

Index

- $(a, m, h, +)$ -EBS, 308
 $(a, m, h, -)$ -EBS, 308
 (a, m, t) -BS, 307
 (c, A) -central collineation, 75
 (c, A) -desarguesian plane, 108
 (c, A) -elation, 75
 (c, A) -homology, 75
 (c, A) -perspectivity, 75
 (c, A) -transitive plane, 108
 (m, n, k, λ) -RDS, 314
 (n, m, d) -code, 98
 (n, r) -net, 63
 (n, r, μ) -net, 106
 (r, λ) -design, 154
 (v, b, r, k, λ) -design, 24
 (v, k, λ) -difference set, 294
 (v, k, λ) -graph, 234
 (v, k, λ) -subdesign, 407
 2 - (v, k, λ) design, 28
 $AG(n, q)$, 78
 $AG_d(n, q)$, 78
 $A \circ B$, 117
 $A \otimes B$, 67, 117
 A^\top , 16
 $A_\mu(s)$, 171
 $A_{n,2}(q)$, 215
 BGW, 323
 BGW with classical parameters, 331
 $BGW(v, k, \lambda; G)$, 323
 C_n , 19
 G -invariant matrix, 289
 G -orbit, 39
 $GF(q)$, 59
 $GF(q)^+$, 60
 $GF(q)^*$, 60
 $GH(G; \lambda)$, 325
 $GL(n, q)$, 108
 GMW-difference set, 317
 G_{23} , 199
 G_{24} , 199
 $G_2(d)$ -graph, 246
 I , 16
 I_n , 16
 J , 16
 $J_{m,n}$, 16
 J_n , 16
 $K_{m,n}$, 20
 K_n , 19
 $L_2(n)$, 214
 $L_r(n)$, 214
 M -arc, 424
 M -partition, 273
 $NL_r(n)$, 215
 O , 16
 PBD , 154
 $PG(n, q)$, 80
 $PG_d(n, q)$, 81
 $PL_r(n)$, 215
 $QR(q)$, 217
 RDS with classical parameters, 316
 RG , 292
 S -matrix, 216
 $SRG(v, k, \lambda, \mu)$, 212
 $T(n)$, 214
 $V(n, q)$, 76
 $\Gamma L(n, q)$, 84
 $\Gamma(x)$, 19
 $\text{Aut}(\mathbf{D})$, 39
 λ -arc, 428
 λ -design, 13
 λ -linked design, 13
 $\mathbf{0}$, 16

- \mathbf{D}^Y , 16
 \mathbf{D}^x , 16
 \mathbf{D}_Y , 16
 \mathbf{D}_x , 16
 \mathbf{W}_{12} , 208
 \mathbf{W}_{22} , 201
 \mathbf{W}_{23} , 201
 \mathbf{W}_{24} , 201
 $\mathbf{a}, \mathbf{b}, \mathbf{x}$, 16
 \mathbf{j} , 16
 \mathcal{B}^Y , 16
 \mathcal{B}_Y , 16
 $\mathcal{K}(H)$, 131
 ω -circulant matrix, 339
 $\overline{xy}z$, 87
 \overline{xy} , 61, 72
 d -flat, 77
 m block nonembeddability condition, 431
 p -order function, 467
 p -rank, 33
 q -analogue of Johnson scheme, 248
 q -ary code, 98
 q -ary $[n, k]$ -code, 99
 s -class association scheme, 248
 s -fold incidence structure, 17
 $s \times \mathbf{D}$, 17
 t - (v, k, λ) design, 186
 $\mathbf{D}(X_0)$, 16
 $\mathbf{D}(X_0, \mathcal{B}_0)$, 16
 \mathbf{D}' , 17
 \mathbf{D}^\top , 17

 abelian difference set, 294
 absolute point, 233
 action of a group, 39
 adjacency matrix, 20, 240
 adjacent vertices, 19, 240
 affine α -resolvable PBD, 161
 affine geometry, 78
 affine plane, 61
 affine resolution, 157
 alphabet, 97
 amicable Hadamard matrices, 151
 arc of digraph, 239
 arc of symmetric design, 428
 ascendant, 230
 association matrix, 248
 association scheme, 247
 automorphism group, 39
 automorphism of design, 39
 axis of collineation, 74

