Subject index

A

adjacent mean contrasts 188–194
adjusted means
  average marginal effect . . . 289–290
  computing 28–31
  graphing 31–32
  marginal effect at the mean 289–290
analysis of variance 175–181
`anova` command 175–181
`anova` versus `regress` command 212–215, 250–253
as-balanced versus as-observed contrasts 206–208
as-observed versus as-balanced contrasts 206–208
average marginal effect versus marginal effect at the mean 289–290
average marginal value versus marginal value at the mean 30–31

B

Bonferroni adjustments . . 556–557, 588, 591, 593–594
broken line regression . . . . *see* piecewise models
broken stick regression . . . *see* piecewise models

C

categorical by categorical by categorical interactions 257–280
  interaction contrasts 272–275
  partial interactions 268–270, 272–275
  simple comparisons 279
  simple contrasts 268
categorical by categorical by categorical interactions, *continued*
  simple effects 263, 279
  simple interactions . . 260–263, 266, 276–279
  simple partial interactions 266–268
  three by three by three design 270–279
  two by two by three design 263–270
  two by two by two design . . 258–263
categorical by categorical by continuous interactions
  linear . . *see* linear by categorical by categorical interactions
categorical by categorical interactions 217–256
  interaction contrast 243–245
  logistic regression 503–509
  partial interactions 230–232, 235–236, 242–243
  simple contrasts 234–235, 240–241
  simple effects . . . 224–226, 229–230, 234, 240
  three by three design 237–245
  two by three design 227–237
  two by two design 219–227
categorical by continuous by continuous interactions . . . . . *see* continuous by continuous by categorical interactions
categorical by continuous interactions
  cubic . . . . . *see* cubic by categorical interactions

categorical by continuous interactions, *continued*
linear . . . . . *see* linear by categorical interactions
quadratic . . . . . *see* quadratic by categorical interactions
categorical by linear by linear interactions . . . *see* linear by linear by categorical interactions
categorical by linear by quadratic interactions . . . . . *see* linear by quadratic by categorical interactions
categorical by piecewise interactions
linear . . . . . *see* piecewise by categorical interactions
categorical predictor
beyond two levels 175–181
two levels 174–175
categorical predictors 173–215
using `regress` command . . 212–215
comparisons . . . . . *see* contrasts
complex survey data 523–527
concave curve 49–50
confidence intervals, interpreting 210–211, 253–255
continuous by categorical by categorical interactions
linear . . *see* linear by categorical by categorical interactions
continuous by categorical by continuous interactions . . . . . *see* continuous by continuous by categorical interactions
continuous by categorical interactions
cubic . . . . . *see* cubic by categorical interactions
linear . . . . . *see* linear by categorical interactions
logistic regression 510–516
quadratic . . . . . *see* quadratic by categorical interactions
continuous by continuous by categorical interactions 375–392
continuous by continuous by continuous interactions 153–169
continuous by continuous interactions 131–152
linear by linear 131–144
linear by quadratic 144–151
continuous by piecewise interactions
linear . . . . . *see* piecewise by categorical interactions
`contrast` command . . 178–181, 583–590
contrast operators . . . . *see* contrast operators
`effects` option 585–588
`level()` option 588–590
`mcompare()` option 588
`noeffects` option 584–585
`nowald` option 585–590
`pveffects` option 585–586
contrast operators
`a` 188–194
`ar` 192–194
custom 202–206
`g` 185–188
`gw` 206–208
`h` 194–199
`hw` 206–208
`j` 198–199
`jw` 206–208
`p` 200–202
`pw` 206–208
`q` 201–202
`qw` 206–208
`r` 182–185
table of 181–182
weighted 206–208
contrasts
adjacent mean 188–194
custom 202–206
grand mean 185–188
Helmert 194–199
polynomial 200–202
reference group 182–185
reverse adjacent mean 192–194
reverse Helmert 198–199

contrasts, *continued*
selecting 183–185, 187–188, 193–194, 199
selecting reference group . . 184–185
to mean of previous levels 198–199
to mean of subsequent levels 194–199
weighted 206–208
convex curve 49–50
cross-level interaction
categorical by categorical . . 417–421
continuous by categorical 409–417
continuous by continuous 406–409
cubic by categorical interactions 329–334
cubic predictor 59–66
graphing 63–66
interpretation of 60, 63–66
custom contrasts 202–206

