

## Index

- adjudicate, 323
- assortativity, 69, 161, 279
- betweenness, 140
- Catalan numbers, 262
- chain of cliques, 178, 237
- Cheeger constant, 152
- Christoffel numbers, 481
- Christoffel-Darboux formula, 327, 472
- clique, 39, *see* complete graph
- clique number, 81, 85, 101, 102
- community, 153
- complementary double cone, 228, 243
- complete graph, 31, 35, 88, 125, 193
- complex networks, 1, 271
  - reconstructability, 106, 287
- complexity, 124, 191
  - weighted, 123
- Courant-Fischer Theorem, 297, 361
- current flow, 24, 175, 179
- cut size, 152
- cut-space of a graph, 22
- cycle, 19, 21
  - Hamiltonian, 19, 41
- cycle-space of a graph, 21–23
- degree of a node, 16
  - in-degree, 17
  - out-degree, 17
- determinant, 320
- differences, 419, 432
- Dirac function, 247, 359, 476
- disjoint paths
  - Merger's Theorem, 172
- divided difference, 418
- effective resistance matrix, 175
- eigenvalues
  - adjacency matrix, 51
  - Laplacian matrix, 111
- elementary orthogonal projector, 308
- Euclid's algorithm, 423, 441
- expander, 152
- Fiedler eigenvector, 137
- forest, 123
- Gauss transformation, 309
- Gaussian Unitary Ensemble, 264
- Godsil-McKay switching, 47
- graph
  - angle, 52, 64, 73
  - antiregular, 231
  - asymmetric, 43
  - automorphism of graph, 43
  - bipartite, 212, 281
  - bisector of a graph, 150
  - co-eigenvector graphs, 106
  - coclique of a graph, 96, 101
  - component, 119
  - cone of a graph, 91–93, 119, 171, 212
  - cospectral, 42, 47
  - cycle or circuit, 40, 201
  - enumeration, 44
  - Erdos-Renyi random graph, 261, 264, 265, 288
  - fundamental weight, 52, 65, 73, 105
  - isomorphic, 42
  - multipartite, 47, 219
  - Paley, 59
  - path, 40, 203
  - pendant (degree one node), 173
  - Petersen, 46, 59
  - power law, 10
  - scale free, 10
  - simple, 15, 16
  - symmetric, 43
  - threshold, 119, 231, 274, 375
  - Turan, 57, 219
  - uniform degree graph, 230
  - weighted, 18
- graph connectivity, 28, 119
- edge connectivity, 171
- vertex connectivity, 171
- graph metrics
  - algebraic connectivity, 134, 218, 283
  - assortativity range, 285
  - diameter, 33, 75–77, 110, 151, 166

- distance (or hopcount), 19
- effective graph resistance, 177
- eigenvector centrality, 93, 162, 290
- graph energy, 291
- hopcount, 128, 192
- reconstructability coefficient, 289, 290
- Hadamard product, 19
- Hadamard's inequality, 53, 335
- harmonic function, 26, 180
- Householder reduction, 312
- Householder reflections, 48, 311
- independence number, 101
- independent set, 70
- inequality
  - Bessel, 470
  - Cauchy-Schwarz, 315, 463
  - Chebyshev's sum, 70
  - Hölder, 56, 71, 315, 354
  - Parseval, 470
- integral of the Cauchy type, 268, 475
- interlacing, 97, 101, 138, 145, 170, 371, 374, 376, 444
- isoperimetric constant, 152
- Kemeny constant, 183, 292
- Kronecker product, 96, 227, 244, 390
- Kronecker's delta, xviii, 413
- Lagrange interpolation polynomial, 335, 342, 413, 429
- law
  - Kirchhoff's current law, 24
  - Kirchhoff's voltage law, 27
  - linear scaling law of the reconstructability coefficient, 290
  - Marcenko-Pastur's Law, 267
  - McKay's Law, 259
  - Ohm's law, 25
  - Wigner's Semicircle Law, 261, 264
- law of total probability, 315
- levelset of a tree, 35, 215
- line graph, 35, 38, 59, 201, 218, 272, 282
- link weight structure, 19
- majorization, 134, 383
- matrix
  - adjacency matrix, 15
  - adjoint, 339, 371
  - circulant, 194
  - community matrix, 45, 154
  - companion matrix, 349, 350
  - distance matrix, 20
  - effective resistance, 176, 292
  - Gram, 386
  - h-hops matrix, 34
  - Hadamard, 336
  - Hermitian, 355
  - incidence matrix, 16
  - inverse, 324
- Jacobi, 485
- Laplacian (admittance matrix), 17
- modularity matrix, 154, 159
- normalized Laplacian, 110
- orthogonal, 42
- permutation matrix, 41
- pseudoinverse Laplacian, 128, 176
- quotient matrix, 45, 239
- resolvent of a matrix, 159, 326, 368, 371
- signless or unsigned Laplacian, 41
- Stieltjes, 387
- stochastic
  - doubly, 43
- stochastic matrix, 20, 108, 291, 384
- Vandermonde matrix, 74, 333, 351, 407, 416
- weighted Laplacian, 19
- Matrix Tree Theorem, 121
- min-cut problem, 147
- minor, 323
- modularity, 153, 269
- multiplicity, 344, 399
- neighbor of a node, 16
- network
  - electrical resistor network, 24, 113, 122, 133, 302
  - functional brain network, 276
  - interdependent, 293
- orthogonal polynomials, 238, 240, 261, 359, 370, 465
  - associated, 474
  - Chebyshev polynomials, 259, 491
- partition, 44, 146
  - equitable, 46, 105
- path, 19
- perturbation theory, 274, 391
- polynomial
  - annihilating, 338
  - apolar, 447
  - characteristic, 322, 344
  - discriminant of a polynomial, 407, 408
  - elementary symmetric, 406
  - Gaussian, 41
  - minimal, 59, 75, 338, 424
  - monic, 400, 458, 466, 469, 471, 472
  - Newton identities, 53, 401
  - self-inverse, 412
- potential, 25, 175, 180
- power method, 353
- random walk, 108, 257
  - reflection principle, 258, 263
- reducibility, 119, 377
- regular graphs, 57, 79, 117, 126, 159, 160, 194, 198
  - strongly, 59
- resistance
  - effective, 175, 179, 181, 187, 189
  - relative, 177, 183, 189, 297, 300

*Index*

515

- sampling, 414
- scalar product, 112, 465
- Schur complement, 328
- separator, 147, 148
- Sherman-Morrison-Woodbury formula, 330
- shortest path, 19, 32, 75, 140, 167, 189
- spacing, 88, 89, 458, 460
- sparsification, 296
- spectral gap, 77, 88, 109, 110, 117, 153, 187, 221, 225, 286
- spectral radius, 51, 238
- spectral similarity, 297
- split graph, 96
- Sylvester's law of inertia, 314, 375
- Tree
  - adjacency spectrum, 86, 106, 217
  - Laplacian spectrum, 218
- triangle closure equation, 188
- Unimodal sequence, 124, 444, 478
- walk, 19
  - Eulerian, 19, 41