

# Index

Page numbers in italics refer to figures.

- a posteriori segmentation, 156
- a priori segmentation, 155
- A-not A method, 80, 93
- abnormality detection, 99
- acceptance data, 9–10, 112, 113, 115, 157–8
- additional consumer attributes, 147–9, 163–4
- additional sample attributes, 149–52
- additive consumer effects, 135
- AIC (Akaike's information criterion), 123, 232
- ANCOVA (analysis of covariance), 115
- ANOVA (analysis of variance) (*see also* Brockhoff–Sommer ANOVA model, mixed model ANOVA, multi-way ANOVA, one-way ANOVA, three-way ANOVA, two-way ANOVA), 113–15, 193–4
  - model diagnostics, 241–4
  - relationship to regression analysis, 232–3
- ASCA (ANOVA simultaneous component analysis), 64–5
- assumptions (model diagnostics), 241
- auctions, 9
- average preferences, 135
  
- base alternatives, 121
- Bayesian statistics, 258
- beta-binomial models, 89, 90–2
- bi-plots, 216–17
- BIBDs (balanced incomplete block designs), 189
- binomial distribution, 177–8
- blind tasting, 6
- block experiment designs (blocking), 185, 188–90
- box plots, 16, 17, 99, 169, 170
- Bradley-Terry-Luce method, 123
  
- Brockhoff assessor model, 52
- Brockhoff–Sommer ANOVA model 52
  
- categorical models, 56
- categorical variables, 115, 117, 178, 234–5
- CCDs (central composite designs), 187
- chaining effects (cluster analysis), 252
- chemical methods, 68
- chi-square test, 178, 179
- choice based methods, 120–3
  - segmentation, 162–3
- choice data, 3
- choice sets, 122
- choice tests 9
- circular models, 143
- cluster analysis/clustering, 147, 157–9, 160, 249–51
  - FCM (fuzzy clustering method), 161–2, 162, 254–6
  - finite mixture model clustering, 162, 258–9
  - hierarchical clustering, 251–3
  - K-means clustering, 254
  - noise clustering, 257–8
  - residual distances, 256–7
  - sequential clustering, 257, 258
  - simultaneous clustering, 160–3
- cluster matrices, 259–60
- collinearity problem (regression), 230–1, 237
- complete block experiment designs, 189
- complete linkage, 252
- confidence intervals, 171
- conjoint data, 106
- consensus matrices, 265
- consensuses, 70
- consonance analysis, 34–5
- consumer data, 219–20
- consumer effects, 117

- consumer loadings, 132, 133–5, 137, 138, 142  
 consumer studies, 1, 2  
 consumer variables, 115  
 contingency tables, 178  
 continuous models, 56–7  
 continuous variables, 115, 117–18, 166, 234–5  
 control charts, 172  
 control limits, 172  
 correction methods  
   scaling differences, 40–3  
   unreliable assessors, 43–4  
 correlation, 173–5  
 correlation loadings, 22–3, 61, 134, 137, 138, 217–19  
 correlation plots, 30–2  
 covariance, 174  
 covariance criterion 238  
 covariance matrices, 175  
 cross-validation, 119, 232, 235, 239, 240–1  
 CVA (canonical variate analysis), 62
- data (statistics), 165  
 data compression methods, 236  
 data matrices/tables, 210–11  
 data sets, 97–8, 128  
 degrees of freedom, 167–8, 194  
 dendrograms, 252–3  
 descriptive sensory analysis, 5–6, 67  
 design factors, 108  
 design of experiments (*see* experiment designs)  
 difference tests (*see* discrimination tests)  
 discriminant analysis, 244–5, 246  
 discrimination tests, 7, 79–6  
   comparison with similarity tests, 87–9  
   level 1 analysis, 81–2  
   level 2 analysis, 82  
   power analysis, 85–6  
   Thurstonian approach, 81, 82–5, 86–7  
 distributions (statistics), 166, 167–9
- eggshell plots 33, 34  
 elliptic models, 143  
 empirical validation, 220–1  
 error variance, 176  
 estimates, 169  
 experiment designs, 102–6, 181–91  
   block designs, 188–90  
   fractional factorial designs, 103, 104–5, 187–8  
   full factorial designs, 104, 185–7  
   nested designs, 190–1  
   power, 191  
   product presentation, 105–6, 189–90  
   split-plot designs, 106, 190
- explained variances, 213, 217, 221, 239  
 extended ANOVA tables, 53  
 external preference mapping (PREFMAP), 131, 132, 133, 137, 141, 159  
 external validation, 68, 72–4
- F-distribution 167, 168  
 F-values, 28, 29, 43  
 factor analysis (FA), 224–5  
 factor effects, 98–9, 106–7, 108  
 FCM (fuzzy clustering method), 161–2, 162, 254–6, 260  
 filtered data, 44  
 finite mixture model clustering, 162, 258–9  
 formal equivalence testing, 88  
 fractional factorial experiment designs, 103, 104–5, 111, 150, 184, 187–8, 201–3  
 free choice profiling, 36  
 Friedman test, 120, 271  
 Frobenius norm, 265  
 full factorial experiment designs, 104, 184, 185–7, 188  
 fuzzy clustering method (FCM), 161–2, 162, 254–6, 260
- GCA (generalised canonical analysis), 74, 75, 267–8  
 gender effects, 113–15  
 generators, 188  
 GLMs (generalised linear models), 245–6  
 GPA (generalised procrustes analysis), 74, 264–5
- hierarchical clustering, 251–3  
 histograms, 16, 17, 99, 166  
 homogeneity tests, 179–80  
 hypothesis testing, 169–72, 176–8, 179–80
- ideal point preference mapping, 130, 132, 141–3, 144, 162  
 IIA (independent of irrelevant alternatives) assumption, 122  
 incomplete block experiment designs, 189  
 individual assessor matrices, 36  
 individual effects, 116  
 individual line plots, 33–4, 35  
 INDSCAL (individual MDS) method, 271  
 industrial experiments, 186  
 interactions, 182, 185–6, 198, 199  
 internal preference mapping (MDPREF), 131–2, 133, 134
- joint ANOVA approach, 108–11  
 joint modelling, 118

