

10 Appendix

In each of the subsections below we give generators of the group in its permutation representation, followed by the set of orbits used for a block of the design. This orbited under the group generated by the given orbits and either the binary code from this design or the hull of the code will be the code we have discussed in the paper.

10.1 J_1 of degree 1045: $[1045, 20, 456]_2$

Generators(a2);

[

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10.2 J_1 of degree 1463: $[1463, 20, 608]_2$

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> Generators(a2);
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1339)(1262, 1341)(1267, 1344)(1268, 1346)(1270, 1347)(1272, 1349)(1274,
1352)(1276, 1354)(1281, 1357)(1284, 1359)(1285, 1360)(1292, 1338)(1295,
1296)(1299, 1367)(1300, 1368)(1306, 1373)(1310, 1377)(1312, 1379)(1314,
1348)(1316, 1381)(1317, 1383)(1318, 1384)(1320, 1385)(1322, 1387)(1325,
1389)(1326, 1390)(1327, 1391)(1328, 1393)(1331, 1375)(1334, 1356)(1335,
1398)(1340, 1402)(1342, 1404)(1343, 1405)(1345, 1407)(1350, 1410)(1351,
1411)(1353, 1414)(1355, 1415)(1358, 1419)(1361, 1406)(1362, 1388)(1363,
1409)(1364, 1422)(1365, 1392)(1366, 1424)(1369, 1427)(1370, 1428)(1371,
1430)(1372, 1432)(1374, 1435)(1376, 1438)(1378, 1441)(1380, 1443)(1382,
1401)(1386, 1449)(1395, 1452)(1396, 1453)(1397, 1413)(1399, 1456)(1400,
1457)(1403, 1459)(1408, 1464)(1412, 1454)(1416, 1466)(1417, 1418)(1420,
1467)(1421, 1468)(1423, 1469)(1425, 1471)(1426, 1465)(1429, 1472)(1431,
1437)(1433, 1439)(1434, 1475)(1436, 1476)(1440, 1474)(1442, 1477)(1444,
1480)(1445, 1481)(1446, 1483)(1447, 1485)(1450, 1487)(1451, 1460)(1455,
1491)(1458, 1493)(1461, 1488)(1463, 1494)(1470, 1497)(1473, 1498)(1478,
1479)(1484, 1505)(1486, 1502)(1489, 1508)(1490, 1507)(1495, 1512)(1496,
1514)(1499, 1516)(1500, 1517)(1501, 1519)(1503, 1515)(1504, 1510)(1506,
1523)(1511, 1513)(1518, 1524)(1520, 1527)(1522, 1529)(1525, 1526)(1528,
1530)(1531, 1534)(1532, 1535)(1533, 1536)(1537, 1539)(1538, 1540)
}
orbs[7];
GSet{@ 11, 220, 592, 1043, 580, 770, 1324, 167, 859, 690, 1090, 895, 1199,
1262, 833, 340, 490, 437, 1098, 1059, 1497, 57, 1013, 528, 1382, 999, 523, 435,
122, 304, 856, 1172, 585, 319, 533, 324, 997, 1180, 371, 66, 194, 79, 1462,
665, 1029, 574, 1094, 1390, 59, 988, 1170, 1490, 1174, 156, 714, 600, 889 @}
> orbs[13];
GSet{@ 3, 1367, 51, 1291, 1016, 1355, 1315, 681, 952, 568, 438, 1131, 1348,
832, 4, 90, 1330, 1453, 400, 697, 506, 754, 1381, 802, 1334, 1275, 1322, 186,
813, 1116, 1352, 29, 1303, 740, 384, 1085, 706, 178, 98, 1409, 78, 1135, 612,
1107, 1081, 1253, 885, 1268, 75, 1285, 86, 1192, 661, 1519, 367, 1203, 1044,
297, 775, 283, 1399, 465, 474, 1056, 1527, 1244, 373, 858, 1371, 263, 749, 977,
1338, 1358, 1425, 757, 1224, 800, 1128, 175, 285, 909, 246, 34, 990, 905, 1308,
351, 292, 509, 702, 358, 805, 637, 949, 890, 747, 918, 633, 170, 233, 1383,
981, 603, 87, 1046, 1305, 750, 419, 1474, 1154, 541, 836, 970 @}

```

10.4 J_2 of degree 100: $[100, 36, 16]_2$

