

On Optimal Family of Codes for DNA Storage

Vijay Dhameliya · Dixita Limbachiya ·
Madhav Khakhar · Manish K Gupta

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Supplementary File

1 Family of DNA Golay sub codes

The family of sub-codes with different parameters developed from ternary codes is listed here. ASCII values associated with highest probability of occurrences mentioned by Goldman is described in the Table 1 [1]. ASCII codes are mapped to non linear family of sub codes with different length and minimum distance shown in Table 3 - 10.

References

1. Goldman, N., Bertone, P., Chen, S., Dessimoz, C., LeProust, E.M., Sipos, B., Birney, E.: Towards practical, high-capacity, low-maintenance information storage in synthesized DNA. Nature (2013)

Vijay Dhameliya · Dixita Limbachiya · Madhav Khakhar · Manish K Gupta
Dhirubhai Ambani Institute of Information and Communication Technology
Gandhinagar, Gujarat, 382007 India first address
Tel.: +91-79-30510549
Fax: +91-79-30520010
E-mail: vdhameliya@acm.org, dlimbachiya@acm.org, madhav_khakhar@daiict.ac.in,
mankg@computer.org

Table 1 Probability of occurrence of 256 characters [1]

ASCII Values	Frequency	ASCII values	Frequency	ASCII values	Frequency	ASCII values	Frequency
0	0.005891143	66	0.003998586	115	0.003898128	97	0.003804846
85	0.004233586	24	0.003996793	116	0.003896335	118	0.003804846
170	0.004224617	106	0.003994999	78	0.003894541	246	0.003804846
127	0.004190533	223	0.003994999	67	0.003890953	215	0.003801258
253	0.004177976	58	0.003994999	70	0.003890953	51	0.003799464
52	0.004163625	137	0.003993205	178	0.003889159	206	0.003799464
138	0.004154655	73	0.003989617	159	0.003887365	184	0.00379767
41	0.004145686	101	0.003987823	142	0.003883777	227	0.00379767
86	0.004129541	168	0.003987823	92	0.003881983	233	0.003795877
42	0.004127747	181	0.003986029	48	0.00388019	237	0.003792289
100	0.004124159	175	0.003986029	90	0.003876602	188	0.003788701
44	0.004122365	251	0.003986029	218	0.003876602	113	0.003783319
250	0.004111602	40	0.003984235	126	0.003874808	49	0.003779732
132	0.004111602	140	0.003982441	39	0.003874808	201	0.00377435
161	0.004108014	17	0.003978854	219	0.003873014	155	0.003772556
98	0.004102632	83	0.003973472	167	0.003873014	222	0.003770762
8	0.004102632	254	0.003971678	114	0.00387122	231	0.003770762
34	0.004102632	240	0.00396809	172	0.003869426	5	0.003768968
10	0.004097251	214	0.003964502	14	0.003869426	27	0.003758205
149	0.004091869	53	0.003962709	120	0.003865838	131	0.003752823
87	0.004084693	202	0.003960915	139	0.003865838	164	0.003752823
21	0.004081105	25	0.003960915	160	0.003865838	3	0.003751029
74	0.004079312	18	0.003960915	33	0.003864044	46	0.003751029
36	0.004075724	247	0.003959121	179	0.003864044	119	0.003749235
69	0.004072136	174	0.003955533	117	0.003862251	28	0.003749235
177	0.004072136	112	0.003953739	225	0.003858663	176	0.003747441
20	0.004072136	89	0.003953739	129	0.003858663	23	0.003743854
213	0.004070342	210	0.003951945	183	0.003856869	64	0.003743854
163	0.004070342	217	0.003948357	230	0.003855075	157	0.00374206
229	0.004066754	248	0.003948357	35	0.003855075	187	0.003736678
255	0.004066754	194	0.003948357	93	0.003853281	244	0.00373309
197	0.004061373	182	0.003948357	6	0.003853281	238	0.00373309
133	0.004057785	80	0.003946564	32	0.003853281	96	0.003731296
252	0.004055991	79	0.003941182	56	0.003851487	235	0.003727709
26	0.004055991	195	0.003941182	158	0.003851487	60	0.003724121
173	0.004054197	12	0.003939388	185	0.003846106	1	0.003724121
151	0.004054197	209	0.0039358	47	0.003846106	110	0.003722327
82	0.004050609	165	0.003934006	143	0.003846106	200	0.003720533
75	0.004047022	245	0.003934006	123	0.003844312	221	0.003720533
37	0.00404164	2	0.003930418	204	0.003844312	99	0.003720533
166	0.004038052	81	0.003928625	242	0.003844312	31	0.003716945
191	0.004038052	38	0.003926831	111	0.003842518	198	0.003715151
88	0.004038052	141	0.003925037	103	0.003840724	193	0.003713358
63	0.004036258	211	0.003925037	108	0.003837136	125	0.003711564
68	0.004034464	239	0.003921449	9	0.003835342	124	0.003707976
150	0.004034464	95	0.003921449	65	0.003835342	152	0.003707976
76	0.00403267	43	0.003919655	249	0.003831754	122	0.003704388
4	0.004030876	224	0.003919655	13	0.003831754	71	0.003702594
154	0.004029083	203	0.003916067	180	0.003829961	94	0.0037008
234	0.004027289	145	0.003916067	226	0.003826373	220	0.003693625
22	0.004027289	147	0.003914273	144	0.003826373	29	0.003684655
162	0.004023701	19	0.003914273	15	0.003826373	199	0.003682861
105	0.004021907	50	0.00391248	57	0.003826373	61	0.003673892
102	0.004020113	136	0.00391248	128	0.003824579	11	0.003672098
171	0.004016525	107	0.003907098	135	0.003822785	228	0.003670304
104	0.004014731	134	0.003905304	243	0.003822785	62	0.003666716
169	0.004011144	109	0.00390351	190	0.003822785	55	0.003659541
196	0.00400935	153	0.00390351	207	0.003820991	121	0.003657747
208	0.004003968	148	0.003901716	77	0.003819197	7	0.00364519
84	0.004002174	205	0.003901716	45	0.003815609	30	0.003639808
130	0.00400038	212	0.003901716	91	0.003813815	232	0.003621869
146	0.00400038	54	0.003901716	192	0.003810228	189	0.003618281
72	0.00400038	241	0.003899922	186	0.003810228	59	0.003609312
16	0.003998586	156	0.003899922	216	0.003810228	236	0.003609312

Table 2 Codewords from subcode of Ternary Golay Code i.e. $[11, 6, 5]_3$ assigned to 256 ASCII values is given in the table.

