

Index

- allocation of the economic capital, 69
- arbitrage, 277, 281, 282, 284, 286
- Archimedean copulas, 16
 - Laplace transform-A. c., 29
 - LT-A. c., 29
 - simulation, 29
- Asian option, 284, 290
- asymptotic independence, 177
- at-the-money volatility, 225
- autocorrelation, 278, 284, 285, 289

- backtesting, 190, 198, 200, 205–207, 212–215
- Basel II Accord, 85, 97
- basket default swaps, 235
- basket option, 219
- Bernstein copula, 220
- Bernstein polynomial, 223
- best-of-two-assets option, 225
- beta kernels, 51
- Black–Scholes formula, 275
- Black–Scholes model, 219, 276, 278, 279, 282
- “bottom up” aggregation, 87, 98
- boundary bias, 42
- business risk, 89, 93
- butterflies, 225

- characteristic functions, 117, 123–125, 128
- Cholesky decomposition, 71
- Clayton copula, 17, 114, 181
 - simulation, 172
 - tail dependence, 26
- coherent risk measure, 133
- comonotonic RVs, 10
- comonotonicity copula, 12
- compound Gamma copula, 116, 118
- compound Gamma distribution, 116
- comprehensive, 13, 191

- conditional default probability, 166
- conditional distribution, 194
- conditional distribution, derived from copula, 9
- confidence level, 205, 206
- Cook–Johnson copula, 114
- copula, 3, 92
 - absolutely continuous component, 8
 - Archimedean c., 16, 29
 - bounds of, 9
 - Clayton c., 17, 26
 - comonotonicity c., 12
 - comprehensive, 13
 - conditional distribution, 9
 - countermonotonicity c., 12
 - definition, 5
 - density, 8
 - Frank c., 18, 29
 - Gaussian c., 13, 27, 28
 - generalised Clayton c., 18
 - generalised Cuadras–Augé c., 19
 - generator, 17
 - Gumbel c., 16, 26, 29
 - Gumbel–Hougaard c., 16
 - independence c., 12
 - Laplace
 - transform-Archimedean c., 29
 - LT-Archimedean c., 29
 - Marshall–Olkin c., 19, 30
 - multivariate Gaussian c., 14
 - properties, 5
 - simulations from c., 27
 - singular component, 8
 - Student c., 15, 27, 28
 - t*-copula, 15, 27, 28
 - table of, 34
- copula approach, 87
- copula density, 40, 41
- copula function, 166

- correlation, 21, 166, 189, 192, 198, 200, 202–204, 214, 215
 rank c., 22
 correlation matrix, 14, 66, 68, 71
 correlation matrix approach, 87, 88, 94, 96
 countermonotonic RVs, 10
 countermonotonicity copula, 12
 covariance of default times, 179
 credit derivatives, 149
 credit risk, 85, 89, 93, 104
 CreditMetrics, 64, 112
 CreditRisk+, 93, 109, 113, 115
 CreditRisk+ default copula, 113
 CSFP, 109
 currency options, 219
 curse of dimensionality, 39

 default time
 correlation, 179
 density, 168
 distribution, 169
 simulation, 167, 174
 default times, 165
 scatterplot, 178, 180
 dependency coefficients, 92, 94
 distribution function, 192–196
 diversification effects, 86, 87

 economic capital, 63, 65, 69, 70, 85, 120, 152
 elliptical copulas, 247
 elliptical distributions, 21
 exotic equity derivatives, 276
 expected exposure, 140
 expected shortfall, 69, 70, 75, 133, 153
 exposure management, 141

 factor copula models, 150
 factor model, 157
 fat tail, 190, 214
 Feynman–Kaç formula, 225
 foreign exchange, 219
 Fréchet, 10
 Fréchet–Hoeffding bounds, 11, 12, 191
 frailty, 155

 Frank copula, 18, 42, 190, 191, 194, 195, 199, 202–207, 209, 210, 213–216
 simulation, 29