```

Generators(a2);
  (1, 2, 4, 6, 3)(5, 7, 10, 14, 21)(8, 11, 16, 17, 23)(9, 12, 18, 25, 32)(13,
    19, 26, 34, 44)(15, 22, 20, 27, 35)(24, 30, 39, 51, 65)(28, 36, 47, 60,
    48)(29, 37, 49, 62, 74)(31, 40, 53, 43, 55)(33, 42, 41, 54, 67)(38, 45,
    57, 56, 69)(46, 58, 71, 82, 89)(50, 63, 75, 73, 83)(52, 66, 78, 86,
    59)(61, 72, 77, 85, 93)(64, 76, 79, 87, 95)(68, 80, 84, 91, 94)(70, 81,
    88, 97, 96)(90, 98, 92, 99, 100),
  (2, 3)(4, 5)(6, 8)(7, 9)(10, 13)(11, 15)(12, 17)(14, 20)(18, 24)(21,
    28)(22, 29)(25, 31)(26, 33)(30, 38)(32, 41)(34, 43)(35, 45)(36, 46)(37,
    48)(39, 50)(40, 52)(44, 56)(47, 59)(49, 61)(51, 64)(53, 63)(55, 68)(58,
    70)(62, 73)(65, 77)(67, 79)(72, 78)(74, 81)(75, 82)(76, 84)(83, 90)(85,
    92)(87, 94)(88, 96)(91, 99)
\\orbit taken for blocks of design orbs[2] 1-(100, 36, 36)
GSet{@ 2, 3, 7, 25, 31, 54, 87, 9, 19, 85, 77, 66, 60, 42, 71, 23, 88,
94, 64, 73, 92, 93, 61, 96, 65, 99, 49, 97, 91, 51, 86, 98, 62, 90,
95, 83 @}
\\orbit taken for blocks of design orbs[3] 1-(100, 63, 63)
orbs[3];
GSet{@ 4, 5, 11, 70, 21, 26, 12, 63, 72, 46, 22, 47, 15, 17, 29, 68,
36, 6, 53, 58, 40, 50, 78, 76, 28, 18, 33, 55, 10, 82, 30, 79, 32, 67,
89, 41, 57, 81, 24, 14, 56, 44, 38, 69, 59, 48, 100, 75, 37, 20, 45,
8, 16, 84, 80, 74, 52, 13, 43, 39, 35, 34, 27 @}

```

10.5 J_2 of degree 280: $[280, 13, 128]_2$

```

Generators(a2);
{ (1, 2)(3, 5)(6, 9)(7, 11)(8, 13)(12, 18)(15, 22)(16, 24)(17, 25)(19,
  28)(20, 29)(21, 31)(23, 34)(27, 38)(30, 42)(32, 45)(33, 46)(35,
  36)(37, 50)(39, 53)(40, 55)(41, 57)(43, 60)(47, 65)(48, 67)(49,
  69)(51, 70)(52, 71)(54, 74)(56, 77)(59, 80)(61, 83)(62, 84)(63,
  85)(64, 87)(66, 89)(68, 92)(72, 95)(73, 97)(75, 99)(76, 100)(78,
  103)(79, 104)(81, 107)(82, 109)(86, 101)(88, 114)(90, 117)(91,
  118)(93, 121)(94, 123)(96, 125)(98, 128)(105, 134)(106, 135)(108,
  138)(110, 120)(111, 122)(112, 143)(113, 145)(115, 147)(116,
  149)(119, 141)(124, 155)(127, 158)(130, 161)(131, 163)(132,
  164)(133, 166)(137, 171)(139, 174)(140, 175)(142, 177)(144,
  179)(146, 182)(148, 154)(150, 184)(151, 186)(152, 173)(156,
  169)(157, 192)(160, 194)(162, 195)(165, 197)(167, 198)(168,
  199)(172, 181)(176, 204)(178, 206)(180, 209)(185, 213)(187,
  216)(188, 217)(190, 219)(191, 220)(196, 226)(201, 230)(202,
  232)(203, 234)(205, 235)(212, 240)(214, 243)(218, 246)(221,
  249)(222, 250)(223, 233)(224, 252)(225, 253)(227, 254)(236,
  259)(238, 242)(241, 248)(251, 257)(256, 275)(260, 276)(262,
  266)(264, 271)(268, 278)(269, 272)(273, 277),