ASCII Values	Golay codes	Weight	ASCII values	Golay codes	Weight	ASCII values	Golay codes	Weight	ASCII values	Golay codes	Weight
86	00002111202	6	170	00001222101	6	127	00020220222	6	253	00022001121	6
52	00021112020	6	138	00010110111	6	41	00012221010	6	86	00011002212	6
42	00201010122	6	100	00200121021	6	44	00202202220	6	250	00221200011	6
132	00220011210	6	161	00222122112	9	98	00211120200	6	8	00210201102	6
34	00212012001	6	10	00102020211	6	149	00101101110	6	87	00100212012	6
21	00122210100	6	74	00121021002	6	36	00120102201	6	69	00112100022	6
177	00111211221	9	20	00110022120	6	213	02012212122	9	163	02011020021	6
229	02010101220	6	255	02002102011	6	197	02001210210	6	133	02000021112	6
252	02022022200	6	26	02021100102	6	173	02020211001	6	151	02210222211	9
82	02212000110	6	75	02211111012	9	37	02200112100	6	166	02202220002	6
191	02201001201	6	88	02220002022	6	63	02222110221	9	68	02221221120	9
150	02111202000	6	76	02110010202	5	4	02112121101	9	154	02101122222	9
234	02100200121	6	22	02102011020	6	162	02121012111	9	105	02120120010	6
102	02122201212	9	171	01021121211	9	104	01020202110	6	169	01022010012	6
146	01000012221	6	72	01002120120	6	16	01222101000	6	66	01221212202	9
24	01220020101	6	106	01212021222	9	223	01211102121	9	58	01210210020	6
137	01202211111	9	73	01201022010	6	101	01200100212	6	168	01120111122	9
181	01122220221	9	175	01121000220	6	251	01110001011	6	40	01112112210	9
140	01111220112	9	17	01100221200	6	83	01102002102	6	254	01101110001	6
240	20121202122	9	214	20120010021	6	53	20122121220	9	202	20111122011	9
25	20110200210	6	18	20112011112	9	247	20101012200	6	174	20100120102	6
112	20102201001	6	89	20022212211	9	210	20021020110	6	217	20020101012	6
248	20012102100	6	194	20011210002	6	182	20010021201	6	80	20002022022	6
79	20001100221	6	195	20000211120	6	12	20220222000	6	209	20222000202	6
165	20221111101	9	245	20210112222	9	2	20212220121	9	81	20211001020	6
38	20200002111	6	141	20202110010	6	211	20201221212	9	239	22100111211	9
95	22102222110	9	43	22101000012	6	224	22120001100	6	203	22122112002	9
145	22121220201	9	147	22110221022	9	19	22112002221	9	50	22111110120	9
136	22001121000	6	107	22000202202	6	134	22002010101	6	109	22021011222	9
153	22020122121	9	148	22022200020	6	205	22011201111	9	212	22010012010	6
54	22012120212	9	241	22202101122	9	156	22201212021	9	115	22200020220	6
178	22211022102	9	159	22210100001	6	142	21112020000	6	92	21111101202	9
48	21110212101	9	90	21102210222	9	218	21101021121	9	126	21100102020	6
39	21122100111	9	219	21121211010	9	167	21120022212	9	114	21010000122	6
172	21012111021	9	14	21011222220	9	120	21000220011	6	139	21002001210	6
160	21001112112	9	33	21020110200	6	179	21022221102	9	117	21021002001	6
225	21211010211	9	129	21210121110	9	183	21212202012	9	230	21201200100	6
35	21200011002	6	93	21202122201	9	6	21221120022	9	32	21220201221	9
56	21222012120	9	158	10212101211	9	185	10211212110	9	47	10210020012	6
143	10202021100	6	123	10201102002	6	204	10200210201	6	242	10222211022	9
111	10221022221	9	103	10220100120	6	108	10110111000	6	9	10112222202	9
65	10111000101	6	249	10100001222	6	13	10102112121	9	180	10101220020	6
226	10120221111	9	144	10120002010	6	15	10121110212	9	57	10011121122	9
128	10010202021	6	135	10012010220	6	243	10001011011	6	190	10000122210	6
207	10002200112	6	77	10021201200	6	45	10020012102	6	91	10022120001	6
192	12221010000	6	186	12220121202	9	216	12222202101	9	97	12211200222	9
118	12210011121	9	246	12212122020	9	215	12201120111	9	51	12200201010	6
206	12202012212	9	184	12122020122	9	227	12121101021	9	233	12120212220	9
237	12112210011	9	188	12111021210	9	113	12110102112	9	49	12102100200	6
201	12101211102	9	155	12100022001	6	222	12020000211	6	231	12022111110	9
5	12021222012	9	27	12010220100	6	131	12012001002	6	164	12011112201	9
3	12000110022	6	46	12002221221	9	119	12001002120	6	28	11200222122	9
176	11202000021	6	23	11201111220	9	64	11220112011	9	157	11222220210	9
187	11221001112	9	244	11210002200	6	238	11212110102	9	96	11211221001	9
235	11101202211	9	60	11100010110	6	1	11102121012	9	110	11121122100	9
200	11120200002	6	221	11122011201	9	99	11111012022	9	31	11110120221	9
198	1111201120	9	193	11002212000	6	125	11001020202	6	124	11000101101	6
152	11022102222	9	122	11021210121	9	71	11020021020	6	94	11012022111	9
220	11011100010	6	29	11010211212	9	199	00000201211	5	61	00000102122	5
11	00002012110	5	228	00002210021	5	62	00001021220	5	55	00001120012	5
121	00020121100	5	7	00020022011	5	30	00022100210	5	232	00022202002	5
189	00021010201	5	59	00010212200	5	236	00010011022	5	0	00000000000	0

Table 3 Codewords from subcode of code $[9, 6, 3]_3$ assigned to 256 ASCII values is given in the table.