 Gaussian copula, 13, 69, 70, 72, 81, 92, 94, 99, 119, 121, 122, 176, 189, 192, 197, 206, 209, 215
 density, 248
 multivariate, 14
 simulation, 28, 169
 tail dependence, 27
 generalised Clayton copula, 18
 generalised Cuadras–Augé copula, 20
 generalised inverse, 6, 37
 generator, 168
 generator of copulas, 17
 Gumbel copula, 16
 simulation, 29
 tail dependence, 26
 Gumbel–Hougaard copula, 16, 189–191, 194, 195, 199, 202–204, 207, 209, 210, 213–216

 hedging simulation behaviour, 269
 hedging within the Gaussian copula, 260
 historical data, 196, 198, 200, 201, 214
 historical simulation, 189, 191, 207–209, 212, 213, 215
 Hoeffding, 10
 Hull–White equity model, 278, 279

 implied correlation (currency options), 220
 implied volatility, 227, 275, 277, 280, 282
 implied volatility smile, 227
 importance sampling, 243
 independence, 191, 204, 210, 215
 independence copula, 12

 joint distribution function, 194, 197, 198, 200, 202, 209
 joint loss distribution, 69, 72

- Kendall's tau, 24
 kernel density estimator, 66, 67
 kernel method, 38
 KMV, 112

 L^2 -distance, 222
 Lévy's Continuity Theorem, 125
 Laplace transform Archimedean copulas, 29
 latent variables, 175
 Latin hypercube, 55
 Li model, Gaussian copula model, 239
 Li's model, 112
 likelihood ratio method, 249
 linear correlation, 21
 local volatility, 276, 281, 282, 289–291
 lognormality, 219
 lookback option, 289
 lower tail dependence, 171
 LT-Archimedean copulas, 29

 marginals, 4
 market risk, 85, 89, 93, 102
 Marshall–Olkin copula, 19
 simulation, 30
 maximum likelihood method, 197, 198
 mirror image, 47
 mixed multifactor model, 104
 mixture of lognormals, 226
 mixtures of distributions, 21
 Monte Carlo simulation, 70, 72, 76, 79, 100, 104, 189–191, 196, 197, 206, 216
 multifactor model, 87, 98, 102
 multivariate Gaussian copula, 14
 multivariate options, 219
 multivariate t -distribution, 15

 negative binomial, 118
 Newton–Cotes formula, 73

 operational risk, 85, 89, 93, 105
 option delta, 228
 option-implied distributions, 221
 options, 219
 over-the-counter (OTC), 225

 Pathwise method, 251
 PD term structure, 165, 167
 Poisson mixture model, 113, 115
 Portfolio Manager™, 104
 potential future exposure, 140
 product copula, 191
 pseudo random numbers (PRNs), 190, 194, 195, 199, 200, 214–216
 pseudo-observations, 42

 Q -matrix, 168
 quadratic variation, 281
 quantile, 205–207
 quanto option, 221
 quasi MC method, 110, 119
 quasi-inverse, 195

 rank correlation, 22
 rectangle inequality, 6
 risk factors, 87, 97, 105
 risk type, 85, 87, 88, 92, 94, 97, 105
 risk-neutral measure, 221
 risk-neutral probability, 277
 risk-reversals, 225

 second-to-default basket, 181
 second-to-default likelihood, 184
 simulation from copulas, 27
 Sklar's theorem, 7, 194, 222
 Spearman's rho, 23
 spherical distribution, 21
 spread option, 225
 stochastic processes, 142
 stress tests, 148
 strict
 generator of copulas, 18
 Student copula, *see t-copula* 15
 Student t -copula, 69, 72, 81, 92, 93, 95, 119, 121, 122, 176, 189
 simulation, 170
 Student t -distribution, 190, 192–194, 196–200, 205–207, 209–211, 213–216

 t -copula, 15
 simulation, 28
 tail dependence, 27

- tail behaviour, 211
- tail dependence, 25
- tail dependence of Student t , 172
- theorem
 - Sklar, 7
- time copula, 277–279, 282, 283
- “top level” aggregation, 87, 96
- transformed kernels, 48
- trapezoidal rule, 67, 73, 75
- triangular arbitrage, 221
- uniformly distributed random variables, 194, 195
- upper tail dependence, 171
- value-at-risk (VAR), 89, 94, 101, 189, 190, 194, 197, 198, 200–202, 204, 205, 207–215
- variance swap, 284
- variance–covariance method, 189, 191, 207–209, 212, 215