  (1, 3, 6, 10, 16)(2, 4, 7, 12, 19)(5, 8, 14, 21, 32)(9, 15, 23,
    35, 24)(11, 17, 26, 37, 51)(13, 20, 30, 43, 61)(18, 27, 39,
    54, 75)(22, 33, 47, 66, 90)(25, 36, 49, 65, 50)(28, 40, 56,

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78, 57)(29, 41, 58, 79, 105)(31, 44, 62, 70, 94)(34, 48, 68,
93, 122)(38, 52, 72, 96, 126)(42, 59, 81, 108, 139)(45, 63,
86, 113, 87)(46, 64, 88, 115, 148)(53, 73, 98, 129, 74)(55,
76, 101, 131, 121)(60, 82, 110, 141, 69)(67, 91, 119, 153,
189)(71, 84, 83, 111, 142)(77, 102, 132, 165, 103)(80, 106,
136, 170, 171)(85, 112, 144, 180, 210)(89, 116, 150, 185,
214)(92, 120, 128, 160, 164)(95, 124, 156, 134, 168)(97, 127,
159, 193, 223)(99, 109, 140, 176, 161)(100, 130, 162, 194,
224)(104, 133, 167, 163, 196)(107, 137, 172, 201, 231)(114,
146, 135, 169, 200)(117, 151, 187, 138, 173)(118, 152, 188,
218, 149)(123, 154, 190, 204, 206)(125, 157, 175, 203,
158)(143, 178, 207, 236, 260)(145, 181, 182, 211, 239)(147,
183, 155, 191, 221)(166, 197, 227, 255, 274)(174, 202, 233,
258, 234)(177, 205, 184, 212, 241)(179, 208, 237, 261,
276)(186, 215, 244, 243, 265)(192, 222, 251, 271, 259)(195,
225, 246, 266, 277)(198, 228, 254, 273, 235)(199, 229, 256,
250, 270)(209, 238, 262, 275, 226)(213, 242, 264, 216,
245)(217, 230, 252, 232, 257)(219, 247, 267, 249, 269)(220,
248, 268, 279, 280)(240, 263, 253, 272, 278) }
\\orbit taken for blocks of design >
orbs[3];
GSet{@ 6, 275, 273, 197, 91, 226, 259, 163, 175, 100, 127, 155, 249,
161, 77, 234, 193, 224, 76, 195, 121, 178, 43, 200, 61, 219,
99, 107, 92, 235, 216, 85, 212, 139, 105, 88, 46, 201, 252,
42, 136, 106, 229, 230, 117, 214, 34, 246, 123, 270, 274, 7,
160, 18, 108, 114, 206, 260, 227, 204, 11, 64, 36, 255, 232,
278, 208, 222, 172, 73, 165, 41, 38, 143, 75, 170, 72, 168,
79, 158, 95, 209, 87, 81, 17, 262, 269, 157, 261, 37, 266,
241, 40, 149, 54, 228, 51, 66, 49, 183, 69, 267, 98, 10, 220,
14, 58, 31 @}

```

10.6 J_2 of degree 315, dimension 28: $[315, 28, 64]_2$

```

Generators(a2);
{ (1, 3, 6, 11, 19)(2, 4, 8, 14, 23)(5, 9, 16, 26, 40)(7, 12, 20, 31,
48)(10, 17, 28, 43, 65)(13, 21, 33, 51, 75)(15, 24, 37, 57, 84)(18,
29, 45, 67, 93)(22, 34, 53, 78, 104)(25, 38, 59, 56, 82)(27, 41, 63,
88, 117)(30, 46, 69, 39, 60)(32, 49, 73, 98, 131)(35, 54, 79, 106,
80)(36, 55, 81, 108, 141)(42, 64, 90, 119, 156)(47, 70, 95, 103,
137)(50, 74, 85, 111, 146)(52, 76, 101, 135, 58)(61, 86, 113, 149,
114)(62, 87, 115, 151, 191)(66, 91, 120, 158, 198)(68, 94, 124, 162,
201)(71, 96, 127, 166, 128)(72, 97, 129, 168, 207)(77, 102, 136, 174,
215)(83, 110, 144, 184, 145)(89, 118, 139, 177, 186)(92, 121, 160,
109, 142)(99, 132, 150, 190, 223)(100, 133, 172, 211, 105)(107, 140,
179, 220, 258)(112, 147, 187, 229, 266)(116, 152, 193, 125, 163)(122,
161, 200, 241, 123)(126, 164, 203, 245, 279)(130, 169, 209, 171,
210)(134, 173, 213, 217, 214)(138, 176, 197, 238, 212)(143, 182, 224,
262, 291)(148, 188, 189, 231, 269)(153, 194, 236, 154, 195)(155, 196,
237, 276, 157)(159, 199, 240, 265, 294)(165, 204, 226, 263, 289)(167,
206, 249, 284, 170)(175, 216, 255, 183, 225)(178, 219, 256, 290,

