

Subject Index

- Algorithms
 - bootstrap, 128
 - Drees-Kaufmann, 128
 - Gibbs sampler, 434
 - least squares, 6
 - Metropolis-Hastings, 433
 - optimal sample size, 205
 - weighted least squares, 108
- Angular component, 284
- Asymptotic independence, 285, 342–365
- Automobile insurance, 25, 188–199
- Auxiliary function, 49, 56

- Bandwidth, 238
- Bayesian methods, 429–459
 - in Fréchet-Pareto case, 435–445
 - in general case, 445–452
- Beirlant-Vandewalle estimator, 353
- Benktander II distribution, 72
- Bessel function, 311
- Beta distribution, 68, 69
- Bias reduction
 - Fréchet-Pareto case, 113–119
 - general max-domain of attraction, 165
 - negative, 308
- Block maxima
 - in Bayesian methodology, 434
 - in multivariate case, 313–325
 - in regression, 211–218
 - in time series, 376
 - in univariate case, 132–140
- Bonferroni inequality, 285
- Bootstrap, 126, 235, 409
- Boundary, 48. *See also* Endpoint
- de Bruyn conjugate, 57, 66, 79
- Box-Cox transformation, 52
- Burr distribution, 59, 60, 63
 - reversed, 68

- Capéraà-Fougères-Genest estimator, 317
- Cauchy distribution, 60
- Censored likelihood estimation, 336, 409
- Central limit problem, 45
- Cluster, 382
 - functional, 386
 - maximum, 387, 388, 399
 - size, 387
 - statistics, 386, 406
- Coefficient of extremal dependence, 343–345
- Coefficient of tail dependence, 346–354
- Concomitant, 289
- Condroz data, 34, 177–187, 213–241
- Continuity correction, 5, 19
- Convergence in distribution, 47

- Copula, 272, 281, 288, 343
 Cubic spline, 234
- Decustering, 389, 392, 425
 Dependence, 252
 complete, 260, 266
 positively quadrant, 266
 Dependence function
 asymptotic complete, 286
 Pickands, 267, 308, 314
 estimation, 330
 stable tail, 257, 283
 estimation, 318, 326
 tail empirical, 327
 Dependence parameter, 318
 Dependent variable, 210
 Diamond data, 34–40, 220–225
 Draisma *et al.* estimator, 351
- Earthquake data, 32, 200–208
 Elemental percentile method, 151, 163
 Empirical distribution function, 2
 Empirical quantile function, 3
 Endpoint
 estimation, 158
 Event profile function, 301
 Exceedance, 277
 Exceedance probabilities
 Fréchet-Pareto case, 122
 exponential regression,
 156–160, 167
 Excess-of-loss treaty, 14, 188, 241
 Excess over threshold, 388
 Exponent measure, 255, 279, 284
 estimation, 328, 357
 Exponential distribution, 72, 84
 memoryless property, 15
 order statistics, 109
 Exponential family, 210
 Exponential regression model,
 109–117, 155, 165–167,
 191
 with covariates, 218–225
- Extremal coefficient, 273
 estimation, 331
 Extremal domain of attraction
 condition, 49, 73, 74
 multivariate, 253, 275–287
 problem, 46, 51
 solution, 56–58, 65–67,
 69–72
 Extremal index, 376–381, 405
 estimation, 390–392
 multivariate, 421–424
 Extremal limit problem
 for maximum, 46–51
 for k -th largest order statistic,
 84–90
 for multivariate stationary
 process, 419–425
 for time series, 371–375
 Extremal types, 50, 75
 Extreme quantiles
 conditional, 216–218,
 223–225, 231–233
 in Fréchet-Pareto case,
 119–123
 general case, 135–137,
 156–160
 Extreme value condition, 49, 73, 74
 Extreme value distribution, 47. *See*
 also Generalized extreme
 value distribution (GEV)
 multivariate, 254
 estimation, 326–337
 of type I, 69
 of type II, 58
 of type III, 67
 simple multivariate, 256
 Extreme value index (EVI), *see also*
 Generalized extreme value
 distribution, Pareto-type
 index, Peak-over-threshold
 exponential regression, 155,
 165
 generalized quantile estimator,
 143–146

