

Index

- algorithm, genetic, 134, 136, 138, 190–191, 268–269
- analysis
 - drought, 11
 - error distribution, 11
 - flood frequency, 11
 - least squares, 11
 - rainfall frequency, 11
- applications, 34
 - annual rainfall, 34, 77, *See* rainfall, annual
 - drought. *See also* drought
 - maximum daily precipitation, 34, 77, 105, *See also* precipitation, maximum daily
 - monthly discharge, 105, *See also* discharge, monthly
 - monthly sediment yield, 77, 81, 105, *See also* sediment yield, monthly
 - peak flow, 34, 77, 105, *See* flow, peak
 - total flow deficit, 130
 - TPN, 105, *See also* TPN
- approximation, density, 219
- approximation, nonnormal, 222
- approximation, series, 214
- B2, 177
- bias, 249
- Brazos River, 195
- Burr system, 40, 77, 144, 153, 159, 199, 204
 - Burr I, 44
 - Burr II, 44, 73
 - Burr III, 46, 69, 73, 137
 - Burr IV, 47
 - Burr IX, 55, 73
 - Burr V, 49
 - Burr VI, 50
 - Burr VII, 52, 73
 - Burr VIII, 54, 73
 - Burr X, 57, 70, 73, 77
 - Burr XI, 59
 - Burr XII, 61, 71, 73, 77, 137
- Burr system, generalized, 206
- Calcasieu River, 195
- CDF, 41, 62, 69
- Charlier system, 274
 - A-type, 274–275
 - B-type, 274, 276
- condition, orthogonality, 225
- constraints, 231, 245
- cumulant
 - gamma distribution, 222
- cumulants, 207, 214–215, 219, 228
- curve
 - bell-shaped, 15, 19, 21–22, 63, 166, 168, 173, 176, 178, 185–186
 - bell-shaped and skewed, 47, 61
 - bell-shaped, right skewed, 151
 - bell-shaped, skewed, 181
 - bell-shaped, symmetric, 169
 - J-shaped, 18, 22, 25, 63
 - L-shaped, 47, 50, 52, 61, 120, 147, 151, 166–167, 176, 178, 185–186, 188, 258
 - Pearson's generalized probability, 274
 - reverse S-shaped, 53
 - S-shaped, 53
 - twisted J-shape, 25
 - U-shaped, 15, 18–19, 44, 48, 173
- D'Addario system, 83, 108, 114
 - 3-parameter lognormal, 87–88
 - Amoroso, 92–96
 - Amoroso (3-parameter), 95, 106
 - Amoroso (4-parameter), 93, 107
 - Amoroso 3-parameter, 137
 - Amoroso 4-parameter, 137
 - Chi, 103
 - Davis, 89
 - exponential, 102
 - gamma, 99
 - gamma (3-parameter), 100
 - log-normal, 137
 - lognormal, 106

- D'Addario system (cont.)
 - lognormal (3-parameter), 106
 - lognormal type I, 86–88
 - Maxwell, 104, 107
 - Pareto type I, 83–84
 - Pareto type II, 85–86
 - Pearson type III, 96–97
 - Pearson type V, 97
 - Rayleigh, 104, 107
 - seminormal, 97, 108
 - Weibull, 98
- Dagum system, 115–116, 140, 151, 153, 159
 - Benini, 121
 - Dagum I, 126
 - Dagum II, 127–129
 - Dagum III, 129
 - Fisk, 124
 - log-Gompertz, 123
 - Pareto type I, 117–118
 - Pareto type II, 118–119
 - Pareto type III, 119–121
 - Singh-Maddala, 125
 - Weibull, 122
- difference, backward, 276
- discharge, monthly, 108
- discriminant
 - negative, 16, 20
 - nonnegative, 16, 18, *See also* Pearson system: type I
- dispersion, 13
- distribution elasticity, 9
- distribution systems
 - Burr, 8, *See* CH3, *See also* Burr System
 - D'Addario, 8, *See also* D'Addario system, *See* CH4
 - Dagum, 8, *See* CH5, *See also* Dagum system
 - Pareto, 8
 - Pearson, 8, *See* CH2, *See also* Pearson system
