

Index

• A •

addition rule
 examples, 217–218
 links in categorical data, 216–218
addition symbol, 253
alpha levels, cutoff probabilities, 179–180
alternative hypothesis (H_a), 155–156
anecdotes, statistical mistakes, 278
answers to problems
 about, 2
 bar graphs, 32–33
 calculating confidence intervals, 140–143
 categorical data links, 228–234
 categorical data organization, 29–33
 confidence intervals, 151–152
 experiments evaluation, 208–209
 hypothesis test, 169–173
 margin of error, 126–128
 normal distribution, 93–100
 organizing categorical data, 29–33
 organizing quantitative data, 48–51
 p-values, 186–188
 pie charts, 29–31
 polls, 199–200
 probability, 77–78
 summarizing quantitative data, 64–68
 surveys, 199–200
 Type I errors, 186–188
 Type II errors, 186–188
asterisk use, 2
average
 about, 55
 formulas, 263–264
 histograms, 38

• B •

backwards normal problems, 90–92
bar charts, 25
bar graphs. *See also* histograms
 about, 25–28
 answers to problems, 32–33
 categorical data organization, 25–28
 examples, 25–28
 side by side bar graph, 28
bell curve, 79
bell-shaped histograms, 38
bias, statistical mistakes, 274

bimodal distribution, 64
bimodal histograms, 38
bins, 35

• C •

calculating
 confidence intervals, 129–143
 margin of error, 119–121
categorical data links, 228–234
categorical data organization
 about, 19
 answers to problems, 29–33
 bar graphs, 25–28
 pie charts, 19–24
categorical data summary
 about, 9–17
 answers to problems, 15–17
 counts, 9–11
 interpreting counts and percents, 13–14
 percentages, 11–12
cause and effect, experiments results, 206–207
cell count, 216, 220
center, finding and interpreting measures, 55–57
center histograms, 38
Central Limit Theorem (CLT)
 about, 104
 answers, 111–114
 examples, 105, 106–107
 probabilities for means and proportions,
 106–107
conditional probabilities
 examples, 221–224
 links in categorical data, 220–224
confidence interval results
 evaluating, 149–150
 examples, 150
confidence intervals
 about, 129–130
 answers to problems, 140–143, 151–152
 calculating, 129–143
 difference of two means, 136–137
 difference of two proportions, 138–139
 examples, 130–131, 132–133
 hypothesis test, 129
 interpreting, 145–152
 margin of error, 129
 population mean, 132–133
 population proportion, 134–135

confidence intervals (*continued*)
 results, 149–150
 Z* values, 129–130

confounding variables
 about, 208
 statistical mistakes, 276–277

conventions used in book, 2

correlation
 formulas, 266
 statistical mistakes, 277

correlation line
 answers to problems, 247–250
 examples, 238–242
 formulas, 237–238
 links in quantitative data, 237–240

counts, 9–11

critical values, hypothesis test, 156–157

crosstabs, 213

cutoff probabilities
 alpha levels, 179–180
 p-values, 179

• D •

data
 analysis bias, 274
 collection process, bias, 274
 links in categorical data, 213–234
 reliability of data, experiments, 203
 shape of data histograms, 53–54
 skewed data sets, 59–60
 unbiased data, experiments designing, 203
 validity of data, experiments designing, 203

deciphering
 Type I errors, 182–183
 Type II errors, 183–185

decreasing margin of error, 122–123

denominator, 254

designed experiment, statistical mistakes, 276

designing
 experiments, 203–206
 surveys, 191–193

difference between two population means
 examples, 163–164
 hypothesis test, 163–164

difference of two means, 136–137

difference of two proportions, 138–139

disjoint, 71

distortion, graphs, 273

division symbol, 253

double-blinds, experiments, 204

• E •

Empirical Rule
 examples, 61–63
 summarizing quantitative data, 60–63

errors. *See also* margin of error
 Type I errors, 182–183
 Type II errors, 183–185

evaluating
 confidence interval results, 149–150
 survey results, 196–198

experiments, bias, 274

experiments design
 about, 203–206
 double-blinds, 204
 examples, 204–206
 reliability of data, 203
 unbiased data, 203
 validity of data, 203

experiments evaluation
 about, 201
 answers to problems, 208–209
 examples, 202–203
 versus observational studies, 201–203

experiments results
 cause and effect, 206–207
 examples, 206–207

exponential rate, 277

extrapolation, 242

• F •

finding and interpreting measures of center
 examples, 55–57
 summarizing quantitative data, 55–57

finding and interpreting measures of spread
 about, 57–59
 examples, 58–59

formulas
 average, 263–264
 correlation, 266
 correlation line, 237–238
 examples, 257–258
 margin of error for sample mean, 266–267
 margin of error for sample proportion, 269–270
 math review, 256–257
 mean, 263–264
 median, 264
 regression lines, 240–241
 sample size needed for, 267–271
 standard deviation, 264–265
 test statistic for mean, 268–269
 test statistic for proportion, 271–272

fractions, 254

frequency histogram, 35, 48

frequency table, 9

functions, math review, 258–259

• G •

graphs, statistical mistakes, 273–274

• H •

Ha (alternative hypothesis), 155–156

histograms

- about, 35–36
- average, 38
- bell-shaped, 38
- bimodal, 38
- center, 38
- examples, 36–44
- left skewed, 38
- median, 38
- misleading, 43–44
- organizing quantitative data, 35–44
- percentage return, 49
- range, 38
- right skewed, 38
- shape, 38
- shape of data, 53–54
- spread, 38
- standard deviation, 38
- symmetric, 38
- uniform, 38
- u-shaped, 38

Ho (null hypothesis), 2, 155–156

hypothesis testing

- about, 155–157
- answers to problems, 169–173
- confidence intervals, 129
- critical values, 156–157
- difference between two population means, 163–164
- examples, 157–158
- mean difference, 165–166
- population mean, 159–160
- population proportion, 161–162
- two population proportions, 167–168

• I •

increasing margin of error, 122–123

independence of categorical variables

- examples, 225–227
- links in categorical data, 224–227

interpreting

- confidence intervals, 145–152
- counts and percents, 13–14
- margin of error, 123–125
- p-values, 179–181
- regression line, 242–244
- survey results, 196–198

intersection

- examples, 217–218
- links in categorical data, 216–218

• J •

joint probability, 216–218

• L •

left skewed histograms, 38

line graphs

- about, 45–47, 274
- examples, 45–47

linear function, 259

linear rate, 277

linear relationship, 277

links in categorical data

- about, 213
- addition rule, 216–218
