

Index

- adapted, 21
- almost every, 259
- almost-sure bounds, 78, 80, 96, 213, 229, 260, 262, 265
- angular asymptotics, xiii, 13, 15, 204, 208
- annealed, 305
- anomalous recurrence, xiii, 10, 19, 173
- asymptotically zero drift, 14, 79, 92, 173, 175, 202, 213, 265
- Azuma–Hoeffding inequalities, 46, 86, 268, 272
- Bessel process, 170, 172
- birth-and-death chain, 164
- Borel sets, 21
- Borel–Cantelli lemma, 37
- branching process, 110, 114, 166, 172, 310
- branching random walk, 310
- Burkholder’s inequality, 302
- central limit theorem, 155, 171
- Chapman–Kolmogorov relation, 23
- Chung–Fuchs theorem, 9, 18, 166, 173, 177
- convexity, 32
- diffusion, 90, 170
- diffusive, 136, 140, 169
- Doob decomposition, 32
- Doob’s inequality, 35
- drift condition, x
- Dvoretzky–Erdős theorem, 141
- Dynkin’s formula, 35, 43, 63, 85
- ergodic theorem, 84, 121, 167, 277
- exclusion process, 288, 297, 307
- exclusion–voter process, 288, 302, 308
- excursion, 119, 123
- excursion maximum, 39, 136
- explosion, 311, 312, 324
- filtration, 21
- Foster’s criterion, 63
- gambler’s ruin, 1, 39
- Gamma distribution, 148
- generator, 311
- growth model, 172, 310
- half strip, 165, 170
- Heaviside configuration, 288
- heavy tails, xiii, 4, 15, 224
- hitting time, 23, 24, 313
 - defective, 53, 329
 - existence of moments, 70, 96, 126, 213, 315
 - integrable, 62, 317
 - non-existence of moments, 4, 73, 96, 126, 315
 - non-integrable, 68, 127
- implosion, 311, 313, 328, 339
- increment covariance matrix, 10, 65, 109, 127, 177, 186
- increment moment function, 6, 8, 91, 97, 182, 283, 334
- inequality
 - Azuma–Hoeffding inequalities, 46, 86, 268, 272
 - Burkholder’s inequality, 302
 - maximal inequality, 41–43, 45, 85
 - for submartingales, 35
 - for supermartingales, 41
 - Kolmogorov’s inequalities, 36, 45, 86, 179, 219
 - Kushner–Kalashnikov inequality, 43