ASCII Values	Ternary Codes	ASCII values	Ternary Codes	ASCII values	Ternary Codes	ASCII values	Ternary Codes
0	000000000	66	201122111	115	002200102	97	020010212
85	000110110	24	201222022	116	002200211	118	020011111
170	000120022	106	202101120	78	002201020	246	020012100
127	000220101	223	202220221	67	002202121	215	020020002
253	000221220	58	211211212	70	002210220	51	020020120
52	001010211	137	212102101	178	002211112	206	020021210
138	001101002	73	212111221	159	002212202	184	020101021
41	001201110	101	220002022	142	010010010	227	020102201
86	001211021	168	220010200	92	010010101	233	020110220
42	002021001	181	221112010	48	010011220	237	020120011
100	002022122	175	222120012	90	010012122	188	020121112
44	002202012	251	000000111	218	010012211	113	020122222
250	010011002	40	000000222	126	010020221	49	020200012
132	010020112	140	000001012	39	010021011	201	020200100
161	010022020	17	000001120	219	010021100	155	020201211
98	010100211	83	000001201	167	010022202	222	020202020
8	011002121	254	000002021	114	010100002	231	020211001
34	011110000	240	000002102	172	010100120	5	020211222
10	011220120	214	000002210	14	010101010	27	021000122
149	012000022	53	000110001	120	010101101	131	021012001
87	012012110	202	000111020	139	010101222	164	021012220
21	012122212	25	000111102	160	010102112	3	021020101
74	012210011	18	000111211	33	010120200	46	021021022
36	020010021	247	000112012	179	010122001	119	021022211
69	020121000	174	000112121	117	010200021	28	021100202
177	020212210	112	000112200	225	010201200	176	021122012
20	021020010	89	000210122	129	010210202	23	021200111
213	021102100	210	000220010	183	010211110	64	021200220
163	021120221	217	000221002	230	010212000	157	021212121
229	021210102	248	000222112	35	010221121	187	021221201
255	022001112	194	001010002	93	010221212	244	022000011
197	022022200	182	001010120	6	011000001	238	022001000
133	100011210	80	001011010	32	011000110	96	022001221
252	100020202	79	001011101	56	011001020	235	022002101
26	100100121	195	001011222	158	011001102	60	022011120
173	100201102	12	001012112	185	011001211	1	022012012
151	100202211	209	001020021	47	011002012	110	022020222
82	101002020	165	001020200	143	011002200	200	022022021
75	101021112	245	001100010	123	011110111	221	022100110
37	101210012	2	001100101	204	011110222	99	022102022
166	101212101	81	001101220	242	011111012	31	022110002
191	102001222	38	001102122	111	011111120	198	022110121
88	102121200	141	001102211	103	011111201	193	022111010
63	110001021	211	001120112	108	011112021	125	022112211
68	110110102	239	001121011	9	011112102	124	022121202
150	110121120	95	001121100	65	011112210	152	022220000
76	110200010	43	001122020	249	011200212	122	022220112
4	110212222	224	001122202	13	011220002	71	022221011
154	111021201	203	001200022	180	011221010	94	022222120
234	111201220	145	001202000	226	011222101	220	100010011
22	111202002	147	001211200	144	011222222	29	100010100
162	112000111	19	001221122	15	012010200	199	100011022
105	112012001	50	001222210	57	012011021	61	100012201
102	112020220	136	002012000	128	012011212	11	100020020
171	120012112	107	002012221	135	012102000	228	100021101
104	120211020	134	002020012	243	012102221	62	100022012
169	121100112	109	002021110	190	012120010	55	100100012
196	122100001	153	002100021	207	012120102	121	100101000
208	122110210	148	002100200	77	012121022	7	100102110
84	122221101	205	002101111	45	012201001	30	100102202
130	200101011	212	002110212	91	012201122	232	100110222
146	200211201	54	002120120	192	012202210	189	100120210
72	201002201	241	002121221	186	012212022	59	100121021
16	201100222	156	002122101	216	012220201	236	100122122

Table 4 Codewords from subcode of code $[15, 6, 7]_3$ assigned to 256 ASCII values is given in the table.