- Pickands' estimator, 140–143
- moment estimator, 142
- Faces, 263
- Farlie-Gumbel-Morgenstern copula, 347
- F -distribution, 59, 60
- Finance, 31–32, 251. *See also*
 - Loss-ALAE data;
 - Standard & Poors 500
- Fire insurance, 11, 16, 29, 241–250
- Fréchet distribution, 52, 59, 60
- Fréchet-Pareto class, 56–65, 99–129. *See also*
 - Pareto-type
- Fréchet-Pareto index, *see*
 - Pareto-type index
- Frequency measure, 301
- Functional equation
 - Cauchy, 49
 - second order, 91
- Gamma distribution, 72, 84
- Generalized extreme value distribution (GEV), 132, 374
 - confidence interval, 137
 - estimation, 132–135
 - extremal quantiles, 135–137
 - with covariates, 211
- Generalized linear model (GLM), 210
- Generalized quantile estimator, 144, 172, 174
- Generalized residuals, 219
- General liability insurance, 31
- Geology, 32–40. *See also* Condroz data; Diamond data; Earthquake data
- Goodness-of-fit methods, 9
 - exponential regression model, 222
 - GEV with covariates, 213
 - local polynomial ML, 240
 - POT with covariates, 229
- Graphical tools, 3–19
- Gumbel
 - class, 69–73
 - distribution, 50, 215
- Hall class, 61, 87, 93, 125, 212
- Hazard function, 60
- Highest posterior density, 430
- Hill estimator, 15, 74, 101–107, 350, 426, 437
 - asymptotic bias, 111
 - asymptotic normality, 104, 111
 - asymptotic variance, 111
 - bias reduction, 113–118
 - mean squared error, 125–128
- Huang's level sets, 270
- Hydrology, 19–21. *See also* Rainfall data; River discharges
- Inclusion-exclusion formula, 378, 420
- Information matrix, 133, 169, 319, 431
- Intensity function, 170
- Insurance, 24–31, 441–451. *See also* Automobile insurance; Fire insurance; Medical insurance; Reinsurance
- Inverse function, 48, 76
- Inverse gamma distribution, 59
- Jeffreys' prior, 431
- Joint tail modelling, 354–365
- Kendall's tau, 274
- Kernel estimators, 108, 112, 316
- Kernel weighted likelihood, 238
- Ledford-Tawn model, 354
- Link function, 210
- Loggamma distribution, 59, 60, 63
- Logistic distribution, 72, 73
- Lognormal distribution, 10, 72, 73
- Log-spacings, 109–113, 219, 220

- Long-range dependence, 373
- Loss-ALAE data, 298–300, 321–325, 338–342, 348–350, 353–356
- Marginal ordering, 253
- Markov Chain Monte Carlo (MCMC) techniques, 430
- Markov-chain models, 401–418
 - higher-order, 412
 - target distribution, 433
- Maximal average data information (MDI), 432
- Maximum
 - in time series, 371–381
 - of iid sample, 46–76
- Maximum likelihood method
 - Fréchet-Pareto case, 122
 - general case, 132, 137, 149
 - with covariates
 - exponential regression model, 219
 - GEV, 212
 - local polynomial, 238
 - penalized, 234
 - POT, 226
- Max-infinite divisibility, 255
- Max-stability, 255, 265–267, 273
- Mean excess
 - function, 14, 74, 104
 - plot, 14–19, 189
- Mean residual life, 14
- Mean squared error, 125
- Medical insurance, 25–29, 123, 144, 152, 156
- Metallurgy, 40–42.
- Meteorology, 21–24. *See also*
 - Temperature data; Wind speed data
- Method of moments, 150, 159, 162
- Mixed-integer programming, 227
- Mixed model, 198, 320
- Mixing conditions
 - $D(u_n)$, 372
 - $D(\mathbf{u}_n)$, 420
 - $D'(u_n)$, 378
 - $D'(\mathbf{u}_n)$, 420
 - $\Delta(u_n)$, 383
 - $\Delta^\phi(u_n)$, 400
 - strong, 373
- Moment estimator, 142, 173
- Multivariate models
 - bi-extremal model, 305
 - circular model, 311
 - Dirichlet model, 312
 - Gaussian model, 309
 - Gumbel model, 305
 - logistic model
 - basic, 304, 319, 347, 405
 - bilogistic, 305, 410
 - bivariate asymmetric, 264, 304, 320, 402, 409
 - multivariate, 305, 308, 310
 - negative, 307, 410
 - mixed model, 320
 - piecewise algebraic model, 312
 - Tajvidi's model, 305
 - time series logistic model, 307
- Net premium, 14, 188
- Network traffic, 42
- Nonparametric methods, 233–250
- Normal distribution, 10, 45, 85
- Objective prior, 431
- One-way ANOVA, 204
- Order restrictions, 302
- Order statistics, 14, 83, 382–385.
 - See also* Maximum, intermediate, 289
 - k -th largest, 84, 100
- Pareto distribution
 - bounded, 61
 - generalized (GP(D)), 59, 60, 118, 147, 351, 389. *See also* peaks-over-threshold multivariate, 278, 328