- integrable, 32
- invariance principle, 170
- irreducibility, 24, 117, 313
- Itô's formula, 317
- jump chain, 312
- Kaplan's condition, 88, 338
- Kolmogorov's inequalities, 36, 45, 86, 179, 219
- Lamperti problem, xii, 6, 91, 181, 283
 - supercritical, 153, 204, 334
- last exit time, 141, 170, 224, 235
- law of large numbers, 9, 15, 19, 123–125, 154, 171, 204
- law of the iterated logarithm, 36, 264, 267
- limiting direction, 13, 15, 204
- linear transformation, 11
- local escape, 99, 100, 118, 140, 145
- local time, *see* occupation time
- locally finite, 26, 118, 120
- Lyapunov exponent, 274
- Lyapunov function, x, 4
- Lyapunov function criterion
 - for positive recurrence, 63, 316
 - for recurrence, 49, 314
 - for transience, 52, 314
- Marcinkiewicz–Zygmund strong law, 125
- Markov chain
 - aperiodic, 24
 - conservative, 312
 - continuous-time, 312
 - countable, 24
 - criterion for positive recurrence, 63
 - criterion for recurrence, 49
 - criterion for transience, 52
 - discrete-time, 23
 - generator, 311
 - irreducible, 24
 - life time, 312
 - null recurrence, 24, 69, 94, 313
 - period, 24
 - positive recurrence, 24, 63, 68, 94, 313, 316
 - recurrence, 24, 49, 313, 314
 - regular, 312
 - stationary measure, 25, 68
 - time-homogeneous, 23
 - transience, 24, 49, 52, 60, 94, 313, 314
 - transition function, 23
 - transition probabilities, 24
- Markov property, 18, 23
 - strong, 28
- martingale, 22
 - convergence theorem
 - for submartingales, 32
 - for supermartingales, 33
 - difference, 97, 102
 - optional stopping theorem, *see* optional stopping theorem
 - orthogonality of increments, 32
 - semimartingale, x, 22
 - submartingale, 22
 - supermartingale, 22
- maximal inequality, *see* inequality
- mean drift, 6, 8, 177
- method of moments, 150, 153
- moments Markov property, 101, 171
- natural filtration, 22
- non-confinement, 99, 118, 165, 177, 186, 219, 225, 251, 255, 282
- non-degeneracy, 45, 51, 177, 179, 186
- non-dissipative, 87
- normal distribution, 148, 155
- nullity, 4, 69, 121, 147
- occupation time, 67, 121, 147, 216, 222
- open problem, 223, 307, 309
- optional stopping theorem
 - for submartingales, 33
 - for supermartingales, 34
- Oseledets multiplicative ergodic theorem, 277
- Pólya's theorem, 3, 50, 53, 108, 177
- partial sums, 3, 8
- passage time, *see* hitting time
- polling system, 310
- polynomial ergodicity, 168, 169
- power set, 21, 24
- previsible, 32
- quadratic variation, 37
- quenched, 258
- queue, 309
- random environment, 258, 273
- random matrix, 274
- random polymer, 172
- random walk, ix, 1, 7
 - branching, 310
 - centrally biased, 14, 173, 175, 202, 213, 221
 - centrally biased, discrete, 188, 219

- random walk (*cont.*)
 - controlled, 19, 175
 - elliptic, 19, 174, 190
 - excited, 310
 - in random environment, 258, 274, 304
 - linear transformation of, 11
 - multidimensional, 52, 79, 92, 100, 109, 127, 141, 173, 176, 240, 336
 - one-dimensional, 25, 28, 82, 95, 96, 141
 - oscillating, 86, 224, 239, 257
 - Pearson–Rayleigh, 9, 18, 173
 - reinforced, 310
 - simple, 2, 8, 17, 25, 28, 47, 50, 52, 82, 92, 98, 108, 141, 240, 336
- range, 175, 216, 222, 223
- rate of escape, 9, 140, 153, 204, 213, 224, 229, 265
- reaction–diffusion process, 309
- recurrence, 3, 6, 9, 24, 49, 107, 120, 178, 186, 191, 196, 203, 213, 252, 259, 265, 276, 282, 297, 299, 302, 303
- regeneration, 119
- renewal function, 144, 170
- reversible, 306
- semimartingale, x, 22
- Sinai’s regime, 260, 265, 305
- Solomon’s theorem, 259
- spatially homogeneous, 8, 13, 173
- square-difference identity, 45
- square-integrable, 32
- square-root boundary, 66, 88
- staircase, 291
- state space, 21
- stochastic billiards, 281, 307
- stochastic difference equation, 97, 102, 165
- stochastic process, 21
- stopping time, 22, 316
- string, 273
- strong law of large numbers, *see* law of large numbers
- strong Markov property, *see* Markov property
- sub-diffusive, 96, 137, 169
- super-diffusive, 154, 204
- supermarket model, 310
- transience, 3, 6, 9, 24, 52, 55, 107, 120, 178, 186, 187, 191, 195, 203, 213, 226, 253, 259, 265, 276, 282, 298
- truncation, 13
- uniform ellipticity, 14, 100, 165, 177, 186, 216, 265
- urn model, 310
- voter model, 288, 299, 307
- weak renewal theorem, 46, 86
- zero drift, 9, 50, 86, 92, 109, 127, 164, 173, 174, 177, 178, 187, 219
- zero–one law, 19