ASCII Values	Ternary Codes	ASCII values	Ternary Codes	ASCII values	Ternary Codes	ASCII values	Ternary Codes
0	000000000000000	66	211021200201201	115	002002110012011	97	011200010110100
85	000001102121102	24	211022002022000	116	002010122220012	118	011201112201202
170	000002201212201	106	211110111002020	78	002011221011111	246	011202211022001
127	000120010222221	223	211111210120122	67	002012020102210	215	011220100020201
253	000121112010020	58	211112012211221	70	002020002010211	51	011221202111000
52	000122211011122	137	211200121221211	178	002021101101010	206	011222001202102
138	000210020111112	73	211201220012010	159	002022200222112	184	012000021022110
41	000211122202211	101	21120222100112	142	002100102112200	227	012001120110212
86	000212221020010	168	222020001202022	92	002101201200002	233	012002222201011
42	011000200122220	181	222021100020121	48	002102000021101	237	012010201112012
100	011001002210022	175	222022202111220	90	002110012202102	188	012011000200111
44	011002101001121	251	222110011121210	218	002111111020201	113	012012102021210
250	011120210011111	40	22211110212012	126	002112210111000	49	012020111202211
132	011121012102210	140	222112212000111	39	002120222022001	201	012021210020010
161	011122111220012	17	222200021010101	219	002121021110100	155	012022012111112
98	011210220200002	83	222201120101200	167	002122120201202	222	012100211001200
8	011211022021101	254	22220222222002	114	002200022121020	231	012101010122002
34	011212121112200	240	000010210120202	172	002201121212122	5	012102112210101
10	022000100211110	214	000011012211001	14	002202220000221	27	012110121212102
149	022001202002212	53	000012111002100	120	002210202211222	131	012111220212201
87	022002001120011	202	000020120210101	139	002211001002021	164	012112022000000
21	022120110100001	25	000021222001200	160	002212100120120	3	012120001211001
74	022121212221100	18	000022021122002	33	002220112001121	46	012121100002100
36	022122011012202	247	000100220012120	179	002221211122220	119	012122202120202
69	022210120022222	174	000101022100222	117	002222010210022	28	012200101010020
177	022211222110021	112	000102121221021	225	010000112222000	176	012201200101122
20	022212021201120	89	000110100102022	129	010001211010102	23	012202002222221
213	100010102012121	210	00011102220121	183	010002010101201	64	012210011100222
163	100011201100220	217	0001120010111220	230	010010022012202	157	012211110221021
229	100012000221022	248	000200110021210	35	010011121100001	187	012212212012120
255	100100112201012	194	000201212112012	93	010012220221100	244	012220221220121
197	100101211022111	182	000202011200111	6	010020202102101	238	012221020011220
133	100102010110210	80	000220200201011	32	010021001220200	96	012222122102022
252	100220122120200	79	000221002022110	56	010022100011002	235	020000221111000
26	100221221211002	195	000222101110212	158	010100002201120	60	020001020202102
173	100222020002101	12	001000121200220	185	010101101022222	1	020002122020201
151	111010002101011	209	001001220021022	47	010102200110021	110	020010101201202
82	111011101222110	165	001002022112121	143	010110212021022	200	020011200022001
75	111012200010212	245	001010001020122	123	010111011112121	221	020012002110100
37	111100012020202	2	001011100111221	204	010112110200220	99	020020011021101
166	111101111111001	81	001012202202020	242	010120122111221	31	020021110112200
191	111102210202100	38	0010202111110021	111	010121221202020	198	020022212200002
88	111220022212120	141	001021010201120	103	010122020020122	193	020100111120120
63	111221121000222	211	001022112022222	108	010200222210210	125	020101210211222
68	11122220121021	239	001100011212010	9	010201021001012	124	020102012002021
150	122010202220201	95	001101110000112	65	010202120122111	152	020110021210022
76	122011001011000	43	001102212121211	249	010210102000112	122	020111120001121
4	122012100102102	224	001110221002212	13	010211201121211	71	020112222122220
154	122100212112122	203	001111020120011	180	010212000212010	94	020120201000221
234	122101011200221	145	001112122211110	226	010220012120011	220	020121000121020
22	122102110021020	147	001120101122111	144	010221111211110	29	020122102212122
162	122220222001010	19	001121200210210	15	01022210002212	199	020200001102210
105	122221021122112	50	001122002001012	57	011010110212122	61	020201100220012
102	122222120210211	136	001200201221100	128	011011212000221	11	020202202011111
171	200020201021212	107	001201000012202	135	011012011121020	228	020210211222112
104	200021000112011	134	001202102100001	243	011020020002021	62	020211010010211
169	200022102200110	109	001210111011002	190	011021122120120	55	020212112101010
196	200110211210100	153	001211210102101	207	011022221211222	121	020220121012011
208	200111010001202	148	001212012220200	77	011100120101010	7	020221220100110
84	200112112122001	205	001220021101201	45	011101222222112	30	020222022221212
130	200200221102021	212	001221120222000	91	011102021010211	232	021000012011220
146	200201020220120	54	00122222010102	192	011110000221212	189	021001111102022
72	200202122011222	241	002000212100110	186	011111102012011	59	021002210220121
16	211020101110102	156	002001011221212	216	011112201100110	236	021010222101122

Table 5 Codewords from subcode of code $[18, 6, 9]_3$ assigned to 256 ASCII values is given in the table.

ASCII Values	Ternary Codes	ASCII values	Ternary Codes	ASCII values	Ternary Codes	ASCII values	Ternary Codes
0	000000000000000000	66	001121200202211210	115	011002211102212200	97	020110001222022000
85	000011122120212012	24	001122102020012211	116	011010000222121212	118	020111200010120001
170	000022211210121021	106	001200020222102001	78	011011202010222210	246	020112102101221002
127	001101120201022221	223	001201222010200002	67	011012101101020211	215	020120221221100011
253	001112212021201200	58	001202121101001000	70	01102020221202220	51	020121120012201012
52	001120001111110212	137	001210210221210012	178	011021122012000221	206	020122022100002010
138	002202210102011112	73	001211112012011010	159	011022021100101222	184	020200210002122100
41	002210002222220121	101	001212011100112011	142	011100212002221012	227	020201112120220101
86	002221121012102100	168	001220100220021020	92	011101111120022010	233	020202011211021102
42	110101201012010121	181	001221002011122021	48	011102010211120011	237	020210100001200111
100	11011202010222100	175	00122201102220022	90	011110102001002020	188	020211002122001112
44	110120112222101112	251	002000211002020221	218	011111001122100021	113	020212012012102110
250	111202021210002012	40	002001110120121222	126	011112200210201022	49	020220020000011122
132	111210110000211021	140	002002012211222220	39	011120022000110001	201	020221222121112120
161	111221202120120000	17	002010101001101202	219	011121221121211002	155	020222121212210121
98	112000111111021200	83	002011000122202200	167	011122120212012000	222	021000101112010020
8	112011200201200212	254	00201220210000201	114	011200011111102120	231	021001000200111021
34	112022022021112221	240	002020021000212210	172	011201210202200121	5	021002202021212022
10	220202102021020212	214	002021220121010211	14	011202112020001122	27	021010021111121001
149	220210221111202221	53	002022122212111212	120	011210201110210101	131	021011220202222002
87	220221010201111200	202	002100010111201002	139	011211100201011102	164	021012122020020000
21	221000222220212100	25	002101212202002000	160	011212002022112100	3	021020211110202012
74	221011011012221112	18	002102111020100001	33	011220121112021112	46	021021110201000010
36	221022100102100121	247	002110200110012010	179	011221020200122110	119	021022012022101011
69	222101012120001021	174	002111102201110011	117	011222222021220111	28	021100200221221101
177	22212101210210000	112	002112001022211012	225	012000202221020010	176	021101102012022102
20	222120220000122012	89	002120120112120021	129	012001101012121011	23	021102001100120100
213	000001202121101001	210	00212102220021022	183	01200200010022012	64	021110120220002112
163	000002101212202002	217	002122221021022020	230	012010122220101021	157	021111022011100110
229	000010220002111011	248	002200112220112110	35	012011021011202022	187	021112221102201111
255	000012021211010010	194	002201011011210111	93	012012220102000020	244	021120010222110120
197	000020110001222022	182	002211201010021122	6	012020012222212002	238	021121212010211121
133	000021012122020020	80	002212100101122120	32	012021211010010000	96	021122111101012122
252	000100102112211111	79	00222022221001102	56	012022110101111001	235	021200002000102212
26	000101001200012112	195	002222020100200101	158	012100001000201121	60	021201201121200210
173	000102200021110110	12	010000021222000122	185	012101200121002122	1	021202100212001211
151	000110022111022122	209	010001220010101120	47	012102102212100120	110	021210222002210220
82	000111221202120120	165	010002122101202121	143	012110221002012102	200	02121121120011221
75	000112120020221121	245	01001021121111100	123	012111120120110100	221	021212020211112222
37	000120212110100100	2	010011110012212101	204	012112022211211101	99	021220112001021201
166	000121111201201101	81	010012012100010102	242	012120111001120110	31	021221011122122202
191	000122010022002102	38	010020101220222111	111	012121010122221111	198	021222210210220200
88	000200201221122222	141	010021000011020112	103	012122212210022112	193	022000220110020102
63	000201100012220220	211	01002202102121110	108	012200100112112202	125	022001122201121100
68	000202002100021221	239	010100120001211200	9	012201002200210200	124	022002021022220101
150	000210121220200200	95	010101022122012201	65	012202201021011201	152	022010110112101110
76	000211020011001201	43	010102221210110202	249	012210020111220210	122	022011012200202111
4	000212222102102202	224	010110010000022211	13	012211222202021211	71	022012211021000112
154	000220011222011211	203	010111212121120212	180	012212121020122212	94	022020000111212121
234	000221210010112212	145	010112111212221210	226	012220210110001221	220	022021202202010122
22	000222112101210210	147	010120200002100222	144	012221112201102222	29	022022101020111120
162	001000122001010112	19	010121102120201220	15	012222011022200220	199	022100022222021210
105	001001021122111110	50	010122001211002221	57	020000012111000211	61	022101221010002211
102	001002220210212111	136	010200222110122011	128	020001211202101212	11	022102120101100212
171	001010012000121120	107	010201121201220012	135	020002110020202210	228	022110212221012221
104	001011211121222121	134	01020200202021010	243	020010202110111222	62	022111111012110222
169	001012110212020122	109	010210112112200022	190	020011101201212220	55	022112010100211220
196	001020202002202101	153	010211011200001020	207	020012000022010221	121	022120102220120202
208	001021101120000102	148	010212210021102021	77	020020122112222200	7	022121001011221200
84	001022000211101100	205	010220002111011000	45	020021021200020201	30	022122200102022201
130	001100221110221220	212	010221201202112001	91	02002220021121202	232	022200121001112021
146	00110202022120222	54	01022210002010002	192	020100111220211022	189	022201020122210022
72	001110111112002201	241	011000110220010201	186	020101010011012020	59	02220222210011020
16	001111010200100202	156	011001012011111202	216	020102212102110021	236	022210011000220002