 Baer partition, 412
 Baer subdesign, 408
 Baer subplane, 209, 408
 balanced generalized weighing matrix, 323
 balanced incomplete block design, 57
 balanced weighing matrix, 366
 balanced weighing system, 366
 base blocks, 42
 Bhattacharya's Example, 33
 BH-design, 283
 BIBD, 57
 binary code, 98
 binary Golay code, 199
 bipartite graph, 19
 biplane, 287
 Birkhoff Theorem, 54
 block, 14
 block circulant matrix, 290
 block complementation, 448
 block derived substructure, 16
 block graph, 252
 block intersection, 57
 block schematic design, 250
 block section, 57
 block set, 14
 block size, 14
 block-residual substructure, 16
 Bose's Inequality, 156
 Bose–Mesner algebra, 249
 Bose–Shrikhande–Parker Theorem, 68
 Bose–Shrikhande–Singhi Theorem, 255
 Bruck subdesign, 420
 Bruck–Ryser–Chowla Theorem, 37
 Bruck–Ryser Theorem, 74
 building block, 307
 building set, 307
 Burnside Lemma, 40
 Bush-type Hadamard matrix, 130

 Cameron's Theorem, 196
 Cameron–Delsarte Theorem, 272
 cardinality of a block, 14
 Cayley table, 105
 center of collineation, 74
 central collineation, 75
 Chang graphs, 227
 character group, 320
 character of group, 296
 character of group ring, 296
 characteristic polynomial of graph, 21
 Chen difference set, 313

- circulant matrix, 290
- class graph, 274
- Clebsch graph, 214
- clique, 19
- coclique, 19
- codeword, 98
- collineation, 74, 84
- complement of graph, 20
- complementary incidence structure, 17
- complete block, 14
- complete design, 25
- complete graph, 19
- complete multipartite graph, 20
- conference matrix, 119
- conjugate element, 296
- conjugate matrices, 323
- connected component, 20
- connected graph, 20
- core of BGW matrix, 347
- core of conference matrix, 120
- covering extended building set, 308
- cycle, 19
- cyclic design, 401
- cyclic difference set, 294
- cyclotomic difference set, 300
- cyclotomic scheme, 249

- Davis–Jedwab difference set, 312
- de Bruijn–Erdős Theorem, 452
- degree, 19
- degree of net, 63
- Dembowski–Wagner Theorem, 90
- derived design, 32
- derived substructure, 16
- Desargues Theorem, 85, 108
- desarguesian plane, 85
- descendant, 230
- development of subset, 294
- difference set, 294
- directed graph, digraph, 239
- direction, 107
- disjoint union of graphs, 20
- divisible difference set, 320
- dodecad, 208
- dominating vertex, 240
- doubly regular tournament, 246
- dual code, 100
- dual incidence structure, 17

- edge, 19
- eigenspace, 21
- eigenvalue, 21
- eigenvector, 21
- elementary abelian group, 60
- embeddable design, 254
- embeddable PBD , 173
- embeddable quasi-derived design, 443
- embeddable quasi-residual design, 33
- equidistant code, 144
- equidistant family of sets, 9
- equivalent codes, 98
- equivalent Hadamard matrices, 114
- error-correcting code, 98
- extended binary Golay code, 199
- extension of field, 59
- extension of t -design, 195

- faithful action, 39
- Fano Plane, 5
- First Ray–Chaudhuri–Wilson Inequality, 3
- Fisher’s Inequality, 26
- fixed block, 39
- fixed point, 39
- flag, 14
- Frobenius automorphism, 60
- full automorphism group, 39
- full collineation group, 74
- Fundamental Theorem of Projective Geometry, 84

