 0 1 0 1 1 1 1 1 0 1
1 1 0 0 1 1 1 0 1 1 1
1 1 0 1 1 0 1 1 1 1 1
1 1 1 1 0 0 1 1 0 1 1
1 1 1 1 1 0 1 1 0 0 1
```

cl = 12 FD = 56 BlockErrorRate = 0.202

```
1 0 1 0 1 1 1 1 1 1 0 1
1 0 1 1 0 0 1 0 0 1 1 1
1 0 1 1 1 1 1 0 1 0 0 1
1 1 0 1 0 1 0 0 1 0 1 1
1 1 0 1 1 0 1 1 0 1 0 1
1 1 1 0 1 1 1 0 0 1 1 1
1 1 1 1 1 0 0 1 0 0 1 1
```

cl = 13 FD = 59 BlockErrorRate = 0.180

```
1 0 0 1 1 1 0 1 1 0 0 1 1
1 0 1 0 1 0 1 1 1 1 0 0 1
1 0 1 1 0 1 1 1 1 0 1 0 1
1 1 0 1 0 1 0 0 1 1 0 1 1
1 1 0 1 1 1 0 1 0 1 1 1 1
1 1 1 1 0 1 0 0 0 1 0 0 1
1 1 1 1 1 1 0 0 1 1 0 0 1
```

```
cl = 14   FD = 62   BlockErrorRate = 0.163

    1  0  0  1  0  1  1  0  1  0  0  0  0  1
    1  0  1  0  1  1  1  1  1  1  0  1  1  1
    1  0  1  1  1  1  0  1  1  1  0  0  0  1
    1  1  0  0  1  0  1  0  0  1  1  1  0  1
    1  1  0  1  0  0  1  0  0  1  1  0  1  1
    1  1  1  1  0  0  1  1  0  1  0  1  0  1
    1  1  1  1  1  1  0  1  1  0  0  1  1  1


cl = 15   FD = 66   BlockErrorRate = 0.151

    1  0  0  1  0  0  0  1  0  1  0  1  1  1  1
    1  0  1  0  0  1  1  0  1  1  0  0  1  1  1
    1  0  1  1  1  0  0  0  1  0  0  1  1  0  1
    1  1  0  0  0  1  1  0  1  1  1  0  0  1  1
    1  1  1  0  0  1  1  0  1  0  1  0  1  0  1
    1  1  1  1  0  1  0  1  1  1  1  1  0  1  1
    1  1  1  1  0  1  1  1  1  1  0  0  1  0  1


cl = 16   FD = 69   BlockErrorRate = 0.135

    1  0  0  1  0  0  1  1  1  1  1  0  0  1  0  1
    1  0  0  1  1  1  1  0  1  0  1  1  0  0  0  1
    1  0  1  0  1  1  0  1  0  1  1  0  0  0  1  1
    1  0  1  1  1  0  1  0  0  1  1  0  1  1  1  1
    1  1  0  0  1  1  1  0  1  0  1  0  0  1  1  1
    1  1  0  1  1  0  1  1  0  0  0  1  1  1  1  1
    1  1  1  0  0  1  0  1  1  0  1  1  1  0  0  1



coderate = 1/ 8
===============

cl =  3   FD = 21   BlockErrorRate = 0.841

    1  0  1
    1  0  1
    1  0  1
    1  1  1
    1  1  1
    1  1  1
    1  1  1
    1  1  1
```

cl = 4 FD = 26 BlockErrorRate = 0.688

```
1 0 0 1
1 0 1 1
1 0 1 1
1 1 0 1
1 1 0 1
1 1 1 1
1 1 1 1
1 1 1 1
```

cl = 5 FD = 28 BlockErrorRate = 0.547

```
1 0 0 0 1
1 0 0 1 1
1 0 1 0 1
1 0 1 1 1
1 1 0 0 1
1 1 0 1 1
1 1 1 0 1
1 1 1 1 1
```

cl = 5 FD = 32 BlockErrorRate = 0.582

```
1 0 1 0 1
1 0 1 0 1
1 0 1 1 1
1 1 0 1 1
1 1 0 1 1
1 1 1 0 1
1 1 1 1 1
1 1 1 1 1
```

cl = 6 FD = 36 BlockErrorRate = 0.460

```
1 0 0 1 1 1
1 0 1 0 1 1
1 0 1 1 0 1
1 0 1 1 1 1
1 1 0 1 0 1
1 1 1 0 0 1
1 1 1 1 0 1
1 1 1 1 1 1
```

cl = 7 FD = 40 BlockErrorRate = 0.391

```
1 0 0 1 1 1 1
1 0 1 1 0 0 1
1 0 1 1 0 1 1
1 0 1 1 1 1 1
1 1 0 1 0 0 1
1 1 0 1 1 0 1
1 1 1 0 1 0 1
1 1 1 1 1 1 1
```

cl = 8   FD = 45   BlockErrorRate = 0.331

```
    1 0 0 1 1 0 1 1
    1 0 1 0 1 1 1 1
    1 0 1 1 0 1 0 1
    1 0 1 1 1 0 1 1
    1 1 0 0 1 0 0 1
    1 1 0 1 1 1 1 1
    1 1 1 0 0 1 0 1
    1 1 1 1 1 1 0 1
```

cl = 9   FD = 50   BlockErrorRate = 0.286

```
    1 0 0 1 0 1 1 1 1
    1 0 1 0 0 1 0 1 1
    1 0 1 1 1 0 1 1 1
    1 1 0 1 0 0 1 0 1
    1 1 0 1 1 1 1 0 1
    1 1 1 0 0 1 0 0 1
    1 1 1 1 0 1 1 0 1
    1 1 1 1 1 1 0 1 1
```

cl = 10   FD = 54   BlockErrorRate = 0.246

```
    1 0 0 1 1 1 0 1 1 1
    1 0 1 0 1 1 1 1 1 1
    1 0 1 1 0 1 0 1 1 1
    1 0 1 1 1 1 0 1 0 1
    1 1 0 0 1 1 0 0 0 1
    1 1 0 1 0 0 1 0 1 1
    1 1 1 0 0 1 0 0 1 1
    1 1 1 1 1 0 1 1 0 1
```

cl = 11   FD = 58   BlockErrorRate = 0.214

```
    1 0 0 1 0 1 1 0 1 1 1
    1 0 1 0 0 1 1 1 0 0 1
    1 0 1 1 0 1 1 1 1 1 1
    1 1 0 0 1 1 1 1 0 1 1
    1 1 0 1 0 1 1 1 1 0 1
    1 1 0 1 1 1 1 0 1 0 1
    1 1 1 0 0 0 1 0 0 1 1
    1 1 1 1 0 0 1 0 1 0 1
```

cl = 11   FD = 59   BlockErrorRate = 0.215

```
    1 0 0 1 0 1 0 1 1 1 1
    1 0 0 1 1 1 0 1 1 0 1
    1 0 1 1 0 1 1 0 0 1 1
    1 0 1 1 1 1 1 0 0 1 1
    1 1 0 1 0 1 0 1 0 0 1
    1 1 1 0 1 0 1 1 1 0 1
    1 1 1 1 0 1 1 1 0 0 1
    1 1 1 1 1 0 1 1 0 0 1
```

cl = 12 FD = 60 BlockErrorRate = 0.193

```
1 0 0 1 1 1 1 0 0 1 1 1
1 0 1 0 0 1 1 1 0 0 1 1
1 0 1 1 0 0 1 0 1 0 1 1
1 0 1 1 1 1 0 0 1 0 0 1
1 1 0 1 0 1 0 1 0 1 0 1
1 1 1 0 0 1 1 0 1 1 0 1
1 1 1 0 1 1 0 1 0 1 1 1
1 1 1 1 1 0 1 0 0 1 0 1
```

cl = 12 FD = 64 BlockErrorRate = 0.200

```
1 0 0 1 0 1 0 1 0 0 1 1
1 0 1 0 0 1 1 1 0 1 1 1
1 0 1 0 1 1 0 1 0 0 1 1
1 0 1 1 1 1 1 1 0 1 1 1
1 1 0 0 1 0 1 1 1 1 0 1
1 1 0 1 1 0 0 1 0 0 1 1
1 1 1 0 1 1 1 1 1 0 0 1
1 1 1 1 1 0 1 0 1 1 0 1
```

cl = 13 FD = 68 BlockErrorRate = 0.174

```
1 0 0 0 1 1 1 0 1 0 1 1 1
1 0 0 1 0 1 0 0 1 1 1 1 1
1 0 1 0 0 1 0 1 1 1 1 1 1
1 0 1 1 0 1 1 1 1 0 1 0 1
1 1 0 1 1 0 1 1 0 1 0 1 1
1 1 0 1 1 1 0 0 1 1 0 0 1
1 1 1 0 0 1 0 1 0 1 1 0 1
1 1 1 1 1 1 0 0 1 1 0 0 1
```

cl = 14 FD = 69 BlockErrorRate = 0.157

```
1 0 0 1 1 0 1 0 1 1 1 0 1 1
1 0 1 0 0 1 1 1 1 1 0 1 1 1
1 0 1 0 1 1 1 1 0 0 1 1 0 1
1 0 1 1 0 1 0 0 1 0 1 1 1 1
1 1 0 0 1 0 1 1 1 0 1 1 1 1
1 1 0 1 0 1 0 1 1 0 1 0 0 1
1 1 0 1 1 1 1 0 1 0 0 1 0 1
1 1 1 0 0 1 1 0 1 1 1 0 0 1
```

cl = 14 FD = 72 BlockErrorRate = 0.161

```
1 0 0 0 1 0 0 1 0 0 1 0 1 1
1 0 0 1 1 0 0 1 1 1 1 1 0 1
1 0 1 1 1 1 1 0 0 1 1 0 0 1
1 1 0 1 0 0 1 0 0 1 0 0 0 1
1 1 1 0 1 0 1 0 1 1 0 1 1 1
1 1 1 0 1 1 0 1 0 1 0 1 1 1
1 1 1 0 1 1 0 1 0 1 1 1 1 1
1 1 1 1 1 0 1 0 1 1 0 1 1 1
```

cl = 15   FD = 74   BlockErrorRate = 0.141

```
    1 0 0 1 0 0 1 1 0 1 1 0 1 0 1
    1 0 0 1 1 0 0 1 0 1 0 1 0 0 1
    1 0 0 1 1 1 1 1 1 0 0 1 0 1 1
    1 0 1 1 1 1 0 1 0 1 1 1 0 1 1
    1 1 0 0 1 1 0 1 0 1 0 0 1 0 1
    1 1 0 1 1 1 0 0 1 1 1 1 0 0 1
    1 1 1 0 1 0 1 1 0 1 0 1 1 1 1
    1 1 1 0 1 1 1 0 1 0 1 1 0 1 1
```

cl = 15   FD = 76   BlockErrorRate = 0.149

```
    1 0 0 1 0 1 0 0 1 0 0 0 1 0 1
    1 0 1 1 0 0 1 1 1 1 1 0 0 0 1
    1 1 0 0 1 0 1 1 0 1 1 0 0 1 1
    1 1 0 0 1 1 0 1 0 0 1 0 1 0 1
    1 1 0 1 1 1 1 0 1 0 0 1 1 1 1
    1 1 1 0 1 0 1 0 1 1 1 0 0 0 1
    1 1 1 0 1 0 1 1 1 1 1 1 0 1 1
    1 1 1 1 1 0 1 1 1 0 1 0 1 1 1
```

cl = 16   FD = 78   BlockErrorRate = 0.130

```
    1 0 0 1 1 0 0 1 0 1 1 1 0 1 1 1
    1 0 0 1 1 0 1 0 1 1 0 1 1 0 1 1
    1 0 1 0 1 1 1 1 1 0 0 0 1 0 0 1
    1 1 0 0 1 0 0 1 0 1 0 0 1 1 1 1
    1 1 1 0 0 0 1 1 1 1 0 1 1 1 0 1
    1 1 1 0 1 0 1 0 0 0 1 0 1 1 0 1
    1 1 1 1 0 0 1 1 0 1 1 0 0 1 1 1
    1 1 1 1 0 1 1 0 0 1 1 1 0 0 0 1
```

coderate = 1/ 9
==========

cl = 3   FD = 24   BlockErrorRate = 0.849

```
    1 0 1
    1 0 1
    1 0 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
```

```
cl =  4   FD = 28   BlockErrorRate = 0.686

    1 0 0 1
    1 0 0 1
    1 0 1 1
    1 0 1 1
    1 1 0 1
    1 1 0 1
    1 1 1 1
    1 1 1 1
    1 1 1 1


cl =  4   FD = 30   BlockErrorRate = 0.713

    1 0 1 1
    1 0 1 1
    1 0 1 1
    1 0 1 1
    1 1 0 1
    1 1 0 1
    1 1 1 1
    1 1 1 1
    1 1 1 1


cl =  5   FD = 33   BlockErrorRate = 0.549

    1 0 0 0 1
    1 0 0 1 1
    1 0 1 0 1
    1 0 1 1 1
    1 1 0 0 1
    1 1 0 1 1
    1 1 1 0 1
    1 1 1 1 1
    1 1 1 1 1

cl =  5   FD = 36   BlockErrorRate = 0.575

    1 0 1 0 1
    1 0 1 0 1
    1 0 1 1 1
    1 0 1 1 1
    1 1 0 1 1
    1 1 0 1 1
    1 1 1 0 1
    1 1 1 1 1
    1 1 1 1 1
```

```
cl =  6   FD = 39   BlockErrorRate = 0.456

    1  0  0  1  0  1
    1  0  0  1  1  1
    1  0  1  0  1  1
    1  0  1  1  0  1
    1  1  0  1  0  1
    1  1  0  1  1  1
    1  1  1  0  0  1
    1  1  1  1  0  1
    1  1  1  1  1  1

cl =  6   FD = 40   BlockErrorRate = 0.475

    1  0  1  0  0  1
    1  0  1  1  0  1
    1  0  1  1  1  1
    1  0  1  1  1  1
    1  1  0  0  1  1
    1  1  0  1  1  1
    1  1  1  0  1  1
    1  1  1  1  0  1
    1  1  1  1  0  1


cl =  7   FD = 46   BlockErrorRate = 0.387

    1  0  0  1  1  1  1
    1  0  1  0  1  1  1
    1  0  1  1  0  1  1
    1  0  1  1  1  1  1
    1  1  0  1  0  0  1
    1  1  0  1  1  0  1
    1  1  1  0  1  0  1
    1  1  1  0  1  1  1
    1  1  1  1  0  0  1


cl =  8   FD = 50   BlockErrorRate = 0.330

    1  0  0  1  1  0  0  1
    1  0  0  1  1  0  1  1
    1  0  1  0  1  0  1  1
    1  0  1  1  1  1  0  1
    1  1  0  1  0  1  0  1
    1  1  0  1  0  1  1  1
    1  1  1  0  1  1  1  1
    1  1  1  1  1  0  1  1
    1  1  1  1  1  1  0  1
```