 - stoppa, 8 *See* CH6, *See also* Stoppa system
- distribution, baseline
 - beta, 222, 226–227
 - gamma, 222, 227
 - normal, 227
- distribution, empirical
 - histogram, 2
- distribution, Laplace, 253
- distribution, least biased, 231
- distributions, basic, 248
- distributions, Bessel function, 208–214
- distributions, frequency
 - 3-parameter lognormal, 5
 - Amoroso, 82, 106, *See also* D'Addario system
 - Amoroso, 3-parameter. *See also* D'Addario system
 - B1, 172–173
 - Benin, 2-parameter, 203
 - Benin, 3-parameter, 203
 - Benini. *See also* Dagum system
 - beta, 18, 224, 226, 241
 - Beta Lomax, 259
 - beta prime, 22, *See* B2, *See also* Pearson system: type VI
 - beta second kind, 177
 - beta, first kind, 172, *See also* B1
 - beta, generalized first kind, 161, 174, 188, 190–192, *See also* GB1, Esteban system, *See also* Esteban system
 - beta, generalized second kind, 161, 188, 190–192, *See also* Esteban system
 - beta, inverse. *See* B2
 - beta, second kind, 172, *See also* B2
 - beta, transformed, 177, 260, *See also* TB, *See also* GB2
 - beta-k, 177, *See also* Burr III
 - beta-kappa, 202
 - beta-P, 177, *See also* Singh-Maddala
 - BMS, 202
 - Burr I, 145, 153
 - Burr I, generalized, 145
 - Burr III, 153, 172, 176
 - Burr IV, 153
 - Burr X, 153
 - Burr XI, 153
 - Burr XII, 7, 116, 153, 176, 231, 260
 - Burr XII, generalized, 259
 - Burr, inverse, 262
 - Chi. *See also* D'Addario system
 - Chi-square, 180, 264 *See also* D'Addario system
 - Chi-squared, 218
 - Conic, general, 203
 - Dagaum I, 130
 - Dagum I, 138, 140, 182–183, 201, *See also* Esteban system, *See also* Dagum system
 - Dagum I (with location), 132
 - Dagum I, with location, 138, 140
 - Dagum II, 130, 138, 140, 201, *See also* Dagum system
 - Dagum II (with location), 133, 138, 140
 - Dagum III, 116, 201, *See also* Dagum system
 - Davis. *See also* D'Addario system
 - double exponential. *See also* Laplace, standard
 - empirical, 73, 140, 155–159, 190–192, 195, 227, 244, 246, 268
 - EVI (Gumbel), 198
 - EVI, 200
 - EVIII, 200
 - ex-exnormal, 250
 - exnormal, 250
 - exponential, 1, 6–7, 13, 34, 68, 82, 147, 161, 163, 172, 177, 180, 198, 200, 234, 240, 264, *See also* D'Addario system, *See also* Pearson system: type X, *See also* Pearson system
 - exponential, generalized. *See* Stoppa type III, *See also* Stoppa system
 - extreme value type I, 1, 7, 231, *See also* EVI

- extreme value type III, 2, *See also* EVIII
 F distribution, generalized, 177
 F, generalized, 261
 F-distribution, generalized. *See also* GB2
 Feller-Pareto, 177, *See also* GB2
 Feller-Pareto (FP), 5-parameter, 258
 Fisk, 116, 130, 140, 176, 185, 202, *See also*
 log-logistic, Dagum system, *See also*
 Dagum system
 gamma, 5–7, 34, 138, 161, 163–164, 172, 176, 179,
 194, 231, 263–264, *See also* Pearson
 system: type III, *See also* Pearson system
 gamma, 3-parameter, 137
 gamma, general 3-parameter, 188
 gamma, generalized, 161, 172, 176, *See also*
 Esteban system
 gamma, generalized 3-parameter, 174–175, 178,
 190–192, *See also* Esteban system