- Gaussian coefficient, 76
- generalized Bhaskar Rao design, 367
- generalized conference matrix, 328
- generalized Hadamard matrix, 325
- generalized weighing matrix, 366
- generator matrix, 100
- Gewirtz graph, 234
- global decomposition, 369
- Gordon–Mills–Welch difference set, 317
- graph, 19
- group divisible designs, 320
- group invariant matrix, 289
- group of rotations, 342
- group of symmetries, 302, 341, 392
- group ring, 292

- Hadamard 2-design, 115, 193
- Hadamard 3-design, 116, 187, 193
- Hadamard difference set, 313
- Hadamard family, 10
- Hadamard matrix, 9, 113

- Hadamard product, 117
 Hadamard series, 115, 488
 Hadamard system, 366
 Hadamard–Menon difference set, 321
 Hall–Connor Theorem, 254
 Hamming Bound Theorem, 99
 Hamming code, 101
 Hamming distance, 8
 Hamming scheme, 248
 Hamming space, 97
 Hasse invariant, 37
 Higman–Sims graph, 244
 Higman–Sims group, 211
 Hilbert symbol, 35
 Hoffman–Singleton graph, 221, 245
 hyperoval, 209
 hyperplane, 78
- incidence matrix, 14
 incidence relation, 14
 incidence structure, 14
 Inclusion–Exclusion Principle, 187
 independent subdesigns, 427
 index of BGW matrix, 324
 index of PBD, 154
 index of Ryser design, 8, 447
 induced subgraph, 19
 inner product, 100
 Integrality Condition, 220
 intersecting lines, 62
 intersection number, 3, 188
 inversion formula, 320
 isomorphic structures, 17
- Johnson scheme, 248
- kernel of nearfield, 328
 Kronecker product, 117
 Kronecker product over group, 341
- ladder graph, 19
 large Witt designs, 198
 Latin square, 64
 Latin square graph, 214
 left nearfield, 327
 Legendre symbol, 34
 length of walk, 20
 Levi graph, 19
 line, 61, 62, 72, 78, 86
 linear code, 99
 local decomposition, 392
- Mann’s Inequality, 54
 maximal decomposition, 288
 maximal equidistant code, 183
 McFarland difference set, 311
 mean distance, 182
 Menon design, 127
 Menon difference set, 321
 minimum distance, 98
 MOLS, 64
 monomially equivalent BGW -matrices, 326
 Moore graphs, 220
 multilinear polynomial, 3
 mutually orthogonal Latin squares, 64
- natural series, 81, 488
 nearfield, right nearfield, 327
 nearly affine decomposition, 276
 negacyclic matrix, 366
 negative Latin square graph, 215
 net, 62
 net graph, 214
 nondesarguesian plane, 85
 nonedge, 19
 nonembeddable quasi-derived design, 443
 nonembeddable quasi-residual design, 33
 nonprincipal character, 297
 Nonuniform Fisher’s Inequality, 2
 normal digraph, 240
 normal matrix, 240
 normal series, 422
 normal subdesign, 173, 421
 normalized BGW -matrix, 326
 normalized conference matrix, 119
 normalized Hadamard matrix, 114
 normally regular graph, 240
 null graph, 19
- Orbit Theorem, 41
 Orbit–Stabilizer Theorem, 39
 order of net, 63
 order of design, 25
 order of graph, 19
 order of projective plane, 73
 orthogonal codewords, 100
 orthogonal configuration over group, 366
 orthogonal Latin squares, 64
- pairwise balanced design, 154
 Paley graph, 217
 Paley matrix, 118
 Paley–Hadamard difference set, 299