D
datasets
downloading 1
GSS 4–12
optimism 13
pain 12
school 13
sleep 13
downloading datasets 1
Duncan adjustments 591, 594–596
Dunnett adjustments 591, 594–596

E
`estimates stats` command . . 464–466
`estimates store` command . . 464–466

F
factor variables 173–215
used with `margins` command 551–559
`fp` prefix 66–79
fractional polynomial regression . . 66–79
graphing 74–79
interpreting 74–79
versus quadratic model 71–73

G
grand mean contrasts 185–188
graphing adjusted means 31–32

H
hierarchical linear model . . . . . *see* multilevel model
hockey stick models . . . . . *see* piecewise models

I
interaction contrast
three by three design 243–245
interaction contrasts
three by three by three design 272–275
interactions
categorical by categorical . . . . . *see* categorical by categorical interactions
categorical by categorical by categorical . . . . . *see* categorical by categorical by categorical interactions
categorical by continuous by continuous interactions . . *see* continuous by continuous by categorical interactions
continuous by categorical by continuous interactions . . *see* continuous by continuous by categorical interactions
continuous by continuous . . . . . *see* continuous by continuous interactions
continuous by continuous by continuous . . . . . *see* continuous by continuous by continuous interactions

interactions, *continued*
cubic by categorical . . *see* cubic by categorical interactions
linear by categorical . . *see* linear by categorical interactions
linear by categorical by categorical interactions . . . . . *see* linear by categorical by categorical interactions
linear by linear by categorical interactions . . . . . *see* linear by linear by categorical interactions
linear by quadratic by categorical interactions . . . . . *see* linear by quadratic by categorical interactions
piecewise by categorical . . . . . *see* piecewise by categorical interactions
quadratic by categorical . . . . . *see* quadratic by categorical interactions
interpreting confidence intervals 210–211, 253–255
inverted U-shape 49–50

L

linear by categorical by categorical interactions 393–401
linear by categorical interactions 283–309
linear by linear by categorical interactions 376–385
linear by linear by linear interactions . . *see* continuous by continuous by continuous interactions
linear by linear interactions . . . . . *see* continuous by continuous interactions
linear by quadratic by categorical interactions 386–392
linear by quadratic interactions . . . . . *see* continuous by continuous interactions
linear regression, multiple 27–32
linear regression, simple 19–27
linearity
assessing analytically 39–46
assessing graphically 32–39
assessing using `contrast` command 44–46
assessing via factor variables 42–46
assessing via graphing means 36–39
assessing via lowess 35–36
assessing via polynomials . . . 40–42
assessing via residuals 33–34
assessing via scatterplots 33
logistic regression 476–491
categorical by categorical interactions 503–509
continuous by categorical interactions 510–516
`contrast` command 477–478
`margins` command 479–482, 484–486
margins, default metric 482
`margins, pwcompare` command 482–484
`marginsplot` command . . 479–482, 484–486
one categorical predictor . . 476–484
one continuous predictor . . 484–486
piecewise models 516–522
predictive margins 480
`pwcompare` command 478–479
with covariates 486–491
`logit` command 476–491
longitudinal models . . . . . *see* time, modeled continuously