Table 6 Codewords from subcode of code $[21, 6, 11]_3$ assigned to 256 ASCII values is given in the table.

ASCII Values	Ternary Codes	ASCII values	Ternary Codes
0	00000000000000000000	115	102221020101200100202
85	220000110120121022001	116	201220102011000101210
170	110000220210212011002	78	121220212101121120211
127	212002002120012012010	67	011220022221212112212
253	102002112210100001011	70	110222101101012110220
52	022002222000221020012	178	000222211221100102221
138	121001001210021021020	159	220222021011221121222
41	011001111000112010021	142	000022221111222200000
86	201001221120200002022	92	220022001201010222001
42	200012201220120011100	48	110022111021101211002
100	120012011010211000101	90	212021220201201212010
44	010012121100002022102	218	102021000021022201011
250	112011200010102020110	126	022021110111110220012
132	002011010100220012111	39	121020222021210221020
161	222011120220011001112	219	011020002111001210021
98	021010202100111002120	167	201020112201122202022
8	211010012220202021121	114	200001122001012211100
34	101010122010020010122	172	120001202121100200101
10	100021102110210022200	14	010001012211221222102
149	020021212200001011201	120	112000121121021220110
87	210021022020122000202	139	002000201211112212111
21	012020101200222001210	160	222000011001200201112
74	202020211020010020211	33	021002120211000202120
36	122020021110101012212	179	211002200001121221121
69	221022100020201010220	117	101002010121212210122
177	111022210110022002221	225	100010020221102222200
20	001022020200110021222	129	020010100011220211201
213	111122220000111100000	183	210010210101011200202
163	001122000120202122001	230	012012022011111201210
229	221122110210020111002	35	202012102101202220211
255	020121222120120112010	93	122012212221020212212
197	210121002210211101011	6	221011021101120210220
133	100121112000002120012	32	111011101221211202221
252	202120221210102121020	56	001011211011002221222
26	122120001000220110021	158	222222222222000000000
173	012120111120011102022	185	112222002012121022001
151	011101121220201111100	47	002222112102212011002
82	201101201010022100101	143	101221221012012012010
75	121101011100110122102	123	021221001102100001011
37	220100120010210120110	204	211221111222221020012
166	110100200100001112111	242	010220220102021021020
191	000100010220122101112	111	200220000222112010021
88	102102122100222102120	103	120220110012200002022
63	022102202220010121121	108	122201120112120011100
68	212102012010101110122	9	012201200202211000101
150	211110022110021122200	65	202201010022002022102
76	101110102200112111201	249	001200122202102020110
4	021110212020200100202	13	22120020202220012111
154	120112021200000101210	180	111200012112011001112
234	010112101020121120211	226	210202121022111002120
22	200112211110212112212	144	10020201112202021121
162	002111020020012110220	15	020202011202020010122
105	222111100110100102221	57	022210021002210022200
102	112111210200221121222	128	212210101122001011201
171	222211110000222200000	135	102210211212122000202
104	112211220120010222001	243	201212020122222001210
169	002211000210101211002	190	121212100212010020211
196	101210112120201212010	207	011212210002101012212
208	021210222210022201011	77	110211022212201010220
84	211210002000110220012	45	000211102002022002221
130	0102121111210210221020	91	220211212122110021222
146	200212221000001210021	192	000011112222111100000
72	120212001120122202022	186	220011222012202122001
16	122220011220012211100	216	110011002102020111002
66	012220121010100200101	97	212010111012120112010

Table 7 Codewords from subcode of code $[21, 6, 11]_3$ continued from table 6 assigned to 256 ASCII values is given in the table.