```
cl =  8   FD = 51   BlockErrorRate = 0.339

    1 0 0 1 0 1 0 1
    1 0 1 0 1 0 1 1
    1 0 1 1 1 0 0 1
    1 0 1 1 1 0 0 1
    1 1 0 0 1 1 0 1
    1 1 0 1 1 0 1 1
    1 1 1 0 1 1 1 1
    1 1 1 1 1 0 1 1
    1 1 1 1 1 1 0 1


cl =  9   FD = 56   BlockErrorRate = 0.282

    1 0 0 1 0 1 1 1 1
    1 0 0 1 1 1 1 1 1
    1 0 1 0 1 1 1 0 1
    1 0 1 1 0 1 0 1 1
    1 1 0 1 1 1 0 1 1
    1 1 0 1 1 1 1 0 1
    1 1 1 0 0 1 0 0 1
    1 1 1 1 0 1 0 0 1
    1 1 1 1 0 1 1 0 1


cl = 10   FD = 61   BlockErrorRate = 0.244

    1 0 0 1 0 1 1 0 0 1
    1 0 1 0 1 0 1 0 0 1
    1 0 1 1 1 0 0 1 0 1
    1 0 1 1 1 1 0 1 0 1
    1 1 0 1 1 0 1 1 0 1
    1 1 1 0 0 1 1 0 1 1
    1 1 1 0 1 1 0 0 1 1
    1 1 1 1 0 0 1 1 1 1
    1 1 1 1 1 1 1 1 0 1


cl = 11   FD = 66   BlockErrorRate = 0.210

    1 0 0 1 1 1 0 1 1 0 1
    1 0 0 1 1 1 1 1 1 1 1
    1 0 1 0 0 0 1 0 1 0 1
    1 0 1 1 1 0 1 0 0 1 1
    1 0 1 1 1 1 1 1 0 1 1
    1 1 0 1 0 1 1 1 0 0 1
    1 1 0 1 1 0 0 1 1 0 1
    1 1 1 0 1 0 1 1 0 0 1
    1 1 1 1 0 0 1 0 1 1 1
```

cl = 12 FD = 72 BlockErrorRate = 0.190

```
1 0 0 1 0 0 1 0 0 1 0 1
1 0 1 0 1 1 0 0 1 1 0 1
1 0 1 0 1 1 0 1 0 0 1 1
1 0 1 1 0 0 1 1 0 1 1 1
1 1 0 0 1 0 1 1 1 1 0 1
1 1 0 0 1 1 1 1 0 1 0 1
1 1 1 0 1 0 1 1 1 0 1 1
1 1 1 0 1 1 1 1 1 0 0 1
1 1 1 0 1 1 1 1 1 1 1 1
```

cl = 13 FD = 76 BlockErrorRate = 0.167

```
1 0 0 1 1 0 0 1 1 1 0 1 1
1 0 1 0 1 0 1 1 1 1 0 0 1
1 0 1 1 0 1 0 1 0 0 1 1 1
1 0 1 1 1 1 0 1 1 0 0 1 1
1 1 0 1 0 1 1 0 1 1 0 0 1
1 1 0 1 1 1 0 1 0 1 1 1 1
1 1 1 0 1 1 1 1 1 0 0 0 1
1 1 1 1 0 1 0 0 0 1 0 0 1
1 1 1 1 1 1 0 1 0 0 1 0 1
```

cl = 14 FD = 80 BlockErrorRate = 0.151

```
1 0 0 0 1 1 0 0 1 1 1 1 0 1
1 0 1 0 0 1 0 1 1 0 1 0 0 1
1 0 1 0 1 0 1 1 0 0 1 1 1 1
1 0 1 1 1 0 0 1 0 1 0 0 1 1
1 1 0 1 1 0 0 1 0 0 1 0 1 1
1 1 0 1 1 0 1 1 1 0 1 1 1 1
1 1 1 0 0 1 1 0 1 1 1 1 1 1
1 1 1 0 1 1 1 1 1 0 0 1 0 1
1 1 1 1 1 1 1 0 1 1 0 1 0 1
```

cl = 15 FD = 84 BlockErrorRate = 0.135

```
1 0 0 1 0 0 1 1 1 0 0 0 1 0 1
1 0 1 0 0 1 0 0 1 0 0 1 1 0 1
1 0 1 0 1 1 1 0 0 1 1 0 1 0 1
1 0 1 1 0 0 1 0 1 0 1 1 0 1 1
1 1 0 0 1 0 1 1 1 0 1 0 0 1 1
1 1 0 1 0 1 0 1 1 0 0 1 1 1 1
1 1 1 1 0 0 0 1 1 1 1 1 0 1 1
1 1 1 1 1 0 1 1 1 1 1 0 0 0 1
1 1 1 1 1 1 0 0 0 1 1 1 1 0 1
```

cl = 16   FD = 87   BlockErrorRate = 0.120

```
    1  0  0  1  0  1  1  0  1  1  1  0  0  1  1  1
    1  0  1  0  0  1  0  1  1  1  1  1  0  0  0  1
    1  0  1  1  0  1  1  1  1  0  1  0  1  1  1  1
    1  0  1  1  1  0  1  1  0  1  0  1  0  1  0  1
    1  1  0  0  1  1  1  1  1  0  1  0  0  0  1  1
    1  1  0  1  1  0  1  1  0  0  1  0  0  1  0  1
    1  1  1  0  0  0  1  1  1  1  0  0  1  0  1  1
    1  1  1  0  1  0  1  0  0  1  1  1  1  1  1  1
    1  1  1  1  0  1  1  0  1  0  1  1  1  0  0  1
```

coderate = 1/10
==========

cl = 3   FD = 26   BlockErrorRate = 0.839

```
    1  0  1
    1  0  1
    1  0  1
    1  0  1
    1  1  1
    1  1  1
    1  1  1
    1  1  1
    1  1  1
    1  1  1
```

cl = 4   FD = 31   BlockErrorRate = 0.680

```
    1  0  0  1
    1  0  0  1
    1  0  1  1
    1  0  1  1
    1  0  1  1
    1  1  0  1
    1  1  0  1
    1  1  1  1
    1  1  1  1
    1  1  1  1
```

cl = 4   FD = 33   BlockErrorRate = 0.704

```
    1  0  1  1
    1  0  1  1
    1  0  1  1
    1  0  1  1
    1  1  0  1
    1  1  0  1
    1  1  0  1
    1  1  1  1
    1  1  1  1
    1  1  1  1
```

```
cl =  5   FD = 35   BlockErrorRate = 0.554

    1  0  0  0  1
    1  0  0  1  1
    1  0  1  0  1
    1  0  1  1  1
    1  0  1  1  1
    1  1  0  0  1
    1  1  0  0  1
    1  1  0  1  1
    1  1  1  0  1
    1  1  1  1  1

cl =  5   FD = 40   BlockErrorRate = 0.568

    1  0  1  0  1
    1  0  1  0  1
    1  0  1  1  1
    1  0  1  1  1
    1  1  0  1  1
    1  1  0  1  1
    1  1  1  0  1
    1  1  1  0  1
    1  1  1  1  1
    1  1  1  1  1


cl =  6   FD = 44   BlockErrorRate = 0.449

    1  0  0  1  0  1
    1  0  0  1  1  1
    1  0  1  0  1  1
    1  0  1  1  0  1
    1  1  0  1  0  1
    1  1  0  1  1  1
    1  1  1  0  0  1
    1  1  1  0  1  1
    1  1  1  1  0  1
    1  1  1  1  1  1

cl =  6   FD = 45   BlockErrorRate = 0.466

    1  0  0  1  1  1
    1  0  1  0  1  1
    1  0  1  1  1  1
    1  0  1  1  1  1
    1  1  0  1  0  1
    1  1  0  1  0  1
    1  1  0  1  1  1
    1  1  1  0  0  1
    1  1  1  1  0  1
    1  1  1  1  0  1
```

```
cl =  7   FD = 49   BlockErrorRate = 0.380

    1  0  0  0  1  0  1
    1  0  0  1  1  1  1
    1  0  1  0  1  1  1
    1  0  1  1  0  1  1
    1  0  1  1  1  0  1
    1  1  0  0  0  1  1
    1  1  0  1  1  0  1
    1  1  1  0  1  0  1
    1  1  1  1  0  0  1
    1  1  1  1  1  1  1


cl =  7   FD = 51   BlockErrorRate = 0.408

    1  0  0  1  0  1  1
    1  0  0  1  1  1  1
    1  0  1  0  1  1  1
    1  0  1  0  1  1  1
    1  0  1  1  0  1  1
    1  1  0  1  1  0  1
    1  1  0  1  1  0  1
    1  1  1  1  0  0  1
    1  1  1  1  1  0  1
    1  1  1  1  1  0  1


cl =  8   FD = 54   BlockErrorRate = 0.325

    1  0  0  0  1  1  1  1
    1  0  0  1  1  1  0  1
    1  0  1  0  1  0  0  1
    1  0  1  1  0  1  1  1
    1  0  1  1  1  1  1  1
    1  1  0  0  0  1  0  1
    1  1  0  1  0  1  1  1
    1  1  0  1  1  1  1  1
    1  1  1  1  0  1  0  1
    1  1  1  1  1  0  1  1

cl =  8   FD = 56   BlockErrorRate = 0.321

    1  0  0  0  1  1  0  1
    1  0  0  1  1  1  0  1
    1  0  1  0  1  0  0  1
    1  0  1  1  0  0  1  1
    1  0  1  1  1  0  0  1
    1  1  0  1  0  1  0  1
    1  1  0  1  1  1  1  1
    1  1  1  0  1  1  1  1
    1  1  1  1  0  1  1  1
    1  1  1  1  1  0  1  1
```

cl = 9   FD = 62   BlockErrorRate = 0.275

```
1 0 0 1 1 1 1 1 1
1 0 1 0 0 1 0 1 1
1 0 1 0 1 1 1 0 1
1 0 1 1 1 0 1 1 1
1 1 0 0 1 1 0 1 1
1 1 0 1 1 0 1 0 1
1 1 0 1 1 1 1 0 1
1 1 1 0 0 1 0 0 1
1 1 1 1 0 1 0 0 1
1 1 1 1 1 1 0 1 1
```

cl = 10   FD = 68   BlockErrorRate = 0.238

```
1 0 0 1 1 0 1 0 1 1
1 0 1 0 1 1 1 1 1 1
1 0 1 1 0 0 1 1 1 1
1 0 1 1 0 1 0 1 0 1
1 0 1 1 1 1 1 1 0 1
1 1 0 0 1 0 1 0 0 1
1 1 0 0 1 1 1 1 1 1
1 1 0 1 1 0 1 1 0 1
1 1 1 0 0 1 0 0 0 1
1 1 1 1 0 1 1 0 1 1
```

cl = 11   FD = 74   BlockErrorRate = 0.208

```
1 0 0 1 1 1 0 1 1 0 1
1 0 1 0 0 1 0 1 0 0 1
1 0 1 0 1 1 0 0 1 0 1
1 0 1 0 1 1 1 1 1 0 1
1 0 1 1 1 1 1 0 0 1 1
1 1 0 0 1 1 1 0 1 1 1
1 1 0 1 0 1 1 1 0 0 1
1 1 0 1 1 0 1 1 1 1 1
1 1 1 1 0 0 1 1 0 1 1
1 1 1 1 1 0 1 1 0 0 1
```

cl = 12   FD = 80   BlockErrorRate = 0.185

```
1 0 0 1 0 1 1 1 1 1 0 1
1 0 1 0 1 1 0 1 0 0 1 1
1 0 1 0 1 1 0 1 1 0 1 1
1 0 1 1 1 1 1 1 0 1 0 1
1 1 0 0 1 0 0 1 1 1 1 1
1 1 0 0 1 0 1 1 1 1 0 1
1 1 0 1 0 0 1 0 1 0 1 1
1 1 1 0 0 1 0 0 1 1 0 1
1 1 1 0 0 1 1 1 0 1 1 1
1 1 1 0 1 1 1 1 1 0 0 1
```

cl = 13 FD = 82 BlockErrorRate = 0.163

```
1 0 0 1 1 1 1 1 1 1 1 0 1
1 0 1 0 0 1 0 1 1 0 1 1 1
1 0 1 0 0 1 1 1 0 0 0 1 1
1 0 1 1 1 0 1 1 0 1 1 0 1
1 0 1 1 1 1 1 1 1 0 0 1 1
1 1 0 0 0 1 0 1 1 0 1 0 1
1 1 0 0 1 1 1 0 1 1 1 0 1
1 1 1 0 0 1 0 1 0 1 1 1 1
1 1 1 1 0 0 1 1 0 1 0 1 1
1 1 1 1 0 1 1 0 1 0 0 0 1
```

cl = 13 FD = 84 BlockErrorRate = 0.160

```
1 0 0 1 1 0 0 1 1 1 0 1 1
1 0 0 1 1 0 0 1 1 1 1 1 1
1 0 1 0 1 1 1 1 0 1 1 0 1
1 0 1 1 0 0 1 1 0 1 1 1 1
1 0 1 1 0 1 0 1 0 0 1 1 1
1 1 0 1 0 0 1 1 1 1 1 0 1
1 1 0 1 0 1 1 0 1 1 0 1 1
1 1 1 0 1 0 1 1 1 0 0 0 1
1 1 1 1 1 0 0 1 0 1 0 0 1
1 1 1 1 1 1 0 1 0 0 1 0 1
```

cl = 14 FD = 90 BlockErrorRate = 0.146

```
1 0 0 0 1 0 0 1 1 1 1 0 0 1
1 0 1 0 0 1 0 1 0 1 1 1 0 1
1 0 1 1 0 1 0 1 0 1 1 1 1 1
1 0 1 1 1 1 1 1 1 0 1 1 0 0 1
1 1 0 0 1 0 0 1 1 1 1 1 0 1
1 1 0 1 0 0 1 0 0 1 0 0 0 1
1 1 1 0 1 0 1 0 1 1 0 1 1 1
1 1 1 0 1 1 0 0 1 1 0 0 1 1
1 1 1 0 1 1 0 1 1 1 0 0 1 1
1 1 1 1 1 0 1 0 1 1 0 1 1 1
```

cl = 15 FD = 90 BlockErrorRate = 0.131

```
1 0 0 1 1 0 0 1 1 0 1 1 1 1 1
1 0 1 0 0 1 1 1 1 1 0 1 0 1 1
1 0 1 0 1 1 1 0 1 0 1 1 1 0 1
1 0 1 1 0 0 1 1 1 1 1 0 1 0 1
1 0 1 1 0 1 0 1 0 1 1 0 0 1 1
1 1 0 1 0 1 1 1 0 1 0 0 1 1 1
1 1 0 1 0 1 1 1 1 0 0 1 0 0 1
1 1 0 1 1 0 1 1 0 0 1 0 1 0 1
1 1 1 0 1 0 0 1 0 1 0 1 1 0 1
1 1 1 1 0 1 1 0 0 1 1 1 0 0 1
```

cl = 15   FD = 94   BlockErrorRate = 0.136

```
1 0 0 1 0 0 0 1 0 1 0 1 1 1 1
1 0 0 1 0 1 1 1 1 0 0 0 1 0 1
1 0 1 0 0 1 1 0 1 1 0 0 1 1 1
1 0 1 0 1 1 1 0 0 1 1 0 1 0 1
1 0 1 1 1 0 0 0 1 0 0 1 1 0 1
1 1 0 0 0 1 1 0 1 1 1 0 0 1 1
1 1 1 0 0 1 1 0 1 0 1 0 1 0 1
1 1 1 1 0 0 0 1 1 1 1 1 0 1 1
1 1 1 1 0 1 0 1 1 1 1 1 0 1 1
1 1 1 1 0 1 1 1 1 1 0 0 1 0 1
```

cl = 16   FD = 99   BlockErrorRate = 0.119

```
1 0 0 0 1 1 1 1 1 0 1 0 1 1 0 1
1 0 0 1 0 1 0 1 1 1 1 1 0 1 1 1
1 0 1 0 1 1 0 0 1 0 1 1 1 0 0 1
1 0 1 1 1 0 0 1 0 1 0 0 1 1 1 1
1 0 1 1 1 1 1 0 1 0 0 0 1 0 1 1
1 1 0 0 1 1 1 0 0 1 1 0 1 0 0 1
1 1 0 1 0 1 1 1 0 0 1 1 0 1 0 1
1 1 1 0 0 1 0 0 1 1 0 1 1 0 1 1
1 1 1 0 1 0 0 1 1 1 1 0 1 0 1 1
1 1 1 0 1 1 0 1 0 0 0 1 0 1 0 1
```

coderate = 1/11
==========

cl = 3   FD = 29   BlockErrorRate = 0.845