M

main effects
interpreting with categorical interactions 250–253
interpreting with polynomial models 79–81

marginal effect at the mean versus average marginal effect . . . 289–290
marginal value at the mean versus average marginal value 30–31
`margins` command 22–24, 545–566
`asbalanced` option 249–250
`asobserved` option 248–249
`at()` option 22–24, 548–551, 557–559
`contrast()` option 554–557
`dydx()` option . . . 559–560, 562–566
`dyex()` option 561
`expression()` option 546–548
`eydx()` option 562
`eyex()` option 560–561
`mcompare()` option 556–557
`noatlegend` option 550
`predict()` option 545–546
with factor variables 551–559
`marginsplot` command 24–27, 567–581
adding scatterplot to 572
`addplot()` option 572
`bydimension()` option 578
`byopts()` option 579, 581
`ciopts()` option 569–571
customizing by-graphs 579, 581
customizing the legend 576
display of confidence interval 569–571
display of fit line 569–571
`fcolor()` option 570–571
labeling the by-dimension 578
labeling the plot dimension 574–576
labeling the x dimension 577
`lcolor()` option 571
`legend()` option 576
line thickness 569
marker size 569
marker symbol 569
`noci` option 572
omitting confidence interval . . . 572
`plotdimension()` option 574–576
`marginsplot` command, *continued*
`plotopts()` option 569, 571
`recast()` option 569–571
`recast(line)` option 580
`recastci()` option 569–571
`recastci()` option 580
`scheme()` option 572
`scheme()` option 580
selecting a scheme 572
selecting dimension for x axis . . 573
selecting the by-dimension 578
selecting the plot dimension . . . 574
`subtitle()` option 568
`title()` option 568
`xdimension()` option 573
`xlabel()` option 568, 577
`xscale()` option 568
`xtitle()` option 568
`ylabel()` option 568
`yscale()` option 568
`caption()` option 568
`note()` option 568
`ytitle()` option 568
`mixed` command
`residuals()` option 451–452, 464–466
mixed model . . . . . *see* multilevel model
`mkspline` command 88–92
`marginal` option 92–94
`mlogit` command 491–497
multilevel model 405–422
cross-level interactions . . . . . *see* cross-level interactions
longitudinal . . . . *see* time, modeled continuously
multinomial logistic regression 491–497
`contrast` command 492–494
`margins` command 494–497
`marginsplot` command . . . 494–497
`pwcompare` command 494
multiple comparison adjustments 556–557, 588, 591–596
multiple regression 27–32

N
nested model ..... *see* multilevel model
nonlinear models 475–522
categorical by categorical interactions 503–509
continuous by categorical interactions 510–516
piecewise models 516–522
nonlinear relationships
cubic predictor 59–66
fractional polynomial 66–79
piecewise models 83–130
polynomial predictor 49–81
quadratic predictor 49–59

O
`ologit` command 497–500
ordinal logistic regression 497–500
`contrast` command 498–499
`margins` command 499–500
`marginsplot` command ... 499–500

P
pairwise comparisons 208–210
partial interactions
three by three by three design 272–275
three by three design 242–243
two by three design 230–232, 235–236
two by two by three design 268–270
piecewise by categorical interactions 335–374
comparing coding schemes 366–373
one knot and one jump ... 338–351
overview of 335–338
two knots and two jumps .. 351–366
piecewise models 83–130
automating graphs 127–130
change in slope coding 92–94
individual slope coding 88–92
logistic regression 516–522
multiple unknown knots .. 117–124
piecewise models, *continued*
one knot 86–94
one knot and one jump ... 100–105
one unknown knot 113–117
piecewise by categorical interactions .. *see* piecewise by categorical interactions
two knots 95–100
two knots and two jumps .. 106–112
`poisson` command 500–503
Poisson regression 500–503
`contrast` command 501
`margins` command 502–503
`marginsplot` command ... 502–503
`pwcompare` command 501–502
polynomial contrasts 200–202
polynomial models
interpreting main effects 79–81
polynomial predictor 49–81
predicted means, computing 24–27
predictive margins 480
previous levels, contrast to 198–199
`pwcompare` command 208–210, 591–596
`cimargins` option 592–593
`groups` option 593–596
`mcompare()` option .. 591, 594–596
`pveffects` option 592–596
Šidák adjustment 209–210
`sort` option 594–596