 gamma, inverse, 267
 gamma, inverse generalized, 264
 gamma, maximum entropy-based, 236
 GB XII, 202
 generalized Beta, second kind, 137
 generalized extreme value, 1–2, 7, 231,
 See also GEV
 generalized Pareto, 2-parameter, 242
 generalized Pareto, 3-parameter, 242
 GEV, 200
 IGG, 172
 inverse exponential, 172
 inverse gamma, 172, 265
 inverse gamma distribution, 21, *See also* Pearson
 system: type V
 inverse Gaussian, 210–211, 227, 230
 inverse Rayleigh, 172
 inverse Weibull, 172
 kappa, 2-parameter, 202
 kappa, 3-parameter, 202
 Langmuir I, 201
 Langmuir II, 201
 Laplace, standard, 253
 log-Cauchy, 172
 log-EVI, 200
 log-gamma, 263
 log-Gompertz, 116, *See also* Dagum system
 logistic, 199–200, 256
 log-logistic, 7, 200, 256, 262, *See also* LL
 log-logistic, 2-parameter, 242
 log-logistic, 3-parameter, 240
 log-lognormal, 250
 log-normal, 1–2, 6–7, 106, 138, 161, 163, 167, 172,
 194, 231, 240, 250
 lognormal, 250, *See also* LN2
 lognormal type II. *See* 3-parameter lognormal
 log-normal, 3-parameter, 138, 240, 252
 log-Pearson type III, 34, 138, 194, 231, 238,
 244, 264
 log-student-*t*, 266
 log-transformed, 249
 Lomax, 177, 186–188, 201, *See also* Pareto II,
 See Pareto type II
 Lomax, inverse, 177
 maximum entropy-based, 239, 246
 Maxwell, 106, *See also* D'Addario system
 MJ, 202
 multiplication of two first kind Bessel
 functions, 211
 multiplication of first and second kind Bessel
 functions, 212, 214
 multiplication of two first kind Bessel
 functions, 212
 multiplication of two second kind Bessel functions,
 211, 213
 normal, 2, 11, 13, 15, 17, 34, 82, 161, 163, 167,
 188, 191, 231, 240, 248, 250, *See also*
 D'Addario system, *See also* Pearson system:
 type 0, *See also* Pearson system
 normal, generalized, 177
 normal, standard, 250
 paralogistic, 261, 267–271
 inverse, 263
 Pareto, 7, 13, 161, 163, 166, 174–175, 231,
 See also Pearson system: type XI
 Pareto I, 82, 116, 140, 260, *See also* Dagum
 system, *See also* D'Addario system
 Pareto II, 82, 116, 134, 140, 260, *See also* Dagum
 system, *See also* D'Addario system
 Pareto III, 116, 260, *See also* Dagum system
 Pareto IV, 260
 Pareto, 2-parameter, 201, 242
 Pareto, 3-parameter, 201
 Pareto, generalized, 143, 201, 261, *See* Stoppa
 type II, *See also* Stoppa system
 Pareto, generalized 4-parameter, 155–159
 Pearson III, 194
 Pearson type III, 1, 34, 207, 210, 231, 264, *See also*
 D'Addario system, *See also* Pearson system,
 See also PIII
 Pearson type V. *See also* D'Addario system
 power, 144, 172
 power, generalized. *See also* Stoppa type I, *See also*
 Stoppa system
 Rayleigh, 4, 106, 172, 180, *See also* D'Addario
 system
 seminormal, 82, 106, 246, *See also* D'Addario
 system
 Singh-Maddala, 116, 130, 138, 140–141, 153, 172,
 176, 183, 185, *See also* Burr XII, *See also*
 Dagum system
 standard Gaussian, 214, 218
 Stoppa III, 143, 246
 Stoppa type II, 158
 Stoppa type III, 155–159
 Stoppa type V, 155
 uniform, 23, 67, 172, 197, 200, 240
 uniform, standard, 256

- distributions, frequency (cont.)