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307)(180, 221, 260, 181, 222)(185, 227, 205, 247, 252)(192, 234, 273, 297, 254)(202, 243, 278, 299, 218)(208, 251, 287, 305, 239)(228, 248, 282, 302, 312)(230, 267, 261, 232, 270)(233, 271, 296, 300, 286)(235, 274, 298, 304, 281)(244, 253, 288, 295, 306)(246, 280, 301, 264, 293)(250, 285, 268, 259, 272)(275, 283, 303, 292, 308)(309, 313, 310, 311, 314),
 (1, 2)(3, 5)(4, 7)(6, 10)(8, 13)(9, 15)(11, 18)(12, 19)(14, 22)(16, 25)(17, 27)(20, 30)(21, 32)(23, 35)(24, 36)(26, 39)(28, 42)(29, 44)(31, 47)(33, 50)(34, 52)(37, 56)(38, 58)(40, 61)(41, 62)(45, 66)(46, 68)(48, 71)(49, 72)(53, 77)(54, 76)(55, 80)(57, 83)(59, 85)(60, 70)(63, 73)(64, 89)(65, 91)(67, 92)(69, 90)(74, 99)(75, 100)(78, 103)(79, 105)(81, 107)(82, 109)(84, 102)(86, 112)(87, 114)(88, 116)(93, 122)(94, 123)(95, 125)(96, 126)(97, 128)(98, 130)(101, 134)(104, 138)(106, 139)(108, 124)(110, 143)(111, 145)(113, 148)(115, 150)(117, 153)(118, 154)(119, 155)(120, 157)(121, 159)(127, 165)(129, 167)(131, 168)(132, 170)(133, 171)(135, 136)(137, 175)(140, 178)(141, 180)(142, 181)(144, 183)(146, 185)(147, 186)(149, 189)(151, 179)(152, 192)(158, 197)(160, 163)(161, 172)(162, 196)(164, 202)(166, 205)(169, 208)(173, 212)(174, 214)(176, 217)(177, 218)(182, 223)(184, 226)(187, 228)(188, 230)(190, 232)(191, 233)(193, 215)(194, 235)(198, 209)(199, 239)(200, 213)(201, 242)(203, 244)(204, 246)(206, 248)(207, 250)(210, 252)(211, 253)(216, 254)(219, 236)(220, 257)(221, 259)(224, 261)(225, 243)(227, 264)(229, 265)(231, 268)(234, 272)(237, 275)(238, 276)(240, 277)(241, 273)(245, 278)(247, 281)(249, 283)(251, 286)(256, 289)(258, 284)(260, 288)(262, 266)(263, 292)(269, 295)(274, 294)(279, 287)(280, 300)(282, 301)(285, 304)(290, 306)(291, 305)(296, 309)(297, 308)(298, 310)(299, 303)(302, 311)(307, 313)(314, 315) }

`\\orbits chosen`

```
orbs[3]; GSet{@ 10, 88, 250, 138, 276, 229, 292, 107, 287, 244, 198, 272, 251,
  79, 241, 200, 278, 113, 204, 124, 143, 63, 223, 311, 134, 261, 158,
  44, 14, 237, 54, 30 @}
orbs[4]; GSet{@ 13, 135, 283, 101, 31, 262, 273, 169, 289, 234, 279,
  245, 298, 188, 144, 127, 91, 73, 172, 238, 286, 213, 141, 22, 228,
  29, 197, 224, 76, 275, 62, 108 @}

```

10.7 J_2 of degree 315, dimension 36: $[315, 36, 80]_2$

Generators as given above.