```
1 0 1
1 0 1
1 0 1
1 0 1
1 1 1
1 1 1
1 1 1
1 1 1
1 1 1
1 1 1
1 1 1
```

```
cl =  4   FD = 34   BlockErrorRate = 0.679

    1 0 0 1
    1 0 0 1
    1 0 1 1
    1 0 1 1
    1 0 1 1
    1 1 0 1
    1 1 0 1
    1 1 0 1
    1 1 1 1
    1 1 1 1
    1 1 1 1


cl =  4   FD = 36   BlockErrorRate = 0.693

    1 0 0 1
    1 0 1 1
    1 0 1 1
    1 0 1 1
    1 1 0 1
    1 1 0 1
    1 1 0 1
    1 1 1 1
    1 1 1 1
    1 1 1 1
    1 1 1 1


cl =  5   FD = 40   BlockErrorRate = 0.550

    1 0 0 0 1
    1 0 0 1 1
    1 0 1 0 1
    1 0 1 0 1
    1 0 1 1 1
    1 1 0 0 1
    1 1 0 1 1
    1 1 0 1 1
    1 1 1 0 1
    1 1 1 1 1
    1 1 1 1 1

cl =  5   FD = 44   BlockErrorRate = 0.578

    1 0 1 0 1
    1 0 1 0 1
    1 0 1 1 1
    1 0 1 1 1
    1 0 1 1 1
    1 1 0 1 1
    1 1 0 1 1
    1 1 1 0 1
    1 1 1 0 1
    1 1 1 1 1
    1 1 1 1 1
```

```
cl =  6   FD = 47   BlockErrorRate = 0.448

    1 0 0 1 0 1
    1 0 0 1 1 1
    1 0 1 0 0 1
    1 0 1 0 1 1
    1 0 1 1 0 1
    1 1 0 1 0 1
    1 1 0 1 1 1
    1 1 1 0 0 1
    1 1 1 0 1 1
    1 1 1 1 0 1
    1 1 1 1 1 1

cl =  6   FD = 50   BlockErrorRate = 0.469

    1 0 0 1 1 1
    1 0 1 0 1 1
    1 0 1 1 1 1
    1 0 1 1 1 1
    1 1 0 1 0 1
    1 1 0 1 0 1
    1 1 0 1 1 1
    1 1 0 1 1 1
    1 1 1 0 0 1
    1 1 1 1 0 1
    1 1 1 1 0 1


cl =  7   FD = 53   BlockErrorRate = 0.377

    1 0 0 0 1 0 1
    1 0 0 1 0 0 1
    1 0 1 0 1 1 1
    1 0 1 1 0 1 1
    1 0 1 1 1 0 1
    1 1 0 0 1 1 1
    1 1 0 1 0 1 1
    1 1 0 1 1 0 1
    1 1 1 0 1 0 1
    1 1 1 1 0 0 1
    1 1 1 1 1 1 1


cl =  7   FD = 56   BlockErrorRate = 0.395

    1 0 0 1 0 1 1
    1 0 0 1 1 1 1
    1 0 1 0 1 1 1
    1 0 1 0 1 1 1
    1 0 1 1 0 1 1
    1 0 1 1 1 1 1
    1 1 0 1 0 0 1
    1 1 0 1 1 0 1
    1 1 0 1 1 0 1
    1 1 1 1 1 0 1
    1 1 1 1 1 0 1
```

cl = 8   FD = 62   BlockErrorRate = 0.320

```
    1 0 0 1 0 1 0 1
    1 0 0 1 1 0 1 1
    1 0 0 1 1 1 0 1
    1 0 1 0 1 0 0 1
    1 0 1 1 1 0 0 1
    1 0 1 1 1 1 1 1
    1 1 0 0 1 1 0 1
    1 1 1 0 1 1 0 1
    1 1 1 0 1 1 1 1
    1 1 1 1 0 1 1 1
    1 1 1 1 1 0 1 1
```

cl = 9   FD = 67   BlockErrorRate = 0.271

```
    1 0 0 1 0 1 0 1 1
    1 0 0 1 1 0 0 1 1
    1 0 1 0 0 1 1 0 1
    1 0 1 0 1 1 1 0 1
    1 0 1 1 0 1 1 1 1
    1 0 1 1 1 1 0 0 1
    1 1 0 1 1 0 0 0 1
    1 1 0 1 1 1 1 1 1
    1 1 1 0 1 1 0 1 1
    1 1 1 1 0 1 0 1 1
    1 1 1 1 1 1 1 0 1
```

cl = 9   FD = 68   BlockErrorRate = 0.277

```
    1 0 0 0 1 1 1 0 1
    1 0 0 1 0 1 1 0 1
    1 0 1 0 1 1 1 1 1
    1 0 1 1 0 0 1 1 1
    1 0 1 1 0 1 0 1 1
    1 0 1 1 1 1 0 1 1
    1 1 0 1 0 0 1 0 1
    1 1 0 1 1 1 0 1 1
    1 1 0 1 1 1 1 1 1
    1 1 1 0 0 1 0 0 1
    1 1 1 1 0 0 1 1 1
```

cl = 10   FD = 73   BlockErrorRate = 0.234

```
    1 0 0 1 0 1 1 0 0 1
    1 0 0 1 1 0 1 1 1 1
    1 0 1 0 1 0 0 1 0 1
    1 0 1 1 1 0 1 0 1 1
    1 0 1 1 1 1 0 1 0 1
    1 1 0 0 1 0 1 1 1 1
    1 1 0 0 1 1 0 1 1 1
    1 1 0 1 1 1 0 0 1 1
    1 1 1 0 1 0 1 1 0 1
    1 1 1 1 0 1 0 0 1 1
    1 1 1 1 0 1 1 0 0 1
```

cl = 10 FD = 75 BlockErrorRate = 0.238

```
1 0 0 1 0 1 0 1 1 1
1 0 1 0 0 1 1 1 0 1
1 0 1 0 1 1 1 1 0 1
1 0 1 1 0 1 0 0 1 1
1 0 1 1 1 1 0 1 0 1
1 1 0 1 1 0 0 1 1 1
1 1 0 1 1 1 0 1 1 1
1 1 1 0 0 1 1 0 1 1
1 1 1 1 0 0 1 0 0 1
1 1 1 1 0 0 1 0 1 1
1 1 1 1 1 1 0 1 0 1
```

cl = 11 FD = 79 BlockErrorRate = 0.204

```
1 0 0 1 0 0 0 1 1 1 1
1 0 0 1 0 1 0 1 0 1 1
1 0 0 1 0 1 1 0 1 0 1
1 0 0 1 1 1 1 1 1 0 1
1 0 1 0 0 1 0 1 1 1 1
1 0 1 1 0 1 0 0 1 1 1
1 0 1 1 1 0 0 1 1 0 1
1 1 0 1 0 1 1 1 0 1 1
1 1 0 1 1 1 0 1 1 1 1
1 1 1 0 0 1 1 1 0 0 1
1 1 1 1 1 0 1 1 0 0 1
```

cl = 11 FD = 81 BlockErrorRate = 0.214

```
1 0 0 1 0 1 0 1 0 1 1
1 0 0 1 1 0 1 1 1 1 1
1 0 0 1 1 1 0 1 1 0 1
1 0 0 1 1 1 0 1 1 1 1
1 0 1 1 0 1 1 1 0 0 1
1 0 1 1 1 0 1 0 1 1 1
1 0 1 1 1 1 1 1 0 0 1 1
1 1 0 0 1 1 0 1 1 0 1
1 1 0 0 1 1 1 1 1 0 1
1 1 0 1 0 1 1 1 0 0 1
1 1 1 1 0 1 0 1 0 0 1
```

cl = 12 FD = 88 BlockErrorRate = 0.179

```
1 0 0 1 0 1 1 1 1 1 0 1
1 0 1 0 1 1 0 1 0 0 1 1
1 0 1 0 1 1 0 1 1 0 1 1
1 0 1 1 0 1 0 0 1 1 1 1
1 0 1 1 1 1 1 1 0 1 0 1
1 1 0 0 1 0 0 1 1 1 1 1
1 1 0 0 1 0 1 1 1 1 0 1
1 1 0 1 0 0 1 0 1 0 1 1
1 1 1 0 0 1 0 0 1 1 0 1
1 1 1 0 0 1 1 1 0 1 1 1
1 1 1 0 1 1 1 1 1 0 0 1
```

cl = 13 FD = 93 BlockErrorRate = 0.161

```
1 0 0 1 0 0 1 1 0 1 1 1 1
1 0 0 1 1 0 0 1 1 1 1 1 1
1 0 0 1 1 1 0 1 1 0 0 1 1
1 0 0 1 1 1 1 0 1 0 1 0 1
1 0 1 0 1 0 1 1 1 1 0 0 1
1 0 1 0 1 1 1 1 0 1 1 0 1
1 1 0 0 1 1 0 1 1 1 0 0 1
1 1 0 1 1 0 0 1 0 1 0 1 1
1 1 0 1 1 1 0 1 0 1 1 1 1
1 1 1 1 0 1 0 0 0 1 0 0 1
1 1 1 1 0 1 0 1 1 1 0 1 1
```

cl = 14 FD = 98 BlockErrorRate = 0.145

```
1 0 0 1 1 0 1 1 1 0 1 1 1 1
1 0 0 1 1 1 0 0 1 1 1 1 0 1
1 0 1 0 0 1 0 1 1 0 1 0 0 1
1 0 1 0 1 0 1 1 0 0 1 1 1 1
1 0 1 1 1 0 0 1 0 1 0 0 1 1
1 1 0 1 1 0 0 1 0 0 1 0 1 1
1 1 0 1 1 0 1 1 1 0 1 1 1 1
1 1 1 0 0 1 1 0 1 1 1 1 1 1
1 1 1 0 1 1 1 1 1 0 0 1 0 1
1 1 1 1 1 0 1 0 1 1 0 1 0 1
1 1 1 1 1 1 1 0 1 1 0 1 0 1
```

cl = 15 FD = 104 BlockErrorRate = 0.128

```
1 0 0 0 1 1 1 1 1 0 1 1 1 1 1
1 0 0 1 0 0 1 1 1 0 0 0 1 0 1
1 0 1 0 0 1 0 0 1 1 0 1 1 0 1
1 0 1 0 1 1 1 0 0 1 0 0 1 0 1
1 0 1 1 0 1 0 0 1 0 1 1 0 1 1
1 0 1 1 1 0 1 1 1 1 1 1 0 0 1
1 1 0 0 1 0 1 1 1 0 1 0 0 1 1
1 1 0 1 0 1 0 1 1 0 0 1 1 1 1
1 1 0 1 1 0 1 0 1 0 0 1 1 0 1
1 1 1 1 0 0 0 1 1 1 1 1 0 1 1
1 1 1 1 1 1 0 0 0 1 1 1 1 0 1
```

cl = 16 FD = 108 BlockErrorRate = 0.114

```
1 0 0 0 1 0 1 0 0 1 0 1 1 1 1 1
1 0 0 0 1 1 1 1 1 0 1 1 0 1 0 1
1 0 0 1 0 1 0 1 0 1 1 1 1 1 0 1
1 0 0 1 1 1 0 0 1 0 0 1 1 0 1 1
1 0 1 0 0 1 1 0 1 1 1 1 1 0 0 1
1 0 1 1 1 1 1 0 0 1 1 0 0 1 0 1
1 1 0 0 1 1 0 1 1 1 1 0 1 0 1 1
1 1 0 1 0 1 0 0 0 1 1 0 0 1 1 1
1 1 1 0 1 0 0 0 1 0 1 1 1 0 1 1
1 1 1 0 1 1 1 0 0 0 1 0 1 1 1 1
1 1 1 1 1 0 0 1 0 1 0 0 1 0 0 1
```

```
coderate = 1/12
===============

cl =  3   FD = 31   BlockErrorRate = 0.839

    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1


cl =  3   FD = 32   BlockErrorRate = 0.854

    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1


cl =  4   FD = 40   BlockErrorRate = 0.681

    1 0 0 1
    1 0 0 1
    1 0 0 1
    1 0 1 1
    1 0 1 1
    1 0 1 1
    1 1 0 1
    1 1 0 1
    1 1 0 1
    1 1 1 1
    1 1 1 1
    1 1 1 1
```

```
cl =  5   FD = 44   BlockErrorRate = 0.549

    1 0 0 0 1
    1 0 0 1 1
    1 0 1 0 1
    1 0 1 0 1
    1 0 1 1 1
    1 0 1 1 1
    1 1 0 0 1
    1 1 0 1 1
    1 1 0 1 1
    1 1 1 0 1
    1 1 1 1 1
    1 1 1 1 1

cl =  5   FD = 48   BlockErrorRate = 0.580

    1 0 1 0 1
    1 0 1 0 1
    1 0 1 1 1
    1 0 1 1 1
    1 0 1 1 1
    1 1 0 1 1
    1 1 0 1 1
    1 1 1 0 1
    1 1 1 0 1
    1 1 1 0 1
    1 1 1 1 1
    1 1 1 1 1


cl =  6   FD = 50   BlockErrorRate = 0.442

    1 0 0 0 1 1
    1 0 0 1 0 1
    1 0 0 1 1 1
    1 0 1 0 0 1
    1 0 1 0 1 1
    1 0 1 1 0 1
    1 1 0 1 0 1
    1 1 0 1 1 1
    1 1 1 0 0 1
    1 1 1 0 1 1
    1 1 1 1 0 1
    1 1 1 1 1 1
```

cl = 6 FD = 54 BlockErrorRate = 0.465

```
1 0 0 1 0 1
1 0 1 1 0 1
1 0 1 1 1 1
1 0 1 1 1 1
1 0 1 1 1 1
1 1 0 0 1 1
1 1 0 1 0 1
1 1 0 1 1 1
1 1 1 0 0 1
1 1 1 0 1 1
1 1 1 1 0 1
1 1 1 1 0 1
```

cl = 7 FD = 56 BlockErrorRate = 0.371

```
1 0 0 1 0 0 1
1 0 0 1 1 1 1
1 0 1 0 0 0 1
1 0 1 0 1 1 1
1 0 1 1 0 1 1
1 0 1 1 1 0 1
1 1 0 0 1 1 1
1 1 0 1 0 1 1
1 1 0 1 1 0 1
1 1 1 0 0 1 1
1 1 1 0 1 0 1
1 1 1 1 0 0 1
```

cl = 7 FD = 61 BlockErrorRate = 0.386

```
1 0 0 1 1 1 1
1 0 0 1 1 1 1
1 0 1 0 1 1 1
1 0 1 1 0 0 1
1 0 1 1 0 1 1
1 0 1 1 1 1 1
1 1 0 1 0 1 1
1 1 0 1 1 0 1
1 1 0 1 1 0 1
1 1 1 0 1 0 1
1 1 1 1 0 0 1
1 1 1 1 1 0 1
```