- parallel class, 62, 155
 parallel flats, 78
 parallel lines, 61, 62
 parallelism, 61, 155
 parameters of association scheme, 248
 parity check matrix, 101
 partial geometry, 244
 pencil, 5
 perfect code, 98
 permutation matrix, 18
 Petersen graph, 213
 plane, 78, 87
 Plotkin bound, 185
 point, 14, 61, 62, 72, 78
 point class, 104
 point set, 14
 point-derived substructure, 16
 point-residual substructure, 16
 polarity, 233
 Prime Power Conjecture, 363
 primitive element, 60
 principal character, 297
 productive Hadamard matrix, 377
 projective geometry, 80
 projective graph, 215
 projective hyperplane, 80
 projective line, 80
 projective plane, 72, 80
 projective space, 80
 proper symmetric subdesign, 369
 pseudo-Latin square graph, 215
- quadrangle, 72
 quadrangle criterion, 105
 quadratic character, 60
 Quadratic Reciprocity Law, 34
 quasi-3 for blocks, 263
 quasi-3 for points, 263
 quasi-3 symmetric design, 263
 quasi-derived design, 443
 quasi-residual design, 33
 quasi-symmetric design, 250
 quasi-regular collineation group, 367
- regular graph, 19
 regular automorphism group, 40
 regular decomposition, 369
 regular digraph, 240
 regular Hadamard matrix, 126
 regular M -partition, 273
 regular n -simplex, 12
- regular s -set of matrices, 141
 relative difference set, 314
 repetition code, 99
 replication number, 6, 14
 residual design, 32
 residual substructure, 16
 resolution, 155
 resolution class, 154
 resolvable 2-design, 163
 resolvable PBD, 155
 round robin tournament, 164
 Ryser design, 8, 447
 Ryser–Woodall conjecture, 456
 Ryser–Woodall Theorem, 6, 447
- SBIBD, 57
 Schläfli graph, 231
 SDP-design, 263
 Second Ray-Chaudhuri–Wilson Inequality, 191
 Seidel matrix, 216
 self-dual code, 100
 self-dual incidence structure, 18
 self-orthogonal code, 100
 self-orthogonal Latin square, 105
 semilinear mapping, 84
 sharply transitive action, 39
 Shrikhande graph, 227
 Siamese twin designs, 151
 signed group, 345
 simplex code, 101
 Singer difference set, 299
 Singer group, 295
 skew-symmetric BGW matrix, 345
 small Witt design, 208
 smooth design, 88
 span, 81
 spectrum of graph, 21
 Spence difference set, 312
 splitting relative difference set, 314
 spread of subgroups, 107
 spread of subspaces, 82
 square design, 57
 square lattice graph, 214
 stabilizer, 39
 Stanton–Sprott difference set, 300
 Steiner system, 165
 strong graph, 245
 strong subdesign, 428
 strongly regular graph, 212
 subdesign, 443

- subgraph, 19
- subplane, 408
- subspace of projective space, 80
- substructure, 16
- support, 292
- switching, 223
- symmetric design, 8
- symmetric (v, k, λ) -design, 28
- symmetric difference property, 263
- symmetric order, 95
- symmetric subdesign, 369, 407
- symmetrical BIBD, 57
- symmetry of order s , 303
- symmetry of set of Hadamard matrices, 377

- Teirlinck's Theorem, 191
- Thirty-six officers problem, 66
- tight partition, 412
- tight subdesign, 408
- Tits Inequality, 208
- tournament, 243
- translation, 107
- translation plane, 107
- transversal, 105
- transversal design, 104

- triangle, 61, 87
- triangular graph, 214
- triple intersection number, 263
- trivial design, 25
- trivial t -design, 186
- twin designs, 151
- two-graph, 224
- type-1 Ryser design, 456

- uniform decomposition, 369
- uniform subset, 302
- unital, 165

- valency, 19
- variance counting, 26
- variety, 57
- Veblen–Young Axioms, 111
- Veblen–Young Theorem, 86
- vertex, 19, 239

- walk, 20
- weighing matrix, 366
- weight of codeword, 99
- word, 97

- Youden square, 106