ASCII Values	Ternary Codes	ASCII values	Ternary Codes
24	202220201100221222102	118	102010221102211101011
106	001222010010021220110	246	022010001222002120012
223	221222120100112212111	215	121012110102102121020
58	111222200220200201112	51	01101222022220110021
137	210221012100000202120	206	201012000012011102022
73	100221122220121221121	184	200020010112201111100
101	020221202010212210122	227	120020120202022100101
168	022202212110102222200	233	010020200022110122102
181	212202022200220211201	237	112022012202210120110
175	102202102020011200202	188	002022122022001112111
251	201201211200111201210	113	222022202112122101112
40	121201021020202220211	49	02102101102222102120
140	011201101110020212212	201	211021121112010121121
17	110200210020120210220	155	101021201202101110122
83	000200020110211202221	222	100002211002021122200
254	220200100200002221222	231	020002021122112111201
240	11111111111000000000	5	210002101212200100202
214	001111221201121022001	27	012001210122000101210
53	221111001021212011002	131	202001020212121120211
202	020110110201012012010	164	122001100002212112212
25	210110220021100001011	3	221000212212012110220
18	100110000111221020012	46	111000022002100102221
247	202112112021021021020	119	001000102122221121222
174	122112222111112010021	28	11110000222222200000
112	012112002201200002022	176	001100112012010222001
89	011120012001120011100	23	221100222102101211002
210	201120122121211000101	64	020102001012201212010
217	121120202211002022102	157	210102111102022201011
248	220122011121102020110	187	100102221222110220012
194	110122121211220012111	244	202101000102210221020
182	000122201001011001112	238	122101110222001210021
80	102121010211111002120	96	012101220012122202022
79	022121120001202021121	235	011112200112012211100
195	212121200121020010122	60	201112010202100200101
12	211102210221210022200	1	121112120022221222102
209	101102020011001011201	110	220111202202021220110
165	021102100101122000202	200	110111012022112212111
245	120101212011222001210	221	000111122112200201112
2	010101022101010020211	99	102110201022000202120
81	200101102221101012212	31	022110011112121221121
38	002100211101201010220	198	212110121202212210122
141	222100021221022002221	193	211121101002102222200
211	112100101011110021222	125	101121211122220211201
239	222200001111111100000	124	021121021212011200202
95	112200111201202122001	152	120120100122111201210
43	002200221021020111002	122	010120210212202220211
224	101202000201120112010	71	200120020002020212212
203	021202110021211101011	94	002122102212120210220
145	211202220111002120012	220	222122212002211202221
147	010201002021102121020	29	112122022122002221222
19	200201112111220110021	199	010201211220022002000
50	120201222201011102022	61	020102122110011001000
136	122212202001201111100	11	200201021010110021001
107	012212012121022100101	228	210102202200102020001
134	202212122211110122102	62	120201101100201010002
109	001211201121210120110	55	100102012020220012002
153	221211011211001112111	121	222200210010001011010
148	111211121001122101112	7	202101121200020010010
205	210210200211222102120	30	112200020100122000011
212	100210010001010121121	232	122101201020111002011
54	020210120121101110122	189	002200100220210022012
241	022221100221021122200	59	012101011110202021012
156	212221210011112111201	236	101202212100010020020

Table 8 Codewords from subcode of code $[24, 6, 13]_3$ assigned to 256 ASCII values is given in the table.

ASCII Values	Ternary Codes	ASCII values	Ternary Codes
0	000000000000000000000000	115	121210212011220100001211
85	000001220201001221221012	116	121022002000211102220011
170	000002110102002112112021	78	121020222201212020111020
127	000111200121020111001121	67	121021112102210211002002
253	000112120022021002222100	70	121100202121201210221102
52	00011001022002220110112	178	121101122022202101112111
138	000222100212010222002212	159	121102012220200022000120
41	000220020110011110220221	142	100110112221100201012200
86	000221210011012001111200	92	100111002122101122200212
42	001112001210201110011210	48	100112222020102010121221
100	001110221111202001202222	90	100221012012120012010021
44	001111111012200222120201	218	100222202210121200201000
250	001220201001221221012001	126	100220122111122121122012
132	001221121202222112200010	39	100002212100110120011112
161	001222011100220000121022	219	100000102001111011202121
98	001001101122211002010122	167	100001022202112202120100
8	001002021020212220201101	114	101222110101001011020110
34	001000211221210111122110	172	101220000002002202211122
10	002221002120102220022120	14	101221220200000120102101
149	00222222021100111210102	120	101000010222021122021201
87	002220112222101002101111	139	101001200120022010212210
21	002002202211122001020211	160	101002120021020201100222
74	002000122112120222211220	33	101111210010011200022022
36	002001012010121110102202	179	101112100211012121210001
69	002110102002112112021002	117	101110020112010012101010
177	002111022200110000212011	225	102001111011202121001020
20	002112212101111221100020	129	102002001212200012222002
213	011120012102011100112100	183	102000221110201200110011
163	011121202000012021000112	230	102112011102222202002111
229	011122122201010212221121	35	102110201000220120220120
255	011201212220001211110221	93	102111121201221011111102
197	011202102121002102001200	6	102220211220212010000202
133	011200022022000020222212	32	102221101121210201221211
252	011012112011021022111012	56	102222021022211122112220
26	011010002212022110002021	158	222100212010222002212000
173	011011222110020101220000	185	222101102211220220100012
151	012202010012212210120010	47	222102022112221111021021
82	012200200210210101011022	143	222211112101212110210121
75	012201120111211022202001	123	222212002002210001101100
37	012010210100202021121101	204	222210222200211222022112
166	012011100001200212012110	242	22202201222202221211212
191	01201202020201100200122	111	222020202120200112102221
88	012121110221222102122222	103	222021122021201000020200
63	012122000122220020010201	108	220212210220120112220210
68	012120220020221211201210	9	220210100121121000111222
150	010011011222110020101220	65	220211020022122221002201
76	010012201120111211022202	249	220020110011110220221001
4	010010121021112102210211	13	220021000212111111112010
154	010122211010100101102011	180	220022220110112002000022
234	010120101211101022020020	226	220101010102100001222122
22	010121021112102210211002	144	220102200000101222110101
162	010200111101120212100102	15	220100120201102110001110
105	010201001002121100021111	57	221021211100021222201120
102	010202221200122021212120	128	221022101001022110122102
171	022210021201022200221200	135	221020021202020001010111
104	022211211102020121112212	243	221102111221011000202211
169	022212101000021012000221	190	221100001122012221120220
196	022021221022012011222021	207	221101221020010112011202
208	022022111220010202110000	77	221210011012001111200002
84	022020001121011120001012	45	221211201210002002121011

Table 9 Codewords from subcode of code $[24, 6, 13]_3$ continued from table 8 assigned to 256 ASCII values is given in the table.