```
cl =  8   FD = 67   BlockErrorRate = 0.317

    1  0  0  1  1  1  0  1
    1  0  1  0  1  0  1  1
    1  0  1  1  1  0  1  1
    1  0  1  1  1  1  1  1
    1  1  0  0  1  1  0  1
    1  1  0  1  0  0  1  1
    1  1  0  1  1  0  0  1
    1  1  1  0  0  1  0  1
    1  1  1  0  1  0  1  1
    1  1  1  0  1  1  1  1
    1  1  1  1  0  1  0  1
    1  1  1  1  1  1  0  1


cl =  8   FD = 68   BlockErrorRate = 0.319

    1  0  0  0  1  0  1  1
    1  0  0  1  1  1  0  1
    1  0  0  1  1  1  0  1
    1  0  1  0  1  0  0  1
    1  0  1  1  0  0  1  1
    1  0  1  1  1  1  1  1
    1  0  1  1  1  1  1  1
    1  1  0  1  0  1  0  1
    1  1  0  1  1  0  1  1
    1  1  0  1  1  1  1  1
    1  1  1  0  1  1  0  1
    1  1  1  1  0  1  1  1


cl =  9   FD = 73   BlockErrorRate = 0.268

    1  0  0  1  1  0  1  0  1
    1  0  0  1  1  0  1  1  1
    1  0  1  0  1  1  0  1  1
    1  0  1  1  0  0  1  0  1
    1  0  1  1  1  0  0  0  1
    1  1  0  0  0  1  0  1  1
    1  1  0  1  0  1  0  1  1
    1  1  0  1  1  1  0  0  1
    1  1  1  1  0  1  1  1  1
    1  1  1  1  1  0  1  0  1
    1  1  1  1  1  1  0  1  1
    1  1  1  1  1  1  1  0  1
```

cl = 9   FD = 75   BlockErrorRate = 0.271

```
    1  0  0  1  0  1  1  1  1
    1  0  1  0  0  1  0  1  1
    1  0  1  0  1  1  0  1  1
    1  0  1  1  0  0  1  1  1
    1  0  1  1  0  1  1  1  1
    1  0  1  1  1  0  1  0  1
    1  1  0  1  0  1  1  0  1
    1  1  0  1  1  1  0  1  1
    1  1  0  1  1  1  1  1  1
    1  1  1  0  0  1  0  0  1
    1  1  1  1  0  1  0  0  1
    1  1  1  1  1  1  0  0  1
```

cl = 10   FD = 79   BlockErrorRate = 0.232

```
    1  0  0  1  0  0  1  1  0  1
    1  0  1  0  0  1  1  0  1  1
    1  0  1  0  1  0  1  1  1  1
    1  0  1  0  1  1  0  1  1  1
    1  0  1  1  0  1  1  1  0  1
    1  0  1  1  1  0  1  0  1  1
    1  1  0  0  1  1  1  0  0  1
    1  1  0  1  0  1  0  1  0  1
    1  1  1  0  0  1  1  1  0  1
    1  1  1  1  0  0  1  0  1  1
    1  1  1  1  0  1  0  0  1  1
    1  1  1  1  0  1  1  0  0  1
```

cl = 10   FD = 82   BlockErrorRate = 0.228

```
    1  0  0  1  1  1  0  0  1  1
    1  0  0  1  1  1  0  1  0  1
    1  0  0  1  1  1  1  1  1  1
    1  0  1  0  1  0  1  1  1  1
    1  0  1  1  0  0  1  0  0  1
    1  0  1  1  0  1  0  1  1  1
    1  1  0  0  1  0  1  1  0  1
    1  1  0  1  0  1  0  0  1  1
    1  1  0  1  1  0  1  1  0  1
    1  1  0  1  1  1  1  0  0  1
    1  1  1  1  0  1  1  1  0  1
    1  1  1  1  0  1  1  1  1  1
```

cl = 11 FD = 88 BlockErrorRate = 0.199

```
1 0 0 0 1 1 1 1 1 1 1
1 0 0 1 0 1 0 1 1 0 1
1 0 0 1 1 0 1 1 1 1 1
1 0 1 0 0 0 1 0 1 0 1
1 0 1 0 0 1 1 0 1 0 1
1 0 1 1 1 0 1 0 0 1 1
1 0 1 1 1 1 1 0 1 0 1
1 1 0 1 1 0 0 1 1 1 1
1 1 0 1 1 0 1 1 0 0 1
1 1 1 0 1 1 1 0 0 1 1
1 1 1 1 0 0 1 0 1 1 1
1 1 1 1 1 0 1 1 0 1 1
```

cl = 12 FD = 93 BlockErrorRate = 0.175

```
1 0 0 1 0 1 0 0 1 1 1 1
1 0 0 1 0 1 1 1 1 1 1 1
1 0 0 1 1 1 1 1 1 0 1 1
1 0 1 0 1 1 0 1 1 1 0 1
1 0 1 1 1 0 1 1 1 1 0 1
1 0 1 1 1 1 0 1 1 0 1 1
1 1 0 0 1 1 1 0 1 0 1 1
1 1 0 1 0 1 0 1 1 1 0 1
1 1 0 1 1 1 0 1 0 1 0 1
1 1 1 0 0 1 1 0 0 1 0 1
1 1 1 0 1 0 0 1 1 0 0 1
1 1 1 1 1 0 0 1 0 0 1 1
```

cl = 12 FD = 96 BlockErrorRate = 0.175

```
1 0 0 1 0 0 1 0 0 1 0 1
1 0 0 1 1 1 1 1 0 1 1 1
1 0 1 0 1 1 0 0 1 1 0 1
1 0 1 0 1 1 0 1 0 0 1 1
1 0 1 1 0 0 1 1 0 1 1 1
1 0 1 1 1 1 0 1 0 0 1 1
1 1 0 0 1 0 1 1 0 1 0 1
1 1 0 0 1 0 1 1 1 1 0 1
1 1 0 0 1 1 1 1 0 1 0 1
1 1 1 0 1 0 1 1 1 0 1 1
1 1 1 0 1 1 1 1 1 0 0 1
1 1 1 0 1 1 1 1 1 1 1 1
```

cl = 13 FD = 102 BlockErrorRate = 0.157

```
1 0 0 1 1 0 0 1 1 1 0 1 1
1 0 1 0 1 0 1 1 1 1 0 0 1
1 0 1 1 0 1 0 0 1 1 1 1 1
1 0 1 1 0 1 0 1 0 0 1 1 1
1 0 1 1 0 1 1 1 1 0 1 0 1
1 0 1 1 1 0 0 1 1 0 0 1 1
1 1 0 0 1 1 0 1 0 1 1 1 1
1 1 0 1 0 1 1 0 1 1 0 0 1
1 1 1 0 1 1 0 1 1 1 0 0 1
1 1 1 0 1 1 1 1 1 1 0 0 1
1 1 1 1 0 1 0 0 0 1 0 0 1
1 1 1 1 1 1 0 1 0 0 1 0 1
```

cl = 14 FD = 105 BlockErrorRate = 0.139

```
1 0 0 1 1 1 0 1 0 0 1 0 1 1
1 0 1 0 1 0 0 0 1 1 1 1 1 1
1 0 1 1 0 1 0 0 1 0 0 1 1 1
1 0 1 1 1 0 1 0 0 1 0 0 1 1
1 0 1 1 1 0 1 1 1 0 0 1 0 1
1 1 0 0 1 0 1 0 1 0 1 1 1 1
1 1 0 1 0 1 0 1 1 1 0 1 0 1
1 1 0 1 1 1 1 0 0 0 1 0 0 1
1 1 1 0 0 0 1 1 1 1 1 0 1 1
1 1 1 0 1 0 1 1 0 1 1 0 0 1
1 1 1 1 0 1 1 0 0 1 1 1 1 1
1 1 1 1 1 1 1 1 0 0 1 0 1 1
```

cl = 14 FD = 108 BlockErrorRate = 0.135

```
1 0 0 1 0 1 1 0 1 0 0 1 0 1
1 0 1 0 0 1 1 1 1 1 0 1 1 1
1 0 1 0 1 1 0 1 1 1 1 1 1 1
1 0 1 1 1 1 0 0 1 1 1 0 0 1
1 0 1 1 1 1 0 1 1 0 0 1 1 1
1 0 1 1 1 1 1 0 0 1 0 0 0 1
1 1 0 0 1 0 0 0 1 1 0 1 1 1
1 1 0 0 1 0 1 0 0 1 1 1 0 1
1 1 0 1 0 0 1 0 0 1 1 0 1 1
1 1 1 1 0 0 1 1 0 1 0 1 0 1
1 1 1 1 0 1 1 1 0 1 1 0 1 1
1 1 1 1 1 0 1 0 1 0 1 1 0 1
```

cl = 15 FD = 112 BlockErrorRate = 0.123

```
1 0 0 0 1 1 1 1 1 1 0 1 1 0 1
1 0 0 1 1 1 1 0 0 1 1 1 0 0 1
1 0 1 0 0 1 1 1 1 1 0 0 0 1 1
1 0 1 0 1 0 1 1 0 0 1 0 1 1 1
1 0 1 1 0 1 1 1 1 0 0 1 0 0 1
1 0 1 1 1 0 1 0 1 1 0 1 0 0 1
1 1 0 0 1 0 1 1 0 0 0 1 1 1 1
1 1 0 1 0 1 1 0 1 1 1 0 1 0 1
1 1 0 1 1 1 0 1 1 1 1 0 0 0 1
1 1 1 1 0 0 1 1 0 1 0 1 0 0 1
1 1 1 1 0 1 0 0 1 1 0 0 1 1 1
1 1 1 1 1 1 0 0 1 0 1 1 0 1 1
```

cl = 15 FD = 113 BlockErrorRate = 0.122

```
1 0 0 0 1 1 1 0 1 0 1 1 0 1 1
1 0 0 1 0 0 0 1 0 1 0 1 1 1 1
1 0 1 0 0 1 1 0 1 1 0 0 1 1 1
1 0 1 1 1 0 0 0 1 0 0 1 1 0 1
1 0 1 1 1 0 0 1 1 1 1 0 0 1 1
1 0 1 1 1 1 0 0 1 0 1 0 1 0 1
1 1 0 0 0 1 1 0 1 1 1 0 0 1 1
1 1 1 0 0 0 1 1 0 1 0 1 1 1 1
1 1 1 0 0 1 1 0 1 0 1 0 1 0 1
1 1 1 0 1 0 0 1 1 1 0 1 0 0 1
1 1 1 1 0 1 0 1 1 1 1 1 0 1 1
1 1 1 1 0 1 1 1 1 1 0 0 1 0 1
```

cl = 16 FD = 117 BlockErrorRate = 0.114

```
1 0 0 1 0 0 0 1 1 1 1 1 0 1 0 1
1 0 0 1 0 1 1 1 1 1 1 1 0 0 1 1
1 0 0 1 1 0 0 1 1 1 1 1 1 0 0 1
1 0 1 0 0 1 1 1 1 0 1 1 1 0 0 1
1 0 1 1 0 1 1 0 1 1 1 0 1 0 0 1
1 0 1 1 1 1 0 0 0 1 1 0 1 1 1 1
1 1 0 0 1 1 1 0 1 1 0 1 1 0 1 1
1 1 0 0 1 1 1 1 1 0 0 1 1 1 0 1
1 1 0 1 0 1 0 1 0 1 1 1 0 1 1 1
1 1 0 1 1 1 0 0 1 0 1 0 0 1 0 1
1 1 1 0 0 1 0 1 0 1 0 1 1 1 0 1
1 1 1 0 0 1 1 0 1 1 0 1 1 1 1 1
```

coderate = 1/13
==========

cl = 3   FD = 34   BlockErrorRate = 0.840

```
    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
```

cl = 4   FD = 40   BlockErrorRate = 0.686

```
    1 0 0 1
    1 0 0 1
    1 0 0 1
    1 0 1 1
    1 0 1 1
    1 0 1 1
    1 1 0 1
    1 1 0 1
    1 1 0 1
    1 1 1 1
    1 1 1 1
    1 1 1 1
    1 1 1 1
```

cl = 4   FD = 43   BlockErrorRate = 0.712

```
    1 0 1 1
    1 0 1 1
    1 0 1 1
    1 0 1 1
    1 1 0 1
    1 1 0 1
    1 1 0 1
    1 1 0 1
    1 1 0 1
    1 1 1 1
    1 1 1 1
    1 1 1 1
    1 1 1 1
```

```
cl =  5   FD = 48   BlockErrorRate = 0.545

    1  0  0  0  1
    1  0  0  1  1
    1  0  1  0  1
    1  0  1  0  1
    1  0  1  1  1
    1  0  1  1  1
    1  1  0  0  1
    1  1  0  1  1
    1  1  0  1  1
    1  1  1  0  1
    1  1  1  0  1
    1  1  1  1  1
    1  1  1  1  1

cl =  5   FD = 52   BlockErrorRate = 0.578

    1  0  1  0  1
    1  0  1  0  1
    1  0  1  0  1
    1  0  1  1  1
    1  0  1  1  1
    1  1  0  1  1
    1  1  0  1  1
    1  1  0  1  1
    1  1  1  0  1
    1  1  1  0  1
    1  1  1  1  1
    1  1  1  1  1
    1  1  1  1  1


cl =  6   FD = 54   BlockErrorRate = 0.441

    1  0  0  0  1  1
    1  0  0  1  0  1
    1  0  0  1  1  1
    1  0  1  0  0  1
    1  0  1  0  1  1
    1  0  1  1  0  1
    1  1  0  0  1  1
    1  1  0  1  0  1
    1  1  0  1  1  1
    1  1  1  0  0  1
    1  1  1  0  1  1
    1  1  1  1  0  1
    1  1  1  1  1  1
```

```
cl =  6   FD = 59   BlockErrorRate = 0.475

    1  0  1  0  1  1
    1  0  1  0  1  1
    1  0  1  1  1  1
    1  0  1  1  1  1
    1  0  1  1  1  1
    1  1  0  1  0  1
    1  1  0  1  0  1
    1  1  0  1  1  1
    1  1  1  0  0  1
    1  1  1  0  0  1
    1  1  1  0  1  1
    1  1  1  1  0  1
    1  1  1  1  0  1


cl =  7   FD = 66   BlockErrorRate = 0.375

    1  0  0  1  1  1  1
    1  0  1  0  1  1  1
    1  0  1  1  0  0  1
    1  0  1  1  0  1  1
    1  0  1  1  1  0  1
    1  0  1  1  1  1  1
    1  1  0  1  0  0  1
    1  1  0  1  0  1  1
    1  1  0  1  1  0  1
    1  1  1  0  0  0  1
    1  1  1  0  1  0  1
    1  1  1  0  1  1  1
    1  1  1  1  1  1  1


cl =  8   FD = 74   BlockErrorRate = 0.314

    1  0  0  1  1  0  1  1
    1  0  0  1  1  1  0  1
    1  0  1  0  1  1  0  1
    1  0  1  1  0  1  0  1
    1  0  1  1  1  0  0  1
    1  0  1  1  1  1  1  1
    1  1  0  0  1  1  1  1
    1  1  0  1  0  1  0  1
    1  1  1  0  1  0  0  1
    1  1  1  1  0  0  1  1
    1  1  1  1  0  1  0  1
    1  1  1  1  0  1  1  1
    1  1  1  1  1  0  1  1
```

cl = 9 FD = 81 BlockErrorRate = 0.266

```
1 0 0 1 1 0 0 1 1
1 0 1 0 0 1 1 1 1
1 0 1 1 0 1 0 0 1
1 0 1 1 0 1 1 0 1
1 0 1 1 1 1 1 0 1
1 1 0 1 0 1 0 0 1
1 1 0 1 0 1 0 1 1
1 1 0 1 1 1 0 1 1
1 1 1 0 0 1 0 1 1
1 1 1 0 0 1 1 1 1
1 1 1 0 1 0 1 0 1
1 1 1 1 1 0 1 1 1
1 1 1 1 1 1 0 0 1
```

cl = 10 FD = 88 BlockErrorRate = 0.231

```
1 0 0 1 0 0 1 0 1 1
1 0 0 1 1 1 1 1 0 1
1 0 1 0 1 1 1 1 1 1
1 0 1 1 0 0 1 1 1 1
1 0 1 1 0 1 0 1 0 1
1 0 1 1 1 0 1 1 1 1
1 0 1 1 1 1 1 1 1 1
1 1 0 0 0 1 1 0 1 1
1 1 0 0 1 0 1 1 0 1
1 1 0 1 1 0 1 0 0 1
1 1 0 1 1 1 0 1 0 1
1 1 1 0 0 1 0 0 0 1
1 1 1 1 0 1 1 0 1 1
```

cl = 11 FD = 96 BlockErrorRate = 0.194