- K-means clustering, 254, 256  
 Kruskal-Wallis test, 271
- L-PLS regression, 149, 273  
 latent classes, 122  
 least squares, 175  
 level 0 analysis, 81, 90, 93  
 level 1 analysis, 80, 81–2, 90  
 level 2 analysis, 80–1, 82, 90  
 level 3 analysis (*see* Thurstonian approach)  
 leverage, 222, 223, 242, 244  
 line plots, 16–18  
 linear combinations (vectors), 213  
 linear preference mapping, 129–41, 144  
 linear regression (*see also* multiple regression), 175–7  
 loading values, 212  
 loadings plots, 216  
 logit model, 122, 123  
 LS-PLS method, 71, 76  
 LSD (least significant differences) lines, 51
- Mahalanobis distance, 251  
 Manhattan plots, 24, 25  
 Mann Whitney test, 271  
 MANOVA (multivariate ANOVA), 59–62  
 market share simulation, 123  
 maximum likelihood (ML) estimate, 246, 270  
 maximum utility model, 123  
 MDS (multidimensional scaling), 271  
 means (statistics) 168, 169, 170  
 medians, 169  
 MFA (multiple factor analysis), 268  
 missing cells/values, 18–19, 273  
 mixed model ANOVA, 18–19, 43, 203–5  
 model diagnostics, 241–4  
 model validation (*see* validation)  
 MSC (multiplicative signal correction) transforms, 42  
 MSE (mean square error) values, 28, 29  
 multi-way ANOVA, 56, 57, 200–1  
 multinormal distributions, 258  
 multinomial regression, 121, 246  
 multiple regression, 68, 229–32  
   model diagnostics, 241–4  
   variable selection, 235  
 multivariate analysis, 15, 19  
 multivariate sensory data, 58–65
- N-PLS (N-way PLS regression), 269  
 naive analysis, 91  
 nested experiment designs, 190–1, 205  
 NIPALS method, 220  
 NIR (near infrared) spectroscopy, 71, 74
- noise clustering, 257–8  
 nonparametric methods, 52, 271  
 normal distribution 167  
 null hypothesis, 171
- one-way ANOVA, 28–9, 56, 99, 102, 194–6, 232  
 optimal scaling (OS) method, 120, 272–3  
 optimisation (product properties), 72  
 order of product presentation, 105, 189–90  
 outliers, 16, 169, 221–2, 241, 242, 253
- p*-MSE plots, 28, 30  
*p*-values, 28, 29, 50, 171  
 PARAFAC (parallel factor analysis), 74, 75, 76, 266, 271  
 parameters (statistics), 169  
 parametric models, 272  
 path modelling, 269–70  
 PC-ANOVA, 62–4, 65  
 PCA (principal component analysis), 58–9, 60–1, 115, 209–13  
   acceptance data, 112  
   relationship to factor analysis, 224–5  
   three-way PCA, 265–7  
   use of PCA in cluster analysis, 250  
 PCR (principal component regression), 69, 70, 71, 73, 133, 236–7  
   model diagnostics, 244  
 Plackett-Burman experiment designs, 188  
 PLS (partial least square) regression, 69, 70, 71, 76, 133, 237–8, 269  
   model diagnostics, 244  
 PLS path modelling, 270  
 PLS/PCR modelling, 116  
 polynomial models, 117, 143, 233–4  
 populations (statistics), 165–6  
 post hoc testing, 206  
 power (experiment designs), 191  
 power analysis (discrimination tests), 85–6  
 pre-processing, 45  
 prediction testing, 221, 238–9  
 preference mapping, 68, 128–30  
   additional customer attributes, 147–9  
   additional sample attributes, 149–52  
   ideal point preference mapping, 141–3, 144  
   linear preference mapping, 129–41  
   sample selection, 146–7  
 preliminary analysis, 99–102  
 Proc mixed procedure, 205  
 Proclustrees method, 259  
 procrustes analysis, 35–6  
 Procrustes distance, 253, 259, 265