 - Verhulst, 203
 - Weibull, 2, 4, 6, 130, 140, 142, 161, 163, 165, 172, 180, 200. *See also* Dagum system, *See also* D'Addario system
 - Weibull, 3-parameter, 138, 241
 - Weibull, generalized, 200
- distributions, frequency
 - gamma, generalized, 264
- distributions, frequency
 - lognormal type I. *See* lognormal
- distributions, transformed, 248
- domain
 - logarithm, 239
- domain, logarithm, 195
- domain, logarithmic, 144
- drought
 - duration, 139
 - intensity, average, 139
 - time, interarrival, 139
 - total flow deficit, 130, 139, 158, 191, 227
- drought, 139
- elasticity, 115–119, 121–124, 126, 129, 140, 143, 145, 147, 149, 151, 161–162, 164–165, 167, 169, 172, 175, 177, 179, 185, 187
 - constant, 161, 166, 173
 - linear, 161
 - quadratic, 161
- engineering, water and environmental, 38
- entropy maximization, 9, 231–233, 239
- entropy maximization, Shannon, 231
- entropy, Shannon, 231, 246
- equation
 - differential, 41, 116, 143, 153
 - differential, generating, 144
- equation, differential, 8, 41
 - Burr, 41
 - cumulative distribution, 9
 - density function, 9, 11
- equations
 - differential, 225
- equations, differential, 214
- error
 - Gaussian curve, 274
- error impulse, summation of, 277
- errors, elementary, 274, 276
 - component, 274
- Esteban system, 161, 172, 177, 179, 182, 185, 187
 - beta, generalized second kind, 175, *See also* GB2
 - gamma 3-parameter, 137
 - gamma, generalized 3-parameter, 162–169
 - GB1, 169–175
 - generalized Beta, second kind, 137
- estimation, parameter
 - entropy, 232
 - indirect method of moment (IDMOM), 34, 244
 - maximum likelihood, 34, 73, 106, 130, 138, 154–159, 188, 227, 267, 269
 - parameter-space expansion, 232
- EVI, 5, 240
- EVIII, 240
- expansion, 207, 217
 - Gram-Charlier, 227
 - Taylor series, 216
- expansion, Taylor series, 179
- flow peak, 195
- flow, peak, 73, 108, 130, 136, 157, 190, 227, 244, 267–268
 - Burr system, 73
 - Pearson system, 37
- FP, 259–263
- freedom, degree of, 219
- frequency, genetic theory of, 274
- function
 - cumulative distribution, 40, 68, 143, 194, *See also* CDF
 - decreasing, 151, 173, 178, 198
 - gamma, 91
 - increasing, 173, 198
 - independent, 195
 - monotone increasing, 42–43
 - monotonic decreasing, 143
 - nondecreasing, 40, 42–43, 45–47, 50, 53, 57, 59
 - positive continuous, 115
 - probability density, 40, 68, 145, 147, 161, 194, *See also* PDF
 - probability generating, 82, *See also* PGF
 - survival, 143, 199, 206
 - transformation, 82
 - trigonometric, 59
 - zeta, 91
- functions
 - auxiliary, 275
 - baseline density, 217
 - Gaussian, 214
 - characteristic, 215–216, 222
 - continuous and differentiable, 275
 - convex, 243
 - cumulant generating, 215, 222
 - density, 218
 - hypergeometric, 224
 - Lagrangian, 232
 - moment generating, 215–216
 - nondecreasing monotonic, 251
 - objective, 233, 243
 - partition, 243
 - probability density, 217, 219, 232
 - strictly convex, 233, 243
 - transformation, 259
- functions, Bessel, 9, 207–214, 228
 - first kind, 211
 - first kind, modified, 208
 - second kind, 210

- second kind, modified, 208
 - third kind, modified, order 1, 210
- functions, generating, 9
- gage height, 195
- Gaussian density, standard, 218
- GB1, 175
- GB2, 176, 187
- GEV, 5, 241
- Johnson family, 250
 - SB, 250, 252
 - SB', 253
 - SL, 250–251, 267–271, *See also* log-normal, 3-parameter
 - SL', 253
 - SU, 250, 252
 - SU', 253
- Kronecker delta, 215
- kurtosis, 13
 - excess, 217, 239
- kurtosis, sample excess, 239
- kurtosis, standard error, 243
- Laplace, first law of, 250
- L_B , 256
- line, Bessel function, 209
- L_L , 256
- LN2, 5
- log-EVI, 240
- log-space, 249
- LPIII, 5, 7, 241
- L_U , 257
- maintenance-of-variance-extension, 249, *See also* MOVE
- matrix, Hessian, 244
- method, Newton, 243
- moment ratio, 253
- moments