```
1 0 0 1 0 1 0 1 1 1 1
1 0 0 1 1 1 0 1 1 0 1
1 0 0 1 1 1 1 1 1 1 1
1 0 1 0 0 0 1 0 1 0 1
1 0 1 1 0 1 1 0 0 1 1
1 0 1 1 1 0 1 1 0 1 1
1 0 1 1 1 1 1 0 0 1 1
1 1 0 1 0 1 0 1 0 0 1
1 1 0 1 1 0 0 1 1 0 1
1 1 1 0 1 0 1 1 1 0 1
1 1 1 1 0 0 1 0 1 1 1
1 1 1 1 0 1 1 1 0 0 1
1 1 1 1 1 0 1 1 0 0 1
```

cl = 12 FD = 101 BlockErrorRate = 0.174

```
1 0 0 0 1 1 1 1 1 0 0 1
1 0 0 1 0 1 1 1 0 0 1 1
1 0 0 1 0 1 1 1 1 1 1 1
1 0 1 0 0 1 1 0 1 0 1 1
1 0 1 1 0 1 1 0 0 1 1 1
1 0 1 1 1 1 1 0 1 0 1 1
1 0 1 1 1 1 1 1 0 1 0 1
1 1 0 1 0 1 0 1 1 0 0 1
1 1 0 1 0 1 1 0 0 1 1 1
1 1 1 0 0 1 1 0 0 1 0 1
1 1 1 0 1 1 0 1 0 1 1 1
1 1 1 1 1 0 1 0 1 1 0 1
1 1 1 1 1 0 1 1 1 0 0 1
```

cl = 12 FD = 104 BlockErrorRate = 0.174

```
1 0 0 1 0 1 1 1 1 1 0 1
1 0 1 0 0 1 0 0 1 0 0 1
1 0 1 0 1 1 0 1 1 0 1 1
1 0 1 0 1 1 1 1 0 0 1 1
1 0 1 1 0 0 1 1 0 1 0 1
1 0 1 1 1 1 1 1 0 1 0 1
1 1 0 0 1 0 0 1 1 1 1 1
1 1 0 1 0 0 1 0 1 0 1 1
1 1 0 1 1 1 0 1 0 1 1 1
1 1 1 0 0 1 0 0 1 1 0 1
1 1 1 0 0 1 1 1 0 1 1 1
1 1 1 0 1 1 0 0 1 1 0 1
1 1 1 1 1 1 1 1 0 1 1 1
```

cl = 13 FD = 110 BlockErrorRate = 0.152

```
1 0 0 0 1 1 1 1 1 0 1 1 1
1 0 0 1 0 0 0 1 0 1 1 1 1
1 0 0 1 1 0 1 1 0 1 0 1 1
1 0 0 1 1 1 0 1 1 0 0 1 1
1 0 0 1 1 1 1 0 1 0 1 0 1
1 0 1 0 0 1 0 1 1 1 1 1 1
1 0 1 0 1 0 1 1 1 1 0 0 1
1 1 0 0 1 1 0 1 1 1 1 0 1
1 1 0 1 1 1 0 0 1 1 0 0 1
1 1 0 1 1 1 0 1 0 1 1 1 1
1 1 1 0 0 1 0 1 0 1 1 0 1
1 1 1 1 0 1 0 0 1 1 0 0 1
1 1 1 1 0 1 0 1 1 1 0 1 1
```

cl = 14 FD = 116 BlockErrorRate = 0.136

```
1 0 0 0 0 1 0 1 1 0 1 0 0 1
1 0 0 0 1 1 1 0 1 1 1 1 0 1
1 0 0 1 1 1 1 0 0 1 0 0 0 1
1 0 1 0 1 0 1 1 0 0 1 1 1 1
1 0 1 1 1 0 0 1 0 1 0 0 1 1
1 0 1 1 1 0 1 0 1 0 0 1 0 1
1 0 1 1 1 1 1 0 0 1 0 0 1 1
1 1 0 0 1 1 0 0 1 1 0 1 1 1
1 1 0 0 1 1 1 0 1 1 0 1 1 1
1 1 0 1 1 0 1 1 0 0 1 0 1 1
1 1 1 0 0 1 1 0 1 1 1 1 1 1
1 1 1 0 1 1 1 1 1 1 0 1 0 1
1 1 1 1 1 0 1 0 1 0 1 1 0 1
```

cl = 15 FD = 124 BlockErrorRate = 0.122

```
1 0 0 0 1 1 1 0 1 0 0 1 1 0 1
1 0 0 1 0 0 1 1 1 0 0 0 1 0 1
1 0 0 1 1 1 1 0 1 0 1 0 1 1 1
1 0 1 0 0 1 1 1 0 1 0 1 0 0 1
1 0 1 0 1 0 0 1 0 1 1 0 0 1 1
1 0 1 0 1 1 1 0 0 1 1 0 1 0 1
1 0 1 1 0 0 1 0 1 0 1 1 0 1 1
1 1 0 0 1 1 0 1 1 0 1 0 0 1 1
1 1 0 1 1 1 1 1 1 0 1 0 1 1 1
1 1 1 0 1 0 1 1 1 0 0 1 1 1 1
1 1 1 1 0 0 0 1 1 1 1 1 0 1 1
1 1 1 1 0 0 1 0 1 1 1 1 0 1 1
1 1 1 1 1 0 1 1 1 1 1 0 0 0 1
```

cl = 16 FD = 127 BlockErrorRate = 0.111

```
1 0 0 0 1 0 1 1 0 0 1 0 1 1 1 1
1 0 0 1 0 1 1 1 1 0 1 1 0 1 0 1
1 0 1 0 0 1 0 0 1 1 1 0 1 1 1 1
1 0 1 1 1 0 0 1 0 0 1 1 1 0 1 1
1 0 1 1 1 0 1 0 0 1 1 0 0 0 1 1
1 0 1 1 1 1 1 0 1 1 0 1 0 0 0 1
1 1 0 0 1 0 0 1 1 0 1 1 1 1 0 1
1 1 0 0 1 1 1 0 0 1 0 1 1 1 1 1
1 1 0 1 0 1 0 0 1 1 0 1 1 1 0 1
1 1 1 0 0 0 1 0 1 0 0 0 1 1 1 1
1 1 1 0 1 1 0 0 0 1 1 1 0 1 0 1
1 1 1 1 0 0 1 1 0 1 0 0 0 1 1 1
1 1 1 1 1 0 0 1 0 1 0 1 1 1 0 1
```

```
coderate = 1/14
===============

cl =  3   FD = 36   BlockErrorRate = 0.837

    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1

cl =  3   FD = 37   BlockErrorRate = 0.845

    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1


cl =  4   FD = 43   BlockErrorRate = 0.679

    1 0 0 1
    1 0 0 1
    1 0 0 1
    1 0 1 1
    1 0 1 1
    1 0 1 1
    1 0 1 1
    1 1 0 1
    1 1 0 1
    1 1 0 1
    1 1 1 1
    1 1 1 1
    1 1 1 1
    1 1 1 1
```

```
cl =  4   FD = 46   BlockErrorRate = 0.695

    1  0  0  1
    1  0  1  1
    1  0  1  1
    1  0  1  1
    1  0  1  1
    1  1  0  1
    1  1  0  1
    1  1  0  1
    1  1  0  1
    1  1  1  1
    1  1  1  1
    1  1  1  1
    1  1  1  1
    1  1  1  1


cl =  5   FD = 51   BlockErrorRate = 0.552

    1  0  0  0  1
    1  0  0  1  1
    1  0  0  1  1
    1  0  1  0  1
    1  0  1  1  1
    1  0  1  1  1
    1  1  0  0  1
    1  1  0  0  1
    1  1  0  1  1
    1  1  0  1  1
    1  1  1  0  1
    1  1  1  0  1
    1  1  1  1  1
    1  1  1  1  1

cl =  5   FD = 56   BlockErrorRate = 0.576

    1  0  1  0  1
    1  0  1  0  1
    1  0  1  0  1
    1  0  1  1  1
    1  0  1  1  1
    1  1  0  1  1
    1  1  0  1  1
    1  1  0  1  1
    1  1  1  0  1
    1  1  1  0  1
    1  1  1  0  1
    1  1  1  1  1
    1  1  1  1  1
    1  1  1  1  1
```

```
cl =  6   FD = 57   BlockErrorRate = 0.440

    1 0 0 0 1 1
    1 0 0 1 0 1
    1 0 0 1 1 1
    1 0 1 0 0 1
    1 0 1 0 1 1
    1 0 1 1 0 1
    1 0 1 1 1 1
    1 1 0 0 1 1
    1 1 0 1 0 1
    1 1 0 1 1 1
    1 1 1 0 0 1
    1 1 1 0 1 1
    1 1 1 1 0 1
    1 1 1 1 1 1

cl =  6   FD = 64   BlockErrorRate = 0.473

    1 0 0 1 0 1
    1 0 1 0 1 1
    1 0 1 0 1 1
    1 0 1 1 1 1
    1 0 1 1 1 1
    1 0 1 1 1 1
    1 1 0 1 0 1
    1 1 0 1 1 1
    1 1 0 1 1 1
    1 1 1 0 0 1
    1 1 1 0 1 1
    1 1 1 1 0 1
    1 1 1 1 0 1
    1 1 1 1 0 1


cl =  7   FD = 70   BlockErrorRate = 0.372

    1 0 0 0 1 0 1
    1 0 0 1 1 1 1
    1 0 1 0 1 1 1
    1 0 1 1 0 0 1
    1 0 1 1 0 1 1
    1 0 1 1 1 0 1
    1 0 1 1 1 1 1
    1 1 0 1 0 1 1
    1 1 0 1 1 0 1
    1 1 0 1 1 1 1
    1 1 1 0 0 1 1
    1 1 1 0 1 0 1
    1 1 1 1 1 0 1
    1 1 1 1 1 1 1
```

```
cl =  7   FD = 72   BlockErrorRate = 0.378

    1  0  0  1  0  1  1
    1  0  0  1  1  1  1
    1  0  0  1  1  1  1
    1  0  1  0  1  1  1
    1  0  1  1  0  1  1
    1  0  1  1  1  1  1
    1  0  1  1  1  1  1
    1  1  0  1  0  1  1
    1  1  0  1  1  0  1
    1  1  0  1  1  0  1
    1  1  1  0  1  0  1
    1  1  1  0  1  0  1
    1  1  1  1  0  0  1
    1  1  1  1  1  0  1


cl =  8   FD = 75   BlockErrorRate = 0.314

    1  0  0  1  0  1  1  1
    1  0  0  1  1  0  1  1
    1  0  1  0  0  1  1  1
    1  0  1  0  1  0  1  1
    1  0  1  1  0  0  1  1
    1  0  1  1  1  1  0  1
    1  1  0  0  1  0  1  1
    1  1  0  0  1  1  0  1
    1  1  0  1  0  0  1  1
    1  1  0  1  0  1  0  1
    1  1  0  1  1  0  0  1
    1  1  1  0  0  1  0  1
    1  1  1  0  1  1  1  1
    1  1  1  1  0  1  1  1

cl =  8   FD = 80   BlockErrorRate = 0.317

    1  0  0  1  0  1  0  1
    1  0  0  1  1  1  0  1
    1  0  0  1  1  1  0  1
    1  0  1  0  1  0  0  1
    1  0  1  1  0  0  1  1
    1  0  1  1  1  0  0  1
    1  0  1  1  1  1  1  1
    1  1  0  1  0  1  0  1
    1  1  0  1  1  0  1  1
    1  1  0  1  1  1  1  1
    1  1  1  0  1  1  0  1
    1  1  1  0  1  1  1  1
    1  1  1  1  0  1  1  1
    1  1  1  1  1  0  1  1
```

cl = 9   FD = 88   BlockErrorRate = 0.268

```
1 0 0 1 0 1 1 1 1
1 0 0 1 0 1 1 1 1
1 0 1 0 0 1 0 1 1
1 0 1 0 1 1 0 1 1
1 0 1 1 0 0 1 1 1
1 0 1 1 0 1 1 1 1
1 0 1 1 1 0 1 0 1
1 1 0 1 0 1 1 0 1
1 1 0 1 1 1 0 1 1
1 1 0 1 1 1 1 1 1
1 1 1 0 0 1 0 0 1
1 1 1 1 0 1 0 0 1
1 1 1 1 0 1 1 0 1
1 1 1 1 1 1 0 0 1
```

cl = 10   FD = 93   BlockErrorRate = 0.228

```
1 0 0 0 1 0 1 1 1 1
1 0 0 1 0 1 1 0 1 1
1 0 0 1 1 0 1 0 0 1
1 0 0 1 1 1 0 0 1 1
1 0 0 1 1 1 0 1 0 1
1 0 1 0 0 1 1 1 1 1
1 0 1 1 1 0 1 1 0 1
1 1 0 1 0 1 1 1 1 1
1 1 0 1 1 0 1 0 1 1
1 1 0 1 1 0 1 1 1 1
1 1 1 0 1 0 1 0 0 1
1 1 1 0 1 1 1 0 1 1
1 1 1 1 0 1 0 0 0 1
1 1 1 1 0 1 0 1 0 1
```

cl = 10   FD = 96   BlockErrorRate = 0.229

```
1 0 0 1 0 0 1 1 1 1
1 0 0 1 1 1 1 1 0 1
1 0 1 0 1 0 0 1 1 1
1 0 1 0 1 1 1 1 0 1
1 0 1 1 1 0 1 1 1 1
1 0 1 1 1 1 0 1 0 1
1 0 1 1 1 1 1 0 0 1
1 1 0 1 0 1 1 0 1 1
1 1 0 1 1 0 0 1 1 1
1 1 0 1 1 0 1 0 1 1
1 1 1 0 0 1 0 1 0 1
1 1 1 0 0 1 1 0 1 1
1 1 1 1 0 0 1 0 0 1
1 1 1 1 0 1 1 1 0 1
```

cl = 11 FD = 102 BlockErrorRate = 0.196

```
1 0 0 0 1 0 1 1 1 1 1
1 0 0 1 0 0 1 1 0 1 1
1 0 0 1 1 0 1 0 1 0 1
1 0 0 1 1 1 1 1 0 1 1
1 0 1 0 1 0 1 1 0 0 1
1 0 1 1 1 0 1 0 0 1 1
1 0 1 1 1 0 1 0 1 0 1
1 1 0 1 1 1 1 0 0 1 1
1 1 0 1 1 1 1 1 1 0 1
1 1 1 0 0 0 1 0 1 1 1
1 1 1 0 1 1 0 0 1 1 1
1 1 1 0 1 1 0 1 1 0 1
1 1 1 1 0 1 0 0 1 0 1
1 1 1 1 1 1 0 0 1 1 1
```

cl = 11 FD = 104 BlockErrorRate = 0.210

```
1 0 0 1 0 0 1 1 1 1 1
1 0 0 1 1 1 0 1 1 0 1
1 0 0 1 1 1 0 1 1 0 1
1 0 1 0 1 0 0 1 1 0 1
1 0 1 1 0 0 1 0 1 1 1
1 0 1 1 0 1 1 1 0 0 1
1 0 1 1 1 1 1 0 0 1 1
1 0 1 1 1 1 1 1 1 0 1
1 1 0 1 0 1 0 1 0 0 1
1 1 0 1 0 1 1 1 0 0 1
1 1 0 1 1 0 1 1 0 1 1
1 1 1 0 0 1 0 1 0 1 1
1 1 1 1 0 0 1 1 1 1 1
1 1 1 1 0 1 0 1 1 1 1
```

cl = 12 FD = 108 BlockErrorRate = 0.172

