## INDEX

## SYMBOLS

$\Delta$ (delta), 29
' (prime), 32

## A

accuracy. See also coeffi-
cient of determination of logistic regression analysis equation, 173-177
of multiple regression
equation, 119-126
adding matrices, 39-40
adjusted odds ratio, 192-194
adjusted $R^{2}, 124-126$
alternative hypothesis $\left(\mathrm{H}_{\mathrm{a}}\right), 48$
analysis of variance (ANOVA). See also
hypothesis testing
logistic regression analysis, 178-181
multiple regression analysis, 128-132 regression analysis, 87-90
apparent error rate, 177
assumptions of normality, 85-86
autocorrelation, checking for, 102-103
average, 72

## B

bell curves, 53-54
best subsets regression, 139-140
binomial logistic regression analysis. See logistic regression analysis

## $C$

calculus, differential. See differential calculus
Canceling Exponentials Rule, 22
categorical data, 46
converting numerical data, 46-47
in logistic regression analysis, 167
in multiple regression analysis, 147-149
chi-squared ( $\chi^{2}$ ) distributions, 54-55, 56, 204-206
coefficient of determination ( $R^{2}$ )
adjusted, 124-126
logistic regression analysis, 173-177
multiple regression analysis, 119-126
regression analysis, 81-82
coefficients. See specific coefficients by name
columns, in matrices, 38
concentration matrix, 145
confidence coefficient, 92-93
confidence intervals, calculating
multiple regression analysis, 133-135, 146
for odds ratio, 194-195
regression analysis, 91-94
correlation coefficient ( $R$ ), 70
general discussion, 64-65
multiple regression analysis, 120
regression analysis, 78-82
critical value, 55

## D

data. See also categorical data
plotting, 64-65
types of, 46-47
degrees of freedom, 50-51
delta ( $\Delta$ ), 29
dependent variables, 14 , 67, 149-152. See also scatter plots
differential calculus
differentiating, 31-36
general discussion, 24-30
Durbin-Watson statistic, 102-103

## E

elements, in matrices, 38
Euler's number, 19, 198-199
event space, 53
Excel functions, 198
Exponentiation Rule, 22
exponents, 19-23, 200
extrapolation, 102

## F

F distributions, 57-59, 206-209
freedom, degrees of, 50-51
F-test, 129-133
functions. See also probability density functions
exponential, 19-23
inverse, 14-18
likelihood, 161-163, 171
logarithmic, 19-23
log-likelihood, 161-163, 171-172
natural logarithm, 20, 200-201

## $G$

graphs. See also scatter plots
for inverse functions, 17-18
logistic regression analysis equation, 159

H
$\mathrm{H}_{0}$ (null hypothesis), 48
$\mathrm{H}_{\mathrm{a}}$ (alternative hypothesis), 48
hypothesis testing, 85-90
logistic regression analysis, 178-181
multiple regression analysis, 128-132
with odds, 194

## I

identity matrices, 44
independent variables, 14, 67
choosing best combination of, 138-140
determining influence on outcome variables, 149-152
logistic regression analysis, 164-167
multicollinearity, 149
structural equation modeling, 152
interpolation, 102
inverse functions, 14-18
inverse matrices, 44, 202-204

## L

likelihood function, 161-163, 171
likelihood ratio test, 179
linear equations, turning nonlinear equations into, 104-106
linear least squares regression, 71-76, 115
linear regression analysis, 7
linearly independent data, 47
logarithms, 19-23
logistic regression analysis, 8, 157
accuracy of equation, assessing, 173-177
adjusted odds ratio, 192-194
confidence intervals for odds ratios, 194-195
equation for, calculating, 158-159, 170-173
hypothesis testing, 178-181, 194
maximum likelihood method, 159-163, 210-212
odds ratio, 192-194
predicting with, 182
predictor variables, choosing, 164-167
procedure, general discussion of, 168, 190
relative risk, 195-196
scatter plot, drawing, 169 logit, 190-191
log-likelihood function, 161-163, 171-172