ASCII Values	Ternary Codes	ASCII values	Ternary Codes
130	02210212111000212220112	91	221212121111000220012020
146	022100011011000010111121	192	200220221112200102021100
72	022101201212001201002100	186	200221111010201020212112
16	020022022111220010202110	216	200222001211202211100121
66	020020212012221201120122	97	200001121200220210022221
24	020021102210222122011101	118	200002011101221101210200
106	020100222202210121200201	246	200000201002222022101212
223	020101112100211012121210	215	200112021021210021020012
58	020102002001212200012222	51	200110211222211212211021
137	020211122020200202201022	206	200111101120212100102000
73	020212012221201120122001	184	201002222022101212002010
101	020210202122202011010010	227	201000112220102100220022
168	021101020021121120210020	233	201001002121100021111001
181	021102210222122011101002	237	201110122110121020000101
175	021100100120120202022011	188	201111012011122211221110
251	021212220112111201211111	113	201112202212120102112122
40	021210110010111212102120	49	201221022201111101001222
140	021211000211110010020102	201	2012221210211202222201
17	021020120200101012122202	155	201220102000110210110210
83	02102101010102200100211	222	202111220202002022010220
254	021022200002100121021220	231	202112110100000210201202
240	111200121020111001121000	5	202110000001001101122211
214	111201011221112222012012	27	202222120020022100011011
53	111202201122110110200021	131	202220010221020021202020
202	11101102111110111212121	164	202221200122021212120002
25	111012211012102000010100	3	202000020111012211012102
18	111010101210100221201112	46	202001210012010102200111
247	111122221202121220120212	119	202002100210011020121120
174	111120111100122111011221	28	211010200211211202100200
112	111121001001120002202200	176	211011120112212120021212
89	112012122200012111102210	23	211012010010210011212221
210	112010012101010002020222	64	211121100002201010101021
217	112011202002011220211201	157	211122020200202201022000
248	112120022021002222100001	187	211120210101200122210012
194	112121212222000110021010	244	211202000120221121102112
182	112122102120001001212022	238	211200220021222012020121
80	112201222112022000101122	96	211201110222220200211100
79	112202112010020221022101	235	212122201121112012111110
195	112200002211021112210110	60	212120121022110200002122
12	110121120110210221110120	1	212121011220111121220101
209	110122010011211112001102	110	212200101212102120112201
165	110120200212212000222111	200	212201021110100011000210
245	110202020201200002111211	221	212202211011101202221222
2	110200210102201220002220	99	212011001000122201110022
81	110201100000202111220202	31	212012221201120122001001
38	110010220022220110112002	198	212010111102121010222010
141	11001111022021001000011	193	210201202001010122122020
211	11001200012122222221020	125	210202122202011010010002
239	122020100122122101200100	124	210200012100012201201011
95	122021020020120022121112	152	210012102122000200120111
43	122022210221121210012121	122	210010022020001121011120
224	122101000210112212201221	71	210011212221002012202102
203	122102220111110100122200	94	210120002210020011121202
145	122100110012111021010212	220	210121222111021202012211
147	122212200001102020202012	29	210122112012022120200220
19	122210120202100211120021	199	000011212002202100222210
50	122211010100101102011000	61	000012102200200021110222
136	120102101002020211211010	11	000010022101201212001201
107	120100021200021102102022	228	000022121001101200111120
134	120101211101022020020001	62	000020011202102121002102
109	120210001120010022212101	55	000021201100100012220111
153	120211221021011210100110	121	000122112120222211220001
148	120212111222012101021122	7	000120002021220102111010
205	120021201211000100210222	30	00012122222221020002022
212	120022121112001021101201	232	000100021122121011112211
54	120020011010002212022210	189	000101211020122202000220
241	121211102212221021222220	59	000102101221120120221202
156	121212022110222212110202	236	000200012211212022221122

Table 10 Codewords from subcode of code $[26, 6, 15]_3$ assigned to 256 ASCII values is given in the table.

ASCII Values	Ternary Codes	ASCII values	Ternary Codes
0	000000000000000000000000	115	01200101112022011221101102
85	00011201212220001211110221	116	01212111022122210212222200
170	0002210212111000212220112	78	0121222222210200020220021
127	01112220010110120200212212	67	01212000122001220101221112
253	01120121222000121111022100	70	01210220020002111022200110
52	01101022101220122022102021	178	01210001220120101100201201
138	02221110020220210100121121	159	01210112120211121211202022
41	02202011202110211011201012	142	01211002021212012102211020
86	0221021211100021222011200	92	01211110221000002210212111
42	00000111200121020111001121	48	01211221121121022021210202
100	00000222100212010222002212	90	01001101122211002010122000
44	00001112001210201110011210	218	01001212022002022121120121
250	00001220201001221221012001	126	01001020222120012202121212
132	00001001101122211002010122	39	01002210120121200120100210
161	00002221002120102220022120	219	01002021020212220201101001
98	00002002202211122001020211	167	01002102220000210012102122
8	00002110102002112112021002	114	01000022121001101200111120
34	0001120012102011100112100	172	01000100021122121011112211
10	00011012112011021022111012	14	01000211221210111122110002
149	00012202010012212210120010	120	01012221101010010110201100
87	00012010210100202021121101	139	01012002001101000221202221
21	00012121110221222102122222	160	01012110201222020002200012
74	00010011011222110020101220	33	01010000102220211220212010
36	00010122211010100101102011	179	01010111002011201001210101
69	00010200111101120212100102	117	01010222202102221112211222
177	00022210021201022200221200	225	01011112100100112000220220
20	00022021221022012011222021	129	01011220000221102111221011
213	00020022022111220010202110	183	0101100120001212222222102
163	0002010022202210121200201	230	01020011110112021210010200
229	0002011122020200202021022	35	01020122010200011021011021
255	00021101020021121120210020	93	01020200210021001102012112
197	00021212220112111201211111	6	01021120111022222020021110
133	00021020120200101012212202	32	01021201011110212101022201
252	00111200121020111001121000	56	01021012211201202212020022
26	0011011021111101112122121	158	01022202112202120100002020
173	00111122221202121220120212	185	01022010012020110211000111
151	00112012122200012111102210	47	01022121212111100022001202
82	00112120022021002222100001	143	02221002120102220022120000
75	00112201222112022000101122	123	02221221220011200211122212
37	00110121120110210221110120	204	0222211112101212102101210
166	001102020201201200002111211	242	02222222021100111210102001
191	0011001022002220110112002	111	02222000221221101021100122
88	00122020100122122101200100	103	0222022012222022212112120
63	00122101000210112212201221	108	02220001022010012020110211
68	00122212200001102020202012	9	02220112222101002101111002
150	00120102101002020211211010	65	02202122102201201122202100
76	00120210001120010022212101	249	02202200002022221200200221
4	00120021201211000100210222	13	02200201100111102202210010
154	00121211102212221021222220	180	02200012000202122010211101
234	00121022002000211102220011	226	02200120200020112121212222
22	00121100202121201210221102	144	02201010101021000012221220
162	00100110112221100201012200	15	0220112100111202012022011
105	00100221012012120012010021	57	02201202201200010201220102
102	00100002212100110120011112	128	02210020011121202000012021
171	00101222110101001011020110	135	02210101211212222111010112
104	0010100001022021122021201	243	02211021112210110002022110
169	0010111121001001120002022	190	02211102012001100110020201
196	00102001111011202121001020	207	02211210212122120221021022
208	0010211201110222202002111	77	02212100110120011112000020
84	00102220211220212010000202	45	02212211010211001220001111
130	00222100212010222002212000	91	02212022210002021001002202
146	00222211112101212110210121	192	02002202211122001020211000
72	002220201222202221211212	186	02002010111210021101212121
16	00220212210220120112220210	216	02002121011001011212210212
66	00220020110011110220221001	97	02000011212002202100222210
24	00220101010102100001222122	118	02000122112120222211220001
106	0022102121110002122201120	246	02000200012211212022221122
223	00221102111221011000202211	215	02001120210212100210200120
58	00221210011012001111200002	51	02001201110000120021201211
137	00200220221112200102021100	206	02001012010121110102202002
73	00200001121200220210022221	184	02010022220221012120020100
101	00200112021021210021020012	227	02010100120012002201021221
168	0020100222022101212002010	222	02010211020100022012022012