```
1 0 0 1 1 0 0 1 0 1 1 1
1 0 1 0 0 1 1 1 1 1 1 1
1 0 1 0 1 0 1 1 0 1 1 1
1 0 1 1 0 0 0 1 1 0 1 1
1 0 1 1 0 0 0 1 1 1 0 1
1 0 1 1 1 0 0 1 1 1 1 1
1 0 1 1 1 0 1 1 0 0 1 1
1 0 1 1 1 1 1 0 1 0 0 1
1 1 0 0 1 1 1 0 0 1 1 1
1 1 0 1 0 1 1 1 1 1 0 1
1 1 1 0 1 0 1 0 1 0 1 1
1 1 1 0 1 0 1 0 1 1 0 1
1 1 1 1 0 0 1 1 0 0 0 1
1 1 1 1 1 0 1 1 1 0 0 1
```

cl = 12 FD = 112 BlockErrorRate = 0.170

```
1 0 0 1 0 0 1 0 0 1 0 1
1 0 0 1 0 1 0 1 0 0 1 1
1 0 1 0 0 1 1 1 0 1 1 1
1 0 1 0 1 1 0 0 1 1 0 1
1 0 1 0 1 1 0 1 0 0 1 1
1 0 1 1 0 0 1 1 0 1 1 1
1 0 1 1 1 1 1 1 0 1 1 1
1 1 0 0 1 0 1 1 1 1 0 1
1 1 0 0 1 1 1 1 0 1 0 1
1 1 0 1 1 0 0 1 0 0 1 1
1 1 1 0 1 0 1 1 1 0 1 1
1 1 1 0 1 1 1 1 1 0 0 1
1 1 1 0 1 1 1 1 1 1 1 1
1 1 1 1 1 0 1 0 1 1 0 1
```

cl = 13 FD = 119 BlockErrorRate = 0.150

```
1 0 0 0 1 1 1 0 1 0 1 0 1
1 0 0 1 0 0 1 1 0 1 1 1 1
1 0 0 1 0 1 0 1 0 1 1 0 1
1 0 0 1 1 1 0 1 1 0 0 1 1
1 0 1 0 1 0 1 1 1 1 0 0 1
1 0 1 1 0 0 1 0 0 1 1 1 1
1 0 1 1 1 1 1 1 0 0 1 0 1
1 1 0 0 1 1 0 0 1 1 0 0 1
1 1 0 0 1 1 0 1 1 1 0 0 1
1 1 0 1 1 0 1 1 1 1 1 0 1
1 1 0 1 1 1 0 1 0 1 1 1 1
1 1 1 1 0 1 0 1 0 1 0 0 1
1 1 1 1 0 1 0 1 1 1 0 1 1
1 1 1 1 1 1 0 1 1 1 0 1 1
```

cl = 14 FD = 122 BlockErrorRate = 0.135

```
1 0 0 0 1 1 1 0 1 1 1 0 1 1
1 0 0 1 0 0 1 1 1 1 0 0 1 1
1 0 1 0 0 1 1 1 1 0 1 0 0 1
1 0 1 0 1 1 0 0 0 1 1 0 1 1
1 0 1 1 0 1 0 1 0 1 0 1 0 1
1 0 1 1 1 1 1 1 1 1 1 0 1 0 1
1 1 0 0 1 0 1 1 0 1 0 0 1 1
1 1 0 0 1 1 1 0 0 0 1 1 0 1
1 1 0 1 1 0 1 1 0 1 1 1 1 1
1 1 1 0 1 1 1 1 0 0 1 0 0 1
1 1 1 1 0 1 0 1 1 1 0 0 1 1
1 1 1 1 1 0 0 1 1 1 0 1 0 1
1 1 1 1 1 0 1 0 1 1 1 1 0 1
1 1 1 1 1 1 0 1 1 0 0 1 1 1
```

cl = 14 FD = 126 BlockErrorRate = 0.139

```
1 0 0 0 1 0 0 1 1 1 1 0 0 1
1 0 0 1 0 1 1 0 1 1 0 0 0 1
1 0 1 0 1 1 1 1 1 1 0 1 1 1
```

```
    1  0  1  1  0  1  0  1  0  1  1  1  1  1
    1  0  1  1  1  1  0  1  1  1  0  1  0  1
    1  0  1  1  1  1  1  0  0  1  1  0  0  1
    1  1  0  0  1  0  1  0  0  1  1  1  0  1
    1  1  0  1  0  0  1  0  0  1  0  0  0  1
    1  1  0  1  0  0  1  0  0  1  1  0  1  1
    1  1  1  0  1  0  1  0  1  1  0  1  1  1
    1  1  1  0  1  1  0  0  1  1  0  0  1  1
    1  1  1  1  0  0  1  1  0  1  0  1  0  1
    1  1  1  1  1  0  1  0  1  1  0  1  1  1
    1  1  1  1  1  1  0  1  1  0  0  1  1  1
```

cl = 15 FD = 134 BlockErrorRate = 0.122

```
    1  0  0  0  1  1  1  1  1  0  1  1  1  1  1
    1  0  0  1  0  1  0  0  1  0  0  0  1  0  1
    1  0  1  1  0  0  1  0  0  1  0  0  1  0  1
    1  0  1  1  0  0  1  1  0  1  1  1  0  0  1
    1  0  1  1  1  1  0  0  1  1  1  1  1  1  1
    1  1  0  0  1  0  1  1  0  1  1  0  0  1  1
    1  1  0  0  1  1  0  1  0  0  1  0  1  0  1
    1  1  0  1  1  0  1  0  1  0  0  1  1  0  1
    1  1  0  1  1  1  1  0  1  0  0  1  1  1  1
    1  1  1  0  1  0  1  0  1  1  1  0  0  0  1
    1  1  1  0  1  0  1  1  1  0  1  0  0  1  1
    1  1  1  0  1  0  1  1  1  1  1  1  0  1  1
    1  1  1  1  0  0  1  0  0  1  0  1  0  1  1
    1  1  1  1  1  0  1  1  1  0  1  0  1  1  1
```

cl = 16 FD = 139 BlockErrorRate = 0.110

```
    1  0  0  0  1  0  0  1  0  1  1  1  0  1  1  1
    1  0  0  0  1  1  1  0  1  1  1  1  0  0  1  1
    1  0  0  1  1  0  1  1  0  0  1  0  1  1  1  1
    1  0  0  1  1  1  0  1  0  1  1  1  0  1  0  1
    1  0  0  1  1  1  1  0  1  1  1  0  1  1  1  1
    1  0  1  0  0  1  1  0  1  1  1  1  1  0  0  1
    1  0  1  1  0  0  1  0  0  0  1  1  1  0  1  1
    1  0  1  1  0  0  1  1  1  1  0  1  1  0  0  1
    1  0  1  1  1  0  1  1  1  1  1  0  1  0  1  1
    1  1  0  0  1  0  1  1  0  1  0  1  0  0  1  1
    1  1  0  1  0  0  0  1  0  0  1  1  1  1  1  1
    1  1  0  1  0  1  0  0  0  1  0  1  1  1  0  1
    1  1  1  0  1  0  1  0  1  0  1  1  0  0  1  1
    1  1  1  1  1  1  0  1  0  1  1  0  1  0  0  1
```

coderate = 1/15
==========

cl = 3   FD = 39   BlockErrorRate = 0.839

```
    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
```

cl = 3   FD = 40   BlockErrorRate = 0.850

```
    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
```

cl = 4   FD = 46   BlockErrorRate = 0.679

```
    1 0 0 1
    1 0 0 1
    1 0 0 1
    1 0 1 1
    1 0 1 1
    1 0 1 1
    1 0 1 1
    1 1 0 1
    1 1 0 1
    1 1 0 1
    1 1 0 1
    1 1 1 1
    1 1 1 1
    1 1 1 1
    1 1 1 1
```

```
cl =  4   FD = 50   BlockErrorRate = 0.711

    1  0  1  1
    1  0  1  1
    1  0  1  1
    1  0  1  1
    1  0  1  1
    1  0  1  1
    1  1  0  1
    1  1  0  1
    1  1  0  1
    1  1  0  1
    1  1  1  1
    1  1  1  1
    1  1  1  1
    1  1  1  1
    1  1  1  1


cl =  5   FD = 54   BlockErrorRate = 0.547

    1  0  0  0  1
    1  0  0  1  1
    1  0  0  1  1
    1  0  1  0  1
    1  0  1  0  1
    1  0  1  1  1
    1  0  1  1  1
    1  1  0  0  1
    1  1  0  0  1
    1  1  0  1  1
    1  1  0  1  1
    1  1  1  0  1
    1  1  1  0  1
    1  1  1  1  1
    1  1  1  1  1


cl =  5   FD = 60   BlockErrorRate = 0.580

    1  0  1  0  1
    1  0  1  0  1
    1  0  1  0  1
    1  0  1  1  1
    1  0  1  1  1
    1  0  1  1  1
    1  1  0  1  1
    1  1  0  1  1
    1  1  0  1  1
    1  1  1  0  1
    1  1  1  0  1
    1  1  1  0  1
    1  1  1  1  1
    1  1  1  1  1
    1  1  1  1  1
```

```
cl =  6   FD = 62   BlockErrorRate = 0.438

    1 0 0 0 1 1
    1 0 0 1 0 1
    1 0 0 1 1 1
    1 0 1 0 0 1
    1 0 1 0 1 1
    1 0 1 1 0 1
    1 0 1 1 1 1
    1 1 0 0 0 1
    1 1 0 0 1 1
    1 1 0 1 0 1
    1 1 0 1 1 1
    1 1 1 0 0 1
    1 1 1 0 1 1
    1 1 1 1 0 1
    1 1 1 1 1 1


cl =  6   FD = 68   BlockErrorRate = 0.473

    1 0 0 1 0 1
    1 0 0 1 1 1
    1 0 1 0 1 1
    1 0 1 0 1 1
    1 0 1 1 1 1
    1 0 1 1 1 1
    1 0 1 1 1 1
    1 1 0 0 1 1
    1 1 0 1 0 1
    1 1 0 1 1 1
    1 1 1 0 1 1
    1 1 1 1 0 1
    1 1 1 1 0 1
    1 1 1 1 0 1
    1 1 1 1 0 1


cl =  7   FD = 76   BlockErrorRate = 0.364

    1 0 0 1 0 1 1
    1 0 0 1 1 1 1
    1 0 1 0 1 0 1
    1 0 1 1 0 1 1
    1 0 1 1 1 0 1
    1 0 1 1 1 1 1
    1 1 0 0 1 0 1
    1 1 0 0 1 1 1
    1 1 0 1 0 0 1
    1 1 0 1 1 0 1
    1 1 0 1 1 1 1
    1 1 1 0 1 0 1
    1 1 1 1 0 0 1
    1 1 1 1 0 1 1
    1 1 1 1 1 1 1
```

cl = 8 FD = 84 BlockErrorRate = 0.314

```
1 0 0 1 1 0 0 1
1 0 1 0 1 0 1 1
1 0 1 0 1 1 1 1
1 0 1 1 0 0 1 1
1 0 1 1 0 1 1 1
1 0 1 1 1 1 1 1
1 0 1 1 1 1 1 1
1 1 0 0 1 0 0 1
1 1 0 1 0 0 1 1
1 1 0 1 0 1 0 1
1 1 1 0 0 0 1 1
1 1 1 0 1 1 0 1
1 1 1 1 0 1 0 1
1 1 1 1 1 0 1 1
1 1 1 1 1 1 0 1
```

cl = 8 FD = 85 BlockErrorRate = 0.329

```
1 0 0 1 0 1 1 1
1 0 0 1 1 1 0 1
1 0 0 1 1 1 0 1
1 0 1 0 1 0 0 1
1 0 1 0 1 0 0 1
1 0 1 0 1 1 0 1
1 0 1 1 0 0 1 1
1 0 1 1 1 1 1 1
1 1 0 1 1 0 1 1
1 1 0 1 1 0 1 1
1 1 0 1 1 1 1 1
1 1 0 1 1 1 1 1
1 1 1 0 0 1 0 1
1 1 1 1 0 1 1 1
1 1 1 1 1 0 1 1
```

cl = 9 FD = 94 BlockErrorRate = 0.267

```
1 0 0 1 0 0 1 1 1
1 0 0 1 0 0 1 1 1
1 0 1 0 0 1 0 1 1
1 0 1 0 1 1 1 0 1
1 0 1 1 0 1 1 1 1
1 0 1 1 1 1 0 1 1
1 0 1 1 1 1 1 1 1
1 1 0 0 1 1 1 0 1
1 1 0 1 0 0 1 0 1
1 1 0 1 0 1 1 0 1
1 1 0 1 1 0 1 1 1
1 1 0 1 1 1 0 1 1
1 1 1 1 0 1 0 0 1
1 1 1 1 0 1 1 0 1
1 1 1 1 1 1 0 0 1
```

cl = 10 FD = 101 BlockErrorRate = 0.225

```
1 0 0 0 1 0 1 1 0 1
1 0 0 1 0 1 0 1 0 1
1 0 0 1 1 0 0 1 1 1
1 0 0 1 1 1 0 1 1 1
1 0 0 1 1 1 1 0 1 1
1 0 1 0 1 1 0 1 0 1
1 0 1 0 1 1 1 1 1 1
1 0 1 1 1 1 0 0 1 1
1 0 1 1 1 1 0 1 1 1
1 1 0 1 0 1 0 0 1 1
1 1 0 1 0 1 1 1 1 1
1 1 0 1 1 1 0 0 1 1
1 1 1 0 0 1 1 0 1 1
1 1 1 0 0 1 1 1 0 1
1 1 1 1 1 0 1 0 0 1
```

cl = 10 FD = 102 BlockErrorRate = 0.223

```
1 0 0 1 0 0 1 1 0 1
1 0 0 1 1 1 1 0 1 1
1 0 1 0 1 1 1 0 0 1
1 0 1 0 1 1 1 1 0 1
1 0 1 1 0 1 0 0 1 1
1 0 1 1 0 1 1 0 1 1
1 0 1 1 1 0 1 1 1 1
1 1 0 0 1 0 1 0 1 1
1 1 0 0 1 1 1 0 0 1
1 1 0 1 1 1 0 1 1 1
1 1 1 0 0 0 1 0 0 1
1 1 1 0 1 0 1 1 0 1
1 1 1 1 0 1 0 1 0 1
1 1 1 1 1 0 1 1 1 1
1 1 1 1 1 1 1 0 0 1
```

cl = 11 FD = 111 BlockErrorRate = 0.191

```
1 0 0 1 0 1 0 1 0 1 1
1 0 0 1 1 0 1 1 1 1 1
1 0 0 1 1 1 0 1 1 1 1
1 0 1 0 0 1 0 1 0 0 1
1 0 1 0 1 1 0 0 1 0 1
1 0 1 0 1 1 1 1 1 0 1
1 0 1 1 0 1 1 1 0 0 1
1 0 1 1 1 0 1 0 1 1 1
1 1 0 0 1 1 0 1 1 0 1
1 1 0 0 1 1 1 0 1 1 1
1 1 0 0 1 1 1 1 1 0 1
1 1 0 1 1 0 1 1 1 1 1
1 1 1 1 0 0 1 1 0 1 1
1 1 1 1 0 1 0 1 0 0 1
1 1 1 1 1 0 1 1 0 0 1
```

cl = 12 FD = 116 BlockErrorRate = 0.169