Q
quadratic by categorical interactions 311–329
quadratic by linear by categorical interactions ..... *see* linear by quadratic by categorical interactions
quadratic by linear interactions ..... *see* continuous by continuous interactions
quadratic predictor 49–59
graphing 55–59
interpretation of 50–51, 56–59

quadratic term
interpretation of 50–51, 56–59

R

random-coefficient model . . . . . *see* multilevel model
reference group contrasts 182–185
`regress` versus `anova` command 212–215, 250–253
repeated-measures models . . . . *see* time, modeled categorically
residual covariance structures, comparing 464–466

S

Scheffé adjustments 556–557, 588, 591, 593–594
selecting contrasts . . 183–185, 187–188, 193–194, 199
selecting reference group 184–185
Šidák adjustments . . 556–557, 588, 591, 593–594
simple comparisons
three by three by three design . . 279
simple contrasts
three by three design 240–241
two by three design 234–235
two by two by three design 268
simple effects
three by three by three design . . 279
three by three design 240
two by three design . . 229–230, 234
two by two by two design 263
two by two design 224–226
simple interactions
three by three by three design 276–279
two by two by three design 266
two by two by two design . . 260–263
simple linear regression 19–27
simple partial interactions
two by two by three design 266–268
spline regression . . *see* piecewise models
split plot design 455–464
squared term
interpretation of 50–51, 56–59
Student–Newman–Keuls adjustments 591, 594–596
subsequent levels, contrast to . . 194–199
survey data . . . *see* complex survey data
`svyset` command 523
`svy` prefix 523–527

T

t test 174–175
three by three by three design . . 270–279
interaction contrasts 272–275
partial interactions 272–275
simple comparisons 279
simple effects 279
simple interactions 276–279
three by three design 237–245
interaction contrast 243–245
partial interactions 242–243
simple contrasts 240–241
simple effects 240
three by two by two design . . *see* two by two by three design
three by two design . . . *see* two by three design
three-way interactions
categorical by categorical by categorical . . . . . *see* categorical by categorical by categorical interactions
continuous by continuous by categorical interactions . . . *see* continuous by continuous by categorical interactions
continuous by continuous by continuous . . . . . *see* continuous by continuous by continuous interactions
linear by categorical by categorical interactions . . . . . *see* linear by categorical by categorical interactions

three-way interactions, *continued*
linear by linear by categorical interactions . . . . . *see* linear by linear by categorical interactions
linear by quadratic by categorical interactions . . . . . *see* linear by quadratic by categorical interactions
time, modeled categorically . . . 449–474
split plot design 455–464
time by categorical interaction 455–464
time modeled alone 450–455
time, modeled continuously . . . 423–448
categorical by time piecewise interaction 438–447
linear effect of time 424–428
time by categorical interaction 428–433
time piecewise 433–438
Tukey adjustments 591, 594–596
two by three design 227–237
partial interactions 230–232, 235–236
simple contrasts 234–235
simple effects 229–230, 234
two by two by three design 263–270
partial interactions 268–270
simple contrasts 268
simple interactions 266
simple partial interactions 266–268
two by two by two design 258–263
simple effects 263
simple interactions 260–263
two by two design 219–227
simple effects 224–226
two-level categorical predictor 174–175
two-way interactions
categorical by categorical . . . . . *see* categorical by categorical interactions
two-way interactions, *continued*
continuous by continuous . . . . . *see* continuous by continuous interactions
cubic by categorical . . *see* cubic by categorical interactions
linear by categorical . . *see* linear by categorical interactions
piecewise by categorical . . . . . *see* piecewise by categorical interactions
quadratic by categorical . . . . . *see* quadratic by categorical interactions

U

U-shape 49–50
unadjusted means 290–291
unbalanced designs 245–250

W

weighted contrasts 206–208
within subjects models . . . . . *see* time, modeled categorically