- perturbed, 118, 122
 - strict, 11, 56, 61, 64, 103, 109, 118,
 - type, 56, 62–65
- Pareto-type index, *see also* Hill estimator
 - generalizations of Hill estimator, 107
 - confidence intervals, 115
 - second order aspects, 117
- Peaks-over-threshold (POT)
 - asymptotic normality, 162
 - basic model, 147–149
 - confidence intervals, 159
 - estimators, 149–154
 - second order, 163–165, 171
- Peng estimator, 351
- Pickand’s estimator
 - multivariate, 315
 - univariate, 140–142
- Posterior predictive density, 430
 - probability, 431
 - quantile, 431
- Potter bounds, 79, 82
- Prior elicitation, 430
- Probability integral transform, 109, 265
- Probability-probability (pp-) plot, 12–14, 63
- Probability-weighted moments, 133–138, 150, 159, 162
- Process
 - compound Poisson, 170, 382, 394
 - linear, 425
 - max-autoregressive (ARMAX), 374, 384
 - max-stable, 300, 311, 366
 - moving-maximum, 369
 - multivariate, 423
 - multivariate stationary, 419
 - non-stationary, 428
 - point, 147, 169–171, 280, 285, 334–336, 362–365 382–400
 - marked, 170, 382
 - two-dimensional, 399
 - Poisson, 147, 170, 362
- Profile likelihood, 138, 160, 220, 226
- Pseudo-polar coordinates, 258, 284
- Quantile
 - estimation, 10, 90, 163
 - function, 1, 48
 - local plot, 240
 - regression method, 227, 232
- Quantile-quantile (qq-)plot, 3–11, 63, 101
- Rainfall data, 19–21, 251, 301
- Ratio estimator, 103, 428
- Rayleigh distribution, 92
- Regression methods, 209–250
- Regular variation, 49, 77–82. *See also* Second order regular variation
 - multivariate, 283, 287
- Reinsurance, 29–31, 188–199, 241–250
- Representation
 - dependence function, 270
 - extreme-value distributions, 293–295
 - log-spacings, 110
 - Rényi, 103, 109, 155, 166
 - slowly varying functions, 78
 - spectral measure, 258, 300
- Resampling, 126
- Residual quantile plot, 215
 - with covariates, 225–233
- Response variable, 210
- Return period
 - definition, 21
 - estimation, 10
- Risk measures, 32

River discharges, 21, 51–55, 135,
138, 251, 436–440

Score statistic, 319

Second order regular variation
90–94, 97

Slow variation, 49, 346. *See also*
Regular variation
bivariate, 354

Spatial extremes, 366

Spearman's rho, 274

Spectral
decomposition, 258
density, 262, 292
function, 265
measure, 258, 284, 288, 301,
402
estimation, 328, 358–361

Stable distribution, 45

Standard & Poors 500, 32

Stirling's formula, 95

Tail array sums, 399

Tail chain, 404

Tail probability, *see* Exceedance
probabilities

Tail quantile function, 48, 77

Tail sample size, 123–129
Fréchet-Pareto case, 123–129
general case, 167
optimal, 174

t - distribution, 59, 60, 106

Temperature data, 21–24, 251, 375,
395–398, 413–418

Theorem
central limit, 85
Fisher-Tippett-Gnedenko, 75
de Haan-Stadt Müller, 91
Helly-Bray, 47, 84
Karamata, 78
law of large numbers, 47, 86
Lindeberg-Feller, 112
uniform convergence, 78
Von Mises, 60, 69, 73

Threshold dependence, 144

Triangular array, 290, 311

Uniform distribution, 65, 68, 69

Unit simplex, 260

Vague convergence, 280

Value-at-risk (VaR), 32

Von Mises distribution, 311

(extremal) Weibull class, 65–69

(classical) Weibull distribution, 11,
16, 72, 73, 92

Weighted least squares estimator,
107

Weissman estimator, 120, 125, 441

Wicksell's corpuscule problem, 40

Wind speed data, 1, 7, 16, 21–24,
144, 301, 311, 452–459

Zipf
estimator, 144, 173, 174
law, 42