```
1 0 0 0 1 0 1 1 1 0 1 1
1 0 1 0 1 0 0 1 1 1 0 1
1 0 1 0 1 0 1 0 0 1 1 1
1 0 1 1 0 1 1 1 0 1 1 1
1 0 1 1 1 0 1 0 1 0 0 1
1 0 1 1 1 1 0 1 0 1 0 1
1 0 1 1 1 1 1 1 1 0 0 1
1 1 0 0 1 1 0 0 0 1 1 1
1 1 0 0 1 1 0 1 1 0 0 1
1 1 0 1 0 1 1 0 0 0 1 1
1 1 1 0 0 1 0 1 0 1 1 1
1 1 1 0 1 0 0 1 1 1 1 1
1 1 1 0 1 1 0 0 1 1 1 1
1 1 1 1 0 0 1 0 1 0 0 1
1 1 1 1 0 0 1 1 0 1 0 1
```

cl = 12 FD = 120 BlockErrorRate = 0.178

```
1 0 1 0 0 1 0 0 1 0 0 1
1 0 1 0 1 1 0 1 0 0 1 1
1 0 1 0 1 1 1 1 0 0 1 1
1 0 1 1 0 0 1 1 0 1 0 1
1 0 1 1 0 1 0 0 1 1 1 1
1 0 1 1 0 1 0 1 1 1 1 1
1 1 0 0 1 0 0 1 1 0 1 1
1 1 0 0 1 0 1 0 1 0 0 1
1 1 0 0 1 0 1 1 1 1 0 1
1 1 0 1 1 1 0 1 0 1 1 1
1 1 1 0 1 1 0 0 1 1 0 1
1 1 1 0 1 1 1 0 0 1 0 1
1 1 1 0 1 1 1 1 1 0 0 1
1 1 1 0 1 1 1 1 1 1 0 1
1 1 1 1 1 1 1 1 0 1 1 1
```

cl = 13 FD = 124 BlockErrorRate = 0.149

```
1 0 0 1 1 0 1 1 0 0 1 1 1
1 0 1 0 0 0 1 1 1 1 1 0 1
1 0 1 0 1 1 1 1 0 1 1 0 1
1 0 1 0 1 1 1 1 1 1 0 1 1
1 0 1 1 0 0 1 1 0 1 0 0 1
1 0 1 1 1 0 0 0 1 0 1 0 1
1 0 1 1 1 1 1 0 0 0 1 0 1
1 1 0 0 1 0 1 1 1 1 0 1 1
1 1 0 1 1 0 1 1 0 0 0 1 1
1 1 0 1 1 1 1 1 0 0 1 0 1
1 1 1 0 0 1 0 0 1 1 1 1 1
1 1 1 0 0 1 1 0 1 0 1 0 1
1 1 1 1 0 0 0 1 0 1 1 1 1
1 1 1 1 0 1 0 1 1 1 0 0 1
1 1 1 1 0 1 1 1 0 1 0 1 1
```

cl = 13 FD = 128 BlockErrorRate = 0.149

```
1 0 0 1 0 0 0 1 0 0 1 1 1
1 0 0 1 0 1 0 0 1 1 1 1 1
1 0 0 1 1 1 0 1 1 0 0 1 1
1 0 1 0 1 0 1 1 1 1 1 0 1
1 0 1 0 1 1 1 0 1 0 1 0 1
1 0 1 1 0 0 1 1 0 1 0 1 1
1 0 1 1 0 1 1 1 1 0 1 0 1
1 0 1 1 1 1 1 0 0 1 0 1 1
1 1 0 0 1 1 0 1 1 1 0 0 1
1 1 0 1 0 0 1 1 1 1 1 0 1
1 1 0 1 1 1 0 1 0 1 1 1 1
1 1 1 1 0 0 1 0 0 1 1 0 1
1 1 1 1 0 1 0 1 1 1 0 1 1
1 1 1 1 0 1 1 0 0 1 0 0 1
1 1 1 1 1 1 0 0 1 1 0 1 1
```

cl = 14 FD = 132 BlockErrorRate = 0.135

```
1 0 0 1 0 0 1 0 1 0 1 1 1 1
1 0 1 0 1 0 1 0 1 1 0 1 1 1
1 0 1 0 1 1 0 1 1 1 0 0 1 1
1 0 1 1 0 1 1 0 0 1 1 0 0 1
1 1 0 0 0 1 1 0 0 1 1 1 1 1
1 1 0 0 1 1 1 1 1 0 0 1 0 1
1 1 0 1 0 0 1 1 0 1 0 1 1 1
1 1 0 1 0 1 1 1 0 0 0 1 0 1
1 1 1 0 0 1 1 0 0 1 1 0 0 1
1 1 1 0 0 1 1 0 1 0 1 1 0 1
1 1 1 0 1 0 1 1 1 0 1 1 1 1
1 1 1 0 1 1 1 1 1 0 1 0 1 1 1
1 1 1 1 0 0 0 1 0 1 1 1 0 1
1 1 1 1 1 0 0 1 0 1 0 0 0 1
1 1 1 1 1 0 1 0 0 1 1 1 1 1
```

cl = 14 FD = 136 BlockErrorRate = 0.145

```
1 0 0 1 0 1 1 0 1 0 0 1 0 1
1 0 0 1 1 1 1 0 0 1 0 0 0 1
1 0 1 0 0 1 1 1 1 1 0 1 1 1
1 0 1 0 1 1 0 1 1 1 1 1 1 1
1 0 1 1 1 1 0 0 1 1 1 0 0 1
1 0 1 1 1 1 0 1 1 0 0 1 1 1
1 0 1 1 1 1 1 0 0 1 0 0 0 1
1 1 0 0 1 0 1 0 0 1 1 1 0 1
1 1 0 0 1 0 1 0 1 1 0 1 1 1
1 1 0 0 1 1 0 0 1 1 0 1 1 1
1 1 0 1 0 0 1 0 0 1 1 0 1 1
1 1 1 1 0 0 1 1 0 1 0 1 0 1
1 1 1 1 0 1 1 1 0 1 1 0 1 1
1 1 1 1 1 0 1 0 1 0 1 1 0 1
1 1 1 1 1 0 1 0 1 0 1 1 0 1
```

cl = 15 FD = 139 BlockErrorRate = 0.119

```
1 0 0 1 0 1 0 0 1 0 1 1 0 1 1
1 0 0 1 0 1 1 1 1 1 1 1 0 1 1
1 0 1 0 0 1 1 0 1 1 1 1 0 0 1
1 0 1 0 1 1 1 1 1 0 1 0 0 0 1
1 0 1 1 0 0 0 1 1 1 1 1 1 1 1
1 0 1 1 0 1 0 1 1 1 0 0 1 0 1
1 0 1 1 0 1 1 0 0 1 1 0 1 1 1
1 0 1 1 1 1 1 0 0 1 0 0 1 0 1
1 1 0 0 0 1 1 1 0 1 1 0 1 1 1
1 1 0 1 0 1 1 1 1 0 1 1 1 0 1
1 1 0 1 1 1 0 1 1 0 0 1 1 1 1
1 1 1 0 1 1 0 1 0 1 0 0 1 0 1
1 1 1 1 0 0 0 1 0 0 0 1 0 1 1
1 1 1 1 0 1 1 1 0 0 1 1 0 0 1
1 1 1 1 1 0 0 1 1 1 0 1 0 0 1
```

cl = 15 FD = 142 BlockErrorRate = 0.120

```
1 0 0 0 1 1 1 1 1 0 0 1 1 0 1
1 0 0 1 0 0 0 1 0 1 0 1 1 1 1
1 0 0 1 1 1 1 0 1 0 1 0 1 1 1
1 0 1 0 0 0 1 0 0 1 0 1 0 0 1
1 0 1 0 0 1 1 0 1 1 0 0 1 1 1
1 0 1 0 1 0 0 1 0 1 1 0 0 1 1
1 0 1 1 1 0 0 0 1 0 0 1 1 0 1
1 1 0 0 0 1 0 1 1 0 1 0 0 1 1
1 1 0 0 0 1 1 0 1 1 1 0 0 1 1
1 1 0 1 1 1 1 1 1 0 1 0 1 1 1
1 1 1 0 0 1 1 0 1 0 1 0 1 0 1
1 1 1 0 1 0 1 1 1 0 1 1 1 1 1
1 1 1 1 0 0 1 0 1 1 1 1 0 1 1
1 1 1 1 0 1 0 1 1 1 1 1 0 1 1
1 1 1 1 0 1 1 1 1 1 0 0 1 0 1
```

cl = 16 FD = 147 BlockErrorRate = 0.107

```
1 0 0 1 0 0 1 1 1 1 0 1 0 0 1 1
1 0 0 1 1 0 0 1 1 1 1 1 1 1 0 1
1 0 0 1 1 1 0 1 1 1 0 1 0 0 1 1
1 0 1 0 1 0 1 1 0 1 0 0 1 0 1 1
1 0 1 0 1 1 1 1 1 1 0 1 1 1 0 0 1
1 0 1 1 1 0 1 0 0 0 1 1 1 1 0 1
1 1 0 0 0 1 0 1 0 1 1 1 0 1 1 1
1 1 0 0 1 0 1 1 0 1 0 1 1 0 1 1
1 1 0 1 1 0 1 0 0 1 0 1 1 1 1 1
1 1 1 0 0 1 0 1 0 1 1 0 1 1 0 1
1 1 1 0 1 1 0 1 1 1 0 0 1 1 0 1
1 1 1 1 0 0 1 0 0 1 1 1 1 0 0 1
1 1 1 1 0 1 1 1 0 0 1 0 1 0 0 1
1 1 1 1 1 0 1 0 1 1 0 1 0 1 0 1
1 1 1 1 1 1 1 1 0 0 0 1 0 1 1 1
```

```
coderate = 1/16
===============

cl =  3   FD = 40   BlockErrorRate = 0.836

    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1


cl =  3   FD = 42

    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 0 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
    1 1 1
```

```
cl =  4   FD = 50   BlockErrorRate = 0.680

    1  0  0  1
    1  0  0  1
    1  0  0  1
    1  0  1  1
    1  0  1  1
    1  0  1  1
    1  1  0  1
    1  1  0  1
    1  1  0  1
    1  1  0  1
    1  1  0  1
    1  1  1  1
    1  1  1  1
    1  1  1  1
    1  1  1  1
    1  1  1  1

cl =  4   FD = 53

    1  0  1  1
    1  0  1  1
    1  0  1  1
    1  0  1  1
    1  0  1  1
    1  0  1  1
    1  1  0  1
    1  1  0  1
    1  1  0  1
    1  1  0  1
    1  1  0  1
    1  1  1  1
    1  1  1  1
    1  1  1  1
    1  1  1  1
    1  1  1  1

cl =  5   FD = 61   BlockErrorRate = 0.549

    1  0  0  0  1
    1  0  0  0  1
    1  0  0  1  1
    1  0  0  1  1
    1  0  1  0  1
    1  0  1  0  1
    1  0  1  1  1
    1  0  1  1  1
    1  1  0  0  1
    1  1  0  0  1
    1  1  0  1  1
    1  1  0  1  1
    1  1  1  0  1
    1  1  1  0  1
    1  1  1  1  1
    1  1  1  1  1
```

```
cl =  5   FD = 64

    1 0 1 0 1
    1 0 1 0 1
    1 0 1 0 1
    1 0 1 1 1
    1 0 1 1 1
    1 0 1 1 1
    1 0 1 1 1
    1 1 0 1 1
    1 1 0 1 1
    1 1 0 1 1
    1 1 1 0 1
    1 1 1 0 1
    1 1 1 0 1
    1 1 1 1 1
    1 1 1 1 1
    1 1 1 1 1


cl =  6   FD = 69   BlockErrorRate = 0.441

    1 0 0 0 0 1
    1 0 0 0 1 1
    1 0 0 1 0 1
    1 0 0 1 1 1
    1 0 1 0 0 1
    1 0 1 0 1 1
    1 0 1 1 0 1
    1 0 1 1 1 1
    1 1 0 0 0 1
    1 1 0 0 1 1
    1 1 0 1 0 1
    1 1 0 1 1 1
    1 1 1 0 0 1
    1 1 1 0 1 1
    1 1 1 1 0 1
    1 1 1 1 1 1


cl =  6   FD = 72

    1 0 0 1 0 1
    1 0 0 1 1 1
    1 0 1 0 0 1
    1 0 1 0 1 1
    1 0 1 1 0 1
    1 0 1 1 1 1
    1 0 1 1 1 1
    1 1 0 0 1 1
    1 1 0 1 0 1
    1 1 0 1 1 1
    1 1 1 0 1 1
    1 1 1 0 1 1
    1 1 1 1 0 1
    1 1 1 1 0 1
    1 1 1 1 0 1
    1 1 1 1 1 1
```

```
cl =  7   FD = 80   BlockErrorRate = 0.366

    1 0 0 0 1 1 1
    1 0 1 0 1 0 1
    1 0 1 1 0 0 1
    1 0 1 1 0 1 1
    1 0 1 1 1 0 1
    1 0 1 1 1 1 1
    1 1 0 0 1 0 1
    1 1 0 1 0 0 1
    1 1 0 1 0 1 1
    1 1 0 1 1 0 1
    1 1 0 1 1 1 1
    1 1 1 0 0 0 1
    1 1 1 0 1 1 1
    1 1 1 1 0 1 1
    1 1 1 1 1 0 1
    1 1 1 1 1 1 1


cl =  7   FD = 82

    1 0 0 1 1 0 1
    1 0 0 1 1 1 1
    1 0 1 0 1 1 1
    1 0 1 1 0 1 1
    1 0 1 1 0 1 1
    1 0 1 1 1 1 1
    1 0 1 1 1 1 1
    1 0 1 1 1 1 1
    1 1 0 1 0 0 1
    1 1 0 1 0 1 1
    1 1 0 1 1 0 1
    1 1 1 0 1 0 1
    1 1 1 0 1 0 1
    1 1 1 1 0 0 1
    1 1 1 1 0 0 1
    1 1 1 1 1 0 1


cl =  8   FD = 88   BlockErrorRate = 0.308

    1 0 0 0 1 1 0 1
    1 0 0 1 1 1 0 1
    1 0 1 0 1 0 0 1
    1 0 1 1 0 0 1 1
    1 0 1 1 0 1 0 1
    1 0 1 1 1 0 1 1
    1 1 0 0 1 0 0 1
    1 1 0 0 1 1 1 1
    1 1 0 1 1 0 1 1
    1 1 0 1 1 1 1 1
    1 1 1 0 0 0 1 1
    1 1 1 0 0 1 0 1
    1 1 1 0 1 1 0 1
    1 1 1 0 1 1 1 1
    1 1 1 1 1 0 0 1
    1 1 1 1 1 0 1 1
```

cl = 8 FD = 91

```
1 0 0 1 1 0 1 1
1 0 0 1 1 1 0 1
1 0 0 1 1 1 1 1
1 0 1 0 0 1 1 1
1 0 1 0 1 1 0 1
1 0 1 1 0 1 0 1
1 0 1 1 0 1 1 1
1 0 1 1 1 0 0 1
1 1 0 1 0 1 0 1
1 1 0 1 0 1 1 1
1 1 0 1 1 0 0 1
1 1 1 0 1 0 1 1
1 1 1 0 1 1 0 1
1 1 1 1 0 1 1 1
1 1 1 1 1 0 0 1
1 1 1 1 1 1 1 1
```

cl = 9 FD = 98 BlockErrorRate = 0.261

```
1 0 0 0 1 0 1 1 1
1 0 0 1 0 1 1 0 1
1 0 0 1 1 0 1 0 1
1 0 0 1 1 1 0 1 1
1 0 1 0 1 0 0 1 1
1 0 1 1 0 1 0 1 1
1 0 1 1 1 1 0 0 1
1 1 0 0 0 1 1 1 1
1 1 0 1 1 0 0 0 1
1 1 0 1 1 1 1 0 1
1 1 1 0 0 1 1 0 1
1 1 1 0 1 1 1 0 1
1 1 1 1 0 0 1 1 1
1 1 1 1 0 1 1 0 1
1 1 1 1 1 0 1 0 1
1 1 1 1 1 0 1 1 1
```

cl = 9 FD = 100