- Procrustes rotations, 264  
 product combinations, 98, 150–2  
 product development, 135  
 product presentation, 105–6, 189–90  
 profile plots, 32–3  
 projection (vectors), 212, 213–14  
  
*q-q* plots, 202, 242, 243  
 quadratic polynomial models, 130  
 quality control (sensory data), 11–36  
 quartiles, 169  
  
 random coefficient models, 52–3, 258  
 random consumer effects, 135  
 random errors, 108  
 randomisation, 185  
 randomness, 165  
 rank based studies, 119–20  
 ranking data, 3, 136, 271–3  
 ranking tests, 8–9  
 rating based studies, 8, 123  
 rating data, 156–63  
 raw data, 15–18  
 reduced experiment designs, 107, 109  
 regression analysis (*see also* linear regression,  
     multiple regression), 57–8, 68–9, 70, 148,  
     227–9  
     relationship to ANOVA, 232–3  
 regression coefficients, 229–30, 231–2, 236,  
     246, 272  
 relative frequencies, 166  
 relative utility model, 123  
 REML (restricted maximum likelihood)  
     estimates, 65  
 repeated measurements, 185  
 replicates/replication, 53–6, 89–92, 184–5,  
     198  
 residual distances, 256–7  
 residuals, 19, 109, 221, 241–2, 244  
 resolution III/IV/V experiment designs, 187  
 RMSEP (root means square error of variation),  
     118–19, 239  
 RV coefficients, 45, 268  
  
 sample ranking, 29  
 sample selection, 146–7  
 sample spaces, 166, 167  
 Satterthwaite's approximation, 205  
 scaling constants, 41, 42  
 scaling differences, 24–7, 40–3  
 scores plots, 214–16  
 segmentation, 112, 136, 155–64  
 self-explicated tests, 8, 96  
 sensory analysis, 219  
 sensory loadings, 132, 133, 135, 138, 141  
  
 sensory panels, 1, 5  
 sensory profiling (*see* descriptive sensory  
     analysis)  
 sensory science, 2  
 sequential clustering, 257, 258  
 sequential segmentation, 161  
 sign test, 271  
 similarity tests, 87–9  
 simple linear model, 175  
 simultaneous clustering, 160–3  
 single linkage, 252  
 SPC (statistical process control), 172–3  
 Spearman rank order correlation, 272  
 split-plot experiment designs, 190, 205–6  
 standard deviations, 15–16, 40, 168, 170  
 standard errors, 169  
 standardisation (variables), 22, 219, 220  
 STATIS method, 44–5, 268  
 statistics, 165–80  
     contingency tables, 178  
     correlation, 173–5  
     distributions, 167–9  
     hypothesis testing, 169–72, 176–8, 179–80  
     linear regression, 175–6  
     SPC (statistical process control), 172–3  
 Stewart control chart, 172  
 stochastic variables, 166  
 structural equation modelling, 269  
 Student *t*-distribution, 167, 171  
 subset regression, 235  
 supervised classification, 245  
 SVD (singular value decomposition), 220  
  
 Taguchi's experiment designs, 188  
 tau-strategy, 86  
 Thurstonian approach, 81, 82–5, 86–7, 93  
 three-AFC test, 79, 80, 82, 83, 85, 87, 89  
 three-factor interactions, 185, 187  
 three-way analysis, 263–4, 269  
 three-way ANOVA, 45, 55, 204–5  
 three-way component methods, 36, 223  
 three-way PCA, 265–7  
 trained sensory panels (*see* sensory panels)  
 triangle test, 79, 86, 91  
 true replicates, 185  
 Tucker-1 method, 21, 22, 24, 36, 71, 75, 224,  
     265, 266, 267, 268  
 Tucker-2 method, 74–5, 266–7, 269  
 Tukey's correction, 51  
 Tukey's test, 206  
 two-AFC test, 79, 80, 81, 82, 83, 85, 87  
 two-factor interactions, 185, 187  
 two-level factorial experiment designs, 186  
 two-way analysis, 269  
 two-way ANOVA, 48–52, 196–200, 203–4

type I errors, 172  
type II errors, 172  
type I/II/III tests, 201

unbalanced data, 18  
unreliable assessors, 43–4  
utilities, 113

VAF (variance accounted for) index, 35  
validation, 118, 119, 123, 220–1, 232, 238–41  
variable selection, 235  
variances, 168, 169

weighted averages, 44  
willingness to pay tests, 9