`\\orbit chosen`

```
orbs[5]; GSet{@ 3, 84, 48, 313, 194, 60, 193, 191, 185, 109, 139, 300,
  254, 132, 142, 295, 120, 199, 16, 36, 177, 94, 17, 53, 285, 242, 119,
  78, 288, 176, 125, 192, 166, 9, 243, 99, 253, 57, 49, 137, 160, 7,
  248, 140, 170, 304, 179, 264, 236, 86, 291, 220, 293, 61, 130, 75,
  145, 184, 231, 32, 59, 90, 19, 64, 306, 35, 270, 93, 114, 39, 42, 218,
  147, 314, 296, 277, 153, 55, 66, 129 @}

```

10.8 Two ternary codes

1. J_1 of degree 266: $[266, 76, X]_3$

Generators as given above.

```

\\orbit chosen
orbs[4],
GSet{@ 2, 4, 10, 167, 33, 3, 88, 154, 6, 149, 37, 133, 255, 258, 260,
17, 174, 15, 163, 191, 5, 77, 107, 20, 46, 152, 224, 237, 87, 41, 44,
183, 215, 245, 249, 13, 25, 254, 221, 217, 232, 266, 218, 198, 150,
128, 175, 262, 55, 8, 18, 141, 36, 116, 23, 111, 132, 207, 32, 261,
265, 243, 223, 134, 75, 216, 27, 114, 125, 160, 106, 235, 185, 182,
90, 64, 219, 117, 147, 208, 102, 247, 84, 9, 76, 137, 238, 194, 234,
227, 96, 225, 242, 157, 66, 12, 233, 139, 122, 222, 231, 197, 58, 196,
250, 193, 146, 85, 252, 172 @}
orbs[5];
GSet{@ 14, 22, 171, 70, 43, 71, 244, 248, 170, 257, 165, 42, 35, 63,
144, 148, 95, 246, 115, 93, 112, 21, 109, 26, 226, 19, 199, 236, 80,
118, 68, 131, 97, 145, 188, 204, 92, 156, 30, 179, 34, 120, 213, 176,
31, 101, 56, 50, 98, 57, 78, 53, 79, 49, 251, 39, 259, 200, 166, 59,
110, 48, 189, 127, 28, 104, 173, 29, 168, 187, 67, 220, 16, 230, 123,
65, 142, 203, 60, 228, 129, 130, 140, 72, 105, 86, 190, 91, 73, 151,
209, 158, 205, 61, 82, 186, 47, 229, 180, 113, 210, 253, 24, 38, 195,
214, 126, 178, 108, 239, 240, 256, 169, 138, 159, 162, 51, 263, 81,
136, 103, 83, 40, 54, 94, 164, 99, 143, 192, 212, 119, 69 @}

```

2. J_2 of degree 100: $[100, 36, 16]_3$

Generators as given

```

\\orbit chosen #3
orbs[3];
GSet{@ 4, 5, 44, 57, 50, 40, 8, 24, 81, 6, 52, 47, 56, 21, 68, 27, 53,
35, 46, 14, 34, 43, 22, 39, 26, 59, 10, 76, 41, 63, 74, 15, 100, 18,
33, 70, 48, 13, 17, 79, 20, 30, 72, 29, 45, 28, 67, 38, 36, 55, 69,
11, 80, 89, 16, 78, 84, 75, 82, 12, 32, 37, 58 @}

```

10.9 Two 5-ary codes

1. J_1 of degree 266: $[266, 56, X]_5$

\\orbit chosen #4

```

orbs[4];
GSet{@ 2, 4, 15, 56, 52, 240, 23, 114, 239, 44, 104, 18, 108, 25, 97,
173, 46, 266, 85, 32, 55, 198, 206, 57, 159, 95, 121, 179, 150, 69,
130, 80, 238, 59, 185, 197, 17, 183, 154, 162, 196, 160, 81, 122, 9,
117, 47, 49, 140, 241, 36, 67, 86, 60, 263, 135, 228, 251, 73, 27,
204, 144, 257, 244, 200, 158, 99, 6, 218, 232, 202, 147, 78, 188, 20,
169, 8, 209, 254, 112, 171, 89, 207, 221, 102, 53, 109, 236, 5, 111,
195, 41, 220, 13, 155, 141, 101, 174, 33, 91, 214, 37, 12, 115, 10,
181, 105, 193, 119, 3 @}

```

2. J_2 of degree 315: $[315, 14, 180]_5$

Generators as before

```
\\orbit chosen  
orbs[2];  
GSet{@ 2, 77, 12, 178, 89, 216, 24, 4, 271, 40 @}
```