```
1 0 0 1 1 1 1 1 1
1 0 1 0 1 1 1 0 1
1 0 1 1 0 0 1 1 1
1 0 1 1 0 1 0 1 1
1 0 1 1 0 1 0 1 1
1 0 1 1 0 1 0 1 1
1 0 1 1 1 1 0 1 1
1 1 0 1 0 0 1 0 1
1 1 0 1 1 1 0 1 1
1 1 0 1 1 1 1 0 1
1 1 0 1 1 1 1 1 1
1 1 0 1 1 1 1 1 1
1 1 1 0 0 1 0 0 1
1 1 1 0 0 1 0 0 1
1 1 1 0 0 1 0 0 1
1 1 1 1 0 1 0 0 1
```

cl = 10 FD = 106 BlockErrorRate = 0.224

```
1 0 0 1 0 1 1 0 1 1
1 0 0 1 0 1 1 1 1 1
1 0 0 1 1 1 1 0 1 1
1 0 1 0 0 1 0 1 0 1
1 0 1 0 1 1 1 1 0 1
1 0 1 1 0 1 0 0 0 1
1 0 1 1 1 0 0 1 0 1
1 0 1 1 1 0 0 1 1 1
1 1 0 0 0 1 0 0 1 1
1 1 0 0 1 1 0 1 1 1
1 1 0 1 0 1 1 1 1 1
1 1 0 1 1 0 0 1 1 1
1 1 1 1 0 0 0 1 0 1
1 1 1 1 0 1 0 1 1 1
1 1 1 1 0 1 1 1 0 1
1 1 1 1 1 1 1 0 0 1
```

cl = 10 FD = 109

```
1 0 0 1 0 1 0 1 1 1
1 0 0 1 1 0 1 0 1 1
1 0 0 1 1 1 0 1 0 1
1 0 1 0 0 1 1 0 1 1
1 0 1 0 1 1 1 0 0 1
1 0 1 0 1 1 1 1 1 1
1 0 1 1 0 0 1 1 1 1
1 0 1 1 1 1 0 0 1 1
1 1 0 0 1 1 1 1 0 1
1 1 0 1 0 1 1 0 0 1
1 1 0 1 1 0 1 1 1 1
1 1 1 0 1 0 1 0 0 1
1 1 1 0 1 1 1 0 0 1
1 1 1 1 0 0 1 1 0 1
1 1 1 1 0 1 1 0 1 1
1 1 1 1 1 1 0 1 0 1
```

cl = 11 FD = 115 BlockErrorRate = 0.192

```
1 0 0 1 0 1 0 1 1 1 1
1 0 0 1 0 1 1 1 0 1 1
1 0 0 1 1 0 1 0 1 1 1
1 0 0 1 1 1 0 0 1 0 1
1 0 1 0 0 0 1 0 1 1 1
1 0 1 0 1 1 0 1 0 1 1
1 0 1 1 0 1 1 1 1 1 1
1 0 1 1 1 0 1 0 1 0 1
1 1 0 0 1 0 1 1 0 0 1
1 1 0 1 0 1 0 0 1 1 1
1 1 0 1 1 1 0 0 0 1 1
1 1 1 0 1 1 1 0 0 0 1
1 1 1 1 0 0 1 1 0 1 1
1 1 1 1 0 1 0 0 1 0 1
1 1 1 1 0 1 0 0 1 1 1
1 1 1 1 1 1 1 1 0 0 1
```

cl = 11 FD = 118

```
1 0 0 1 0 1 0 1 1 1 1
1 0 0 1 1 1 0 1 1 0 1
1 0 0 1 1 1 0 1 1 0 1
1 0 0 1 1 1 1 1 1 1 1
1 0 1 1 0 0 1 0 1 0 1
1 0 1 1 0 1 1 0 0 1 1
1 0 1 1 1 0 1 0 0 1 1
1 0 1 1 1 1 0 0 0 1 1
1 0 1 1 1 1 1 0 0 1 1
1 1 0 1 0 1 0 1 0 0 1
1 1 0 1 0 1 1 1 1 0 1
1 1 0 1 1 0 0 1 1 0 1
1 1 1 0 1 0 1 1 1 0 1
1 1 1 1 0 0 1 0 1 1 1
1 1 1 1 0 1 1 1 0 0 1
1 1 1 1 1 0 1 1 0 0 1
```

cl = 12 FD = 123 BlockErrorRate = 0.168

```
1 0 0 1 1 0 0 0 1 1 1 1
1 0 0 1 1 0 1 1 1 0 0 1
1 0 0 1 1 1 1 1 0 1 0 1
1 0 1 0 0 1 1 0 1 1 0 1
1 0 1 0 1 0 1 1 1 1 1 1
1 0 1 1 0 1 1 1 0 1 1 1
1 0 1 1 0 1 1 1 1 1 0 1
1 0 1 1 1 1 0 0 1 0 0 1
1 1 0 0 0 1 1 0 1 1 1 1
1 1 0 0 1 0 1 1 0 0 1 1
1 1 0 1 0 1 1 0 1 1 0 1
1 1 0 1 0 1 1 1 1 0 1 1
1 1 1 0 0 1 1 1 1 1 0 1
1 1 1 1 0 1 0 1 1 0 1 1
1 1 1 1 1 0 0 0 1 0 0 1
1 1 1 1 1 1 0 1 0 1 0 1
```

cl = 12 FD = 128

```
1 0 0 1 0 0 1 0 0 1 0 1
1 0 0 1 1 1 1 1 0 1 1 1
1 0 1 0 0 1 0 0 1 0 0 1
1 0 1 0 1 1 0 0 1 1 0 1
1 0 1 0 1 1 1 1 0 0 1 1
1 0 1 1 0 0 1 1 0 1 0 1
1 0 1 1 0 0 1 1 0 1 1 1
1 0 1 1 1 1 0 1 0 0 1 1
1 1 0 0 1 0 1 1 0 1 0 1
1 1 0 0 1 1 1 1 0 1 0 1
1 1 0 1 1 1 0 1 0 1 1 1
1 1 1 0 1 0 1 1 1 0 1 1
1 1 1 0 1 1 0 0 1 1 0 1
1 1 1 0 1 1 1 1 1 1 1 1
1 1 1 1 0 0 1 0 1 1 0 1
1 1 1 1 1 1 1 1 0 1 1 1
```

cl = 13 FD = 132 BlockErrorRate = 0.149

```
1 0 0 0 1 1 1 1 1 1 0 0 1
1 0 0 1 0 1 0 1 1 0 1 1 1
1 0 0 1 0 1 1 1 0 0 1 1 1
1 0 0 1 1 0 1 1 1 0 1 1 1
1 0 1 0 1 1 1 0 0 1 1 0 1
1 0 1 1 0 1 0 1 0 0 1 0 1
1 0 1 1 1 0 1 1 1 1 0 1 1
1 1 0 0 1 0 0 1 1 1 1 1 1
1 1 0 1 0 1 0 0 1 1 1 0 1
1 1 0 1 0 1 0 1 0 1 1 0 1
1 1 1 0 0 1 1 1 1 0 0 1 1
1 1 1 0 1 1 0 0 0 1 1 0 1
1 1 1 0 1 1 1 1 1 1 0 0 1
1 1 1 1 0 0 1 1 0 0 0 1 1
1 1 1 1 0 1 1 1 1 0 1 0 1
1 1 1 1 1 0 1 1 0 1 0 1 1
```

cl = 13 FD = 136

```
1 0 0 1 0 0 0 1 1 1 0 1 1
1 0 0 1 1 0 0 1 0 1 1 1 1
1 0 0 1 1 0 0 1 1 1 0 1 1
1 0 1 1 0 0 1 0 0 1 1 1 1
1 0 1 1 0 1 0 1 0 0 1 1 1
1 0 1 1 0 1 0 1 0 1 1 1 1
1 0 1 1 1 0 1 0 1 0 1 0 1
1 1 0 0 1 1 0 1 1 1 0 0 1
1 1 0 1 0 0 1 1 1 1 1 0 1
1 1 0 1 0 1 1 0 1 1 0 0 1
1 1 0 1 0 1 1 0 1 1 0 0 1
1 1 1 0 1 1 1 1 1 1 0 0 1
1 1 1 0 1 1 1 1 1 1 0 0 1
1 1 1 1 0 1 0 1 1 1 0 1 1
1 1 1 1 1 1 0 1 0 0 1 0 1
1 1 1 1 1 1 0 1 0 0 1 0 1
```

cl = 14 FD = 143 BlockErrorRate = 0.133

```
1 0 0 1 0 0 1 1 1 1 1 0 1 1
1 0 0 1 0 1 0 1 0 1 0 1 1 1
1 0 0 1 0 1 1 1 1 1 0 1 0 1
1 0 0 1 1 0 0 1 1 0 1 0 1 1
1 0 1 0 1 0 1 1 1 1 0 1 0 1
1 0 1 1 0 1 0 0 1 1 0 1 1 1
1 0 1 1 1 1 1 0 0 1 1 0 0 1
1 1 0 0 1 0 0 0 1 1 1 1 0 1
1 1 0 0 1 0 1 1 0 0 0 1 1 1
1 1 1 0 0 1 0 1 0 1 1 0 1 1
1 1 1 0 1 0 1 1 0 0 1 0 0 1
1 1 1 0 1 1 0 1 0 1 1 1 1 1
1 1 1 0 1 1 1 0 0 1 1 1 0 1
1 1 1 0 1 1 1 1 1 1 0 1 0 1
1 1 1 1 0 1 0 0 1 0 1 0 0 1
1 1 1 1 1 0 0 1 1 0 0 0 1 1
```

cl = 14 FD = 144

```
1 0 0 0 1 0 0 1 1 1 1 1 0 1
1 0 0 0 1 1 1 1 1 1 0 1 0 1
1 0 0 1 1 1 0 0 1 1 1 1 0 1
1 0 1 0 0 1 0 1 1 0 1 0 0 1
1 0 1 0 1 0 1 1 0 0 1 1 1 1
1 0 1 1 0 1 0 1 0 1 1 1 1 1
1 0 1 1 1 0 0 1 0 1 0 0 1 1
1 0 1 1 1 1 1 0 0 1 1 0 0 1
1 1 0 1 0 0 1 0 0 1 0 0 0 1
1 1 0 1 1 0 0 1 0 0 1 0 1 1
1 1 0 1 1 0 1 1 1 0 1 1 1 1
1 1 1 0 0 1 1 0 1 1 1 1 0 1
1 1 1 0 1 0 1 0 1 1 0 1 1 1
1 1 1 0 1 1 0 0 1 1 0 0 1 1
1 1 1 1 1 0 1 0 1 1 0 1 1 1
1 1 1 1 1 1 1 0 1 1 0 1 0 1
```

cl = 15 FD = 150 BlockErrorRate = 0.118

```
1 0 0 0 1 0 1 1 1 1 1 0 0 0 1
1 0 0 0 1 1 1 1 0 1 1 1 0 1 1
1 0 0 0 1 1 1 1 1 0 0 0 1 1 1
1 0 1 0 0 1 1 1 1 1 1 0 0 0 1
1 0 1 0 1 0 0 0 1 1 1 0 1 1 1
1 0 1 1 0 0 1 1 1 0 0 1 0 1 1
1 0 1 1 1 0 0 1 0 1 1 1 1 0 1
1 0 1 1 1 1 0 1 1 0 1 0 1 1 1
1 1 0 0 1 1 0 1 1 0 1 1 0 0 1
1 1 0 1 0 1 1 0 1 0 0 1 1 0 1
1 1 1 0 0 1 1 0 0 1 0 1 1 0 1
1 1 1 0 0 1 1 0 1 1 1 1 0 0 1
1 1 1 0 0 1 1 1 1 1 1 0 1 0 1 1
1 1 1 0 1 0 1 0 0 1 0 0 1 0 1
1 1 1 1 0 1 0 1 0 1 0 1 1 1 1
1 1 1 1 0 1 1 1 0 1 0 0 1 0 1
```

cl = 15 FD = 152

```
1 0 0 0 1 1 1 0 1 0 1 0 1 1 1
1 0 0 0 1 1 1 1 1 1 0 0 1 1 0 1
1 0 0 1 0 1 0 0 1 0 0 0 0 1 0 1
1 0 1 0 0 0 1 0 0 1 0 1 0 0 1
1 0 1 0 1 0 0 1 0 1 1 0 0 1 1
1 0 1 1 0 0 1 1 1 1 1 0 0 0 1
1 1 0 0 1 0 1 1 0 1 1 0 0 1 1
1 1 0 0 1 1 0 1 0 0 1 0 1 0 1
1 1 0 0 1 1 0 1 1 0 1 0 0 1 1
1 1 0 1 1 1 1 0 1 0 0 1 1 1 1
1 1 0 1 1 1 1 1 1 0 1 0 1 1 1
1 1 1 0 1 0 1 0 1 1 1 0 0 0 1
1 1 1 0 1 0 1 1 1 0 1 1 1 1 1
1 1 1 0 1 0 1 1 1 1 1 1 0 1 1
1 1 1 1 0 0 1 0 1 1 1 1 0 1 1
1 1 1 1 1 0 1 1 1 0 1 0 1 1 1
```

cl = 16 FD = 158 BlockErrorRate = 0.107

```
1 0 0 0 1 1 0 1 1 1 1 0 0 0 1 1
1 0 0 0 1 1 1 1 0 1 1 0 1 1 0 1
1 0 0 1 0 1 1 1 1 0 0 1 1 0 0 1
1 0 0 1 1 1 1 1 0 1 0 0 0 1 0 1
1 0 1 0 0 1 0 1 0 0 0 1 1 1 1 1
1 0 1 0 1 1 1 1 1 1 1 1 1 0 0 1
1 0 1 1 1 1 1 0 0 1 1 0 0 0 1 1
1 1 0 0 1 1 0 1 1 0 0 0 1 1 1 1
1 1 0 1 0 1 0 0 1 1 0 1 0 1 0 1
1 1 0 1 1 0 1 0 1 0 1 0 1 0 1 1
1 1 1 0 0 0 1 0 1 0 0 1 1 1 0 1
1 1 1 0 0 0 1 1 0 1 1 1 0 0 0 1
1 1 1 0 0 1 1 0 0 1 0 1 0 0 1 1
1 1 1 0 1 0 1 1 1 0 1 0 1 1 1 1
1 1 1 0 1 1 1 0 1 0 1 0 1 0 0 1
1 1 1 1 1 0 1 0 0 1 0 1 1 1 1 1
```

cl = 16 FD = 160

```
1 0 0 0 1 0 1 1 0 1 1 1 1 1 1 1
1 0 0 1 1 1 0 0 1 0 1 0 1 1 0 1
1 0 0 1 1 1 1 1 0 1 0 0 0 1 1 1
1 0 1 0 0 0 1 1 1 0 1 0 1 0 1 1
1 0 1 0 0 1 1 0 1 1 1 1 0 1 0 1
1 0 1 1 0 0 1 1 1 0 1 1 1 0 0 1
1 1 0 0 1 0 0 0 1 1 0 1 1 0 1 1
1 1 0 0 1 0 1 1 1 1 0 0 1 0 0 1
1 1 0 0 1 1 1 0 0 1 0 1 0 0 1 1
1 1 0 1 0 1 0 1 1 0 1 0 0 1 1 1
1 1 0 1 0 1 1 1 0 0 1 1 0 1 1 1
1 1 0 1 1 0 1 0 0 1 0 1 0 1 0 1
1 1 0 1 1 1 1 1 1 0 0 1 0 0 1 1
1 1 1 0 1 1 1 1 0 1 1 0 0 1 1 1
1 1 1 1 0 0 0 1 0 1 1 0 1 1 1 1
1 1 1 1 1 1 1 0 0 0 1 0 1 0 0 1
```