## M

Mahalanobis distance, 133, 137, 144-146
matrices
adding, 39-40
general discussion, 37-38
identity, 44
inverse, 44, 202-204
multiplying, 40-43, 201-202
prediction intervals, calculating, 144-146
maximum likelihood estimate, 162-163
mean, 49
median, 49
multicollinearity, 149
multiple correlation coefficient
accuracy of multiple regression equation, 119-121
adjusted, 124-126
problems with, 122-123
multiple regression analysis, 7-8, 111
accuracy of equation, assessing, 119-126
analysis of variance, 128-132
categorical data, using in, 147-149
confidence intervals, calculating, 133-135
equation for, calculating, 115-119
hypothesis testing, 127
Mahalanobis distance, 144-146
multicollinearity, 149
prediction intervals, calculating, 136-137
predictor variables, choosing, 138-140
predictor variables, determining influence on outcome variables, 149-152
procedure, general discussion of, 112, 142
scatter plot, drawing, 113-114
standardized residuals, 143-144
multiplying matrices, 40-43, 201-202

## N

natural logarithm function, 20, 200-201
nonlinear regression, 103-106
normal distributions, 53-54
normality, assumptions of, 85-86
null hypothesis $\left(\mathrm{H}_{0}\right), 48$
numerical data, 46-47
odds, 190
hypothesis testing, 194
logit, 190-191
odds ratio (OR)
adjusted, 192-194
confidence intervals, calculating, 194-195
general discussion, 191-192
outcome variables, 14,67 , 149-152
outliers, 101, 144
overfitting, 149

## $P$

partial regression coefficients
calculating with Excel, 209-210
general discussion, 116-118
hypothesis testing, 127, 129-131
Pearson product moment correlation coefficient, 79. See also correlation coefficient
plotting data, 64-65
population mean, 91
population regression, 86
populations
assessing, 82-84
confidence intervals, calculating, 133-135
Power Rule, 21
predictions
logistic regression analysis, 182
multiple regression analysis, 136-137
regression analysis, 95-98
predictor variables, 14,67
choosing best combination of, 138-140
determining influence on outcome variables, 149-152
logistic regression analysis, 164-167
multicollinearity, 149
structural equation modeling, 152
prime ('), 32
probability density functions
chi-squared distribution, 54-55, 56, 204-206
F distributions, 57-59, 206-209
general discussion, 52-53
normal distribution, 53-54
tables, 55-56
Product Rule, 23
pseudo- $\mathbf{R}^{2}$, 173-177

## Q

qualitative data, 46
quantitative data, 46
Quotient Rule, 21

## R

$\boldsymbol{R}$ (correlation coeffi-
cient), 70
general discussion, 64-65
multiple regression analysis, 120
regression analysis, 78-82
$R^{2}$ (coefficient of determination)
adjusted, 124-126
logistic regression analysis, 173-177
$R^{2}$ (coefficient of determina-
tion), continued
multiple regression analysis, 119-126
regression analysis, 81-82
regression analysis
analysis of variance, 87-90
assumptions of normality, 85-86
autocorrelation, checking for, 102-103
confidence intervals, calculating, 91-94
correlation coefficient, calculating, 78-82
equation, calculating, 71-77
equation, general discussion, 66-67
interpolation and extrapolation, 102
nonlinear regression, 103-104
prediction intervals, calculating, 95-98
procedure, general discussion of, 68, 100
samples and populations, 82-84
scatter plot, drawing, 69-70
standardized residual, 100-101
regression diagnostics, 119-121
regression equation
calculating, 71-77
general discussion, 66-67
linear equations, turning nonlinear into, 104-106
relative risk (RR), 195-196
residual sum of squares, 73-74
residuals, 71 standardized, 100-101, 143-144
round-robin method, 139-140
rows, in matrices, 38
RR (relative risk), 195-196

## $S$

sample regression, 86
sample variance, unbiased, 50
samples, 82-84
scatter plots
differential calculus, 26
for logistic regression analysis, 169
for multiple regression analysis, 113-114
plotting data, 64-65
for regression analysis, 69-70
SEM (structural equation modeling), 152
squared deviations, sum of, 50
standard deviation, 51-52
standardized residuals, 100-101, 143-144
statistically significant, 58
statistics
data types, 46-47
hypothesis testing, 48
variation, measuring, 49-52
structural equation modeling (SEM), 152
subsets regression, best, 139-140
sum of squared deviations, 50

## T

testing hypotheses, 85-90
logistic regression analysis, 178-181
multiple regression analysis, 128-132
with odds, 194
tolerance, 149
U
unbiased sample variance, 50

## V

variables. See dependent variables; independent variables; scatter plots
variance, 50-51
variance, analysis of
logistic regression analysis, 178-180
multiple regression analysis, 128-132
regression analysis, 87-90
variance inflation factor (VIF), 149

## W

Wald test, 180

## $X$

x-bar, 72

## $y$

y-hat, 73