Table 11 Codewords from subcode of code $[26, 6, 15]_3$ continued from 10 assigned to 256 ASCII values is given in the table.

ASCII Values	Ternary Codes	ASCII values	Ternary Codes
130	00222100212010222002212000	91	02212022210002021001002202
146	00222211112101212110210121	192	02002202211122001020211000
72	00222022012222202221211212	186	02002010111210021101212121
16	00220212210220120112220210	216	02002121011001011212210212
66	00220020110011110220221001	97	02000011212002202100222210
24	00220101010102100001222122	118	02000122112120222211220001
106	0022102121110002122201120	246	02000200012211212022221122
223	00221102111221011000202211	215	02001120210212100210200120
58	00221210011012001111200002	51	02001201110000120021201211
137	00200220221112200102021100	206	02001012010121110102202002
73	00200001121200220210022221	184	02010022220221012120020100
101	00200112021021210021020012	227	02010100120012002201021221
168	0020100222022101212002010	233	02010211020100022012022012
181	0020110122110121020000101	237	02011101221101210200001010
175	0020122102201111101001222	188	02011212121222200011002101
251	00202111220202002202010220	113	02011020021010220122000222
40	00202222120020022100011011	49	02012210222011111010012220
140	00202000020111012211012102	201	02012021122102101121010011
17	00211010200211211202100200	155	0201210202220121202011102
83	00211121100002201010101021	222	02021112202020020220102200
254	00211202000120221121102112	231	02021220102111010001100021
240	00212122201121112012111110	5	02021001002202000112101112
214	00212200101212102120112201	27	02022221200200221000110110
53	00212011001000122201110022	131	02022002100021211111111201
202	00210201202001010122122020	164	02022110000112201222112022
25	00210012102122000200120111	3	02020000201110122110121020
18	00210120002210020011121202	46	02020111101201112221122111
247	01112001210201110011210000	119	02020222001022102002120202
174	01112112110022100122211121	28	02110102002112112021002000
112	01110110211111011121221210	176	02110210202200102102000121
89	01110221111202001202222001	23	02110021102021122210001212
210	01110002011020021010220122	64	02111211000022010101010210
217	01111222212021212201202120	157	021110222200110000212011001
248	01111000112112202012200211	187	02111100100201020020012122
194	01111111012200222120201002	244	02112020001202211211021120
182	01120202122121111222020221	238	02112101201020201022022211
80	01120010022212101000021012	96	02112212101111221100020002
79	01121200220210022221000010	235	02121222011211120121111100
195	01121011120001012002001101	60	02121000211002110202112221
12	01121122020122002110002222	1	02121111111120100010110012
209	01122012221120220001011220	110	02122001012121021201122010
165	01122120121211210112012011	200	02122112212212011012120101
245	01122201021002200220010102	221	02122220112000001120121222
2	01101211201102102211101200	99	02120110010001222011100220
81	01101100001011112100100112	31	02120221210122212122101011
38	01102020202012000021112110	198	02120002110210202200102102
141	01102101102100020102110201	193	02102012020010101221220200
211	01102212002221010210111022	125	02102120220101121002221021
239	01100102200222201101120020	124	02102201120222111110222112
95	0110021010001022121212111	152	02100121021220002001201110
43	01100021000101211020122202	122	02100202221011022112202201
224	01220201001221221012001000	71	02100010121102012220200022
203	01220012201012211120002121	94	02101200022100200111212020
145	01220120101100201201000212	220	02101011222221220222210111
147	01221010002101122122012210	29	02101122122012210000211202
19	01221121202222112200010001	199	11120012102011100112100000
50	01221202102010102011011122	61	1112012000210210220101121
136	01222122000011020202020120	11	11120201202220110001102212
107	01222200200102010010021211	228	11121121100221001222111210
134	01222011100220000121022002	62	11121202000012021000112001
109	01201021010020202112110100	55	11121010200100011111110122
153	01201102210111222220111221	121	11122200101101202002122120
148	0120121011022212001112012	7	11122011001222222110120211
205	01202100011200100222121010	30	11122122201010212221121002
212	01202211211021120000122101	232	11101102111110111212212100
54	0120222111112110111120222	189	11101210011201101020210221
241	01200212012110001002102220	59	11101021211022121101211012
156	01200020212201021110100011	236	11102211112020012022220010