 - cumulative, 64, 67–68
 - fourth, noncentral, 243
 - sample, 243
- moments, central
 - fourth, 13, *See also* kurtosis
 - second, 13, *See also* dispersion
 - third, 13, *See also* skewness
- moments, sample, 238
- multiplier, Lagrange, 232, 234, 243–245, 247
- multipliers, Lagrange, 238
- nitrogen, 195
- nonextremes, 249
- observations, empirical, 194
- orthogonal, 223
- orthogonality, 215
- parameters, distribution, 9, 39, 63, 232–233, 238, 272
- parameters, population, 249
- Pareto law, weak, 161
- PDF, 51, 62, 69, 208
 - maximum entropy-based, 235
- Pearson system, 11, 38, 197
 - beta distribution first kind, 13, *See also* Type I
 - beta distribution second kind (F), 13, *See also* type VI
 - differential equation, 11–12
 - Pearson's diagram, 26
 - type 0, 17
 - type I, 12, 17–18
 - type II, 13, 18–19
 - type III, 13, 19–20
 - type IV, 12, 20–21
 - type IX, 13, 24
 - type V, 13, 21
 - type VI, 12, 22
 - type VII, 13, 22
 - type VIII, 13, 23
 - type X, 13, 25
 - type XI, 13, 25
 - type XII, 25
- periodicity, 189
- PGF, 82, 85
- PIII, 7, 241
- polynomial
 - Hermit, 226
 - Jacobi, 222, 225–227
 - Laguerre, 223, 226–227
 - Laguerre, generalized, 222
 - Laguerre, n-th order, 222
- polynomial, Chebyshev Hermite, 214–215, 218
- polynomials
 - Chebyshev Hermite, 219
- precipitation, daily maximum, 77, 111, 130, 138, 158, 227, 267–268
 - Pearson system, 37
- principle, maximum entropy, 232
- probability, total, 82, 84–85, 87, 90, 92, 95–97, 99–105, 145, 162–169, 173–175, 178, 181–182, 184, 186–187
- quantile, 249
- rainfall, annual, 156, 191, 267, 269
 - Burr system, 73
 - Pearson system, 36
- regression, linear, 144
- relation, revursive, 215
- sediment yield, monthly, 77, 130, 134, 136, 155, 227, 244, 267
- series
 - binomial, 65
 - Edgeworth, 219
 - Edgeworth type A, 214

- series (cont.)
 - Gram-Charlie, 219
 - Gram-Charlier type A, 214
- series, Gram-Charlier type A, 218
- series, Taylor
 - second order, 244
- series, transformed, 249
- Singh system, 194, 199, 206
- size, sample, 243, 249
- skewness, 13, 217
- sources
 - independent, 274
- space, arithmetic, 249
- space, probability, 217
- statistics, mathematical, 274
- statistics, order, 249
- Stoppa system, 143–144, 151, 153, 159, 199, 205
 - Pareto, generalized 4-parameter, 150, 154
 - Stoppa type I (exponential, generalized), 145
 - Stoppa type II, 154
 - Stoppa type II (Pareto, generalized), 145–147
 - Stoppa type III, 154
 - Stoppa type III (exponential, generalized), 147
 - Stoppa type IV, 148
 - Stoppa type V, 149, 154
- Stoppa system, generalized, 206
- symmetry, 19
- tail, heavy, 195
- TB, 260–263
- theory, cumulative moments, 40, 63, 67–68
- theory, entropy, 244
- TPN, 109, 189
- transformation
 - beta distribution, 257
 - Box-Cox, 249
 - exponential, 248
 - Fourier, 219
 - gamma distribution, 263
 - inverse, 264
 - inverse power, 265
 - linear, 245, 248, 266
 - linear, with location, 264
 - log, 249, *See also* transformation: logarithmic
 - logarithm, 263, 266
 - logarithmic, 248
 - logistic distribution, 256
 - log-linear, with location, 264
 - modulus, 250
 - monotonic nondecreasing, 251
 - nonlinear, 249
 - Pareto-type, 258
 - power, 248, 264
 - power, two-step, 250
 - probability density, 185
 - SMEMAX, 248
 - SMEMAX, modified, 248
 - student-*t*, 265
- transformation, probability, 278
- transformations, 9
- translation, method of, 250
- USGS 08015500, 195
- USGS 08096500, 195
- variable
 - Chi-squared, standardized, 219
 - dependent, 11
- variable, baseline, 217
- variable, difference, 217
- variable, random, 40, 194, 214, 216–217, 250, 275
 - continuous, 40, 194, 231
 - identically distributed, independent, 227
 - identically distributed, nonindependent, 227
 - independent, 218
- variable, transformed, 245
- variance, 249
- vector, gradient, 244
- water quality, 189