INDEX

Aggregation bias, 127
Agresti's $\alpha$, 124
Arithmetic mean–harmonic mean inequality, 197
Asymptotic variance, 36
maximum likelihood, 92
restricted maximum likelihood, 92
Backtransformation, 112
Balanced incomplete block design, 43, 183–189
symmetrical, 184
Baseline risk, 136
Bayesian meta-analysis
Binomial model, 160
Poisson model, 159
Behrens–Fisher problem, 67
Best linear unbiased estimator, 44
Between-study variance
confidence interval
heterogeneous error variances, 90–93
homogeneous error variances, 77–81
estimator
ANOVA-type, 87
DerSimonian-Laird, 87
Mandel-Paule, 89
maximum likelihood, 89
MINQUE, 87
nonnegative, 88
nonnegative minimum biased, 88
restricted maximum likelihood, 89
tests, 85
Binary data, 116–122
homogeneity test, 118
odds ratio, 117
probability difference, 116
relative risk, 117
Binomial-normal hierarchical model, 118
odds ratio, 119
probability difference, 120
relative risk, 119
Bonferroni's inequality, 79
Central limit theorem, 11
Combination of polls, 191
efficiency, 197
maximum likelihood estimate, 197
uniformly minimum variance unbiased estimate, 197
Combining test statistics
admissibility, 27
Bahadur-efficiency, 31
dependent $P$-values, 33
Fisher's method, 29
global null hypothesis, 26
inverse chi-square transform, 29
inverse normal method, 29
logit method, 30
mean of $P$-values, 28
methods, 27–30
minimum $P$ method, 28
monotonicity, 27
R, 214
SAS, 214
sensitivity, 31
Stouffer's method, 29
sturdiness, 31
Wilkinson's method, 28
Commentator's estimate, 197
Common mean estimator, see Graybill-Deal estimator
admissible, 48, 50
Bayes, 53
first-order efficiency, 52, 54
general, 46
Jeffrey's prior, 53
minimax, 47, 48, 50
second-order efficiency, 52, 54
unbiased, 47
Common mean interval
approximate, 55
exact, 59–59
Fisher's method, 60
Confidence interval
large sample, 36
Confidence interval plot, 218, 220
Confounding, 127
Correlation coefficient, see Effect size combining, 37
Fisher's $z$ transformation, 38
DerSimonian-Laird estimator, 87, 104, 108, 111, 114, 217
Difference of means
approximate confidence intervals, 109
combining, 40, 98–106
confidence interval for overall effect, 106
exact confidence interval, 100–101
Graybill-Deal estimator, 99
homogeneity tests, 102–103
random effects model, 103–106
ANOVA-type estimator, 104
DerSimonian-Laird estimator, 104
Mandel-Paule estimator, 104
Effect size
$\phi$ coefficient, 20
combined, 142
composite, 142
correlation coefficient, 22
cross-product ratio, 20
difference of proportions, 17, 116
Fisher's $z$ transformation, 22
mean difference, 17
measure of association, 20
odds ratio, 20, 117
relative risk, 17, 117
risk ratio, 17
standardized mean difference, 14
variance-stabilizing transformation of proportions, 17
Empirical Bayes, 155
Error variance
confidence interval, 76
File-drawer method, 173
Fisher's method, 176
inverse normal method, 174
Stouffer's method, 174
Tippett's method, 176
File-drawer problem, 171
Funnel plot, 171, 218
Gallup poll, 191
Generalized confidence interval, 81
Generalized odds ratio, 124
Generalized test variable, 81
Gibbs sampling, 157, 162, 168
Graybill-Deal estimator, 45–51
admissible, 51
Meier's approximation, 50
unbiased variance estimate, 49
variance, 46
Hierarchical Bayes, 155
Historical control, 136
Homogeneity, 35, 64, 99, 108, 111, 114
Homogeneity test
adjusted Welch test, 66, 102
ANOVA $F$ test, 64
approximate ANOVA $F$ test, 66
Brown-Forsythe test, 65
Cochran's test, 37, 65, 102, 108, 111, 114, 118
exact, 68
generalized $P$-value, 68
large sample, 37
Mehrotra test, 66
Welch test, 65, 102
Interblock estimate, 43, 182
Intercorrelation, 142
Intra-block estimate, 43, 181

Likelihood ratio test, 209

Maximal invariant statistic, 184
Maximum likelihood estimator, 20, 44, 90, 104, 217

MCMC methods, 257, 162, 168

Meta-analysis
  definition, 1
  fixed effects model, 114
  random effects model, 89, 114

Meta-regression, 220
  fixed effects, 128
  general random effects, 132
  method-of-moments estimator, 129
  multiple, 128
  random effects, 128
  weighted least-squares estimator, 129
  weighted least-squares residuals, 130

Minimum variance unbiased estimator, 44, 105

Monte Carlo simulation, 215

Multiple dependent variable
  combining, 141–143
  Multiple-endpoint studies, 144–149
  Multiple-treatment studies, 149–153

Noninferiority trials, 136

Normal means
  combining, 39–40

Ordinal data, 122–125
  Agresti’s α, 124
  proportional odds, 123

Overfitting, 127

P-value, 26, 57, 101, 214
   generalized, 68, 81, 215

Partial correlation, 142

Proportional odds model, 123

Publication bias, 171–178
  analytic methods, 173
  Bayesian data augmentation approach, 178
  Figer’s regression test, 178
  rank correlation test, 178
  sampling methods, 173
  weighted distribution theory, 178

R, 68, 123, 213, 216
  probability functions, 214
  quantile functions, 214

R package
  meta, 217
  rmeta, 217

Random effects model
  heterogeneous error variances, 85
  homogeneous error variances
    balanced sample size, 77
    unbalanced sample size, 77
  one-way ANOVA, 74

Ratio of means
  combining, 110–112
  confidence interval for overall effect, 112
  overall effect estimator, 112
  random effects model, 111
  DerSimonian-Laird estimator, 111

Restricted iterative generalized least squares, 163

Restricted maximum likelihood estimator, 90, 105, 114, 217

SAS, 123, 213
  meta-regression, 220
  probability functions, 214
  PROC GLM, 217
  PROC MIXED, 163, 217, 222
  quantile functions, 214

Satterthwaite approximation, 99

Sign test, 204

Standardized mean difference
  Cohen’s d, 14, 142
  combining, 107–109
  confidence interval for overall effect, 109
  definition, 14, 107
  Glass’s Δ, 15, 142
  Hedges’s g, 14, 107
  overall effect estimator, 109
  random effects model, 108
  DerSimonian-Laird estimator, 109
  unbiased estimator, 15
  stochastically larger, 123

Strong law of large numbers, 197

Summary statistics
  extracting, 213–214

Two-way classification model, 180

Uncontrolled study, 136

Variance-stabilizing transformation
  binomial proportion, 11, 17
  sample correlation, 12, 22, 38

Vote counting, 203–211

Wald-type confidence interval, 92

Weighted least-squares regression, 217

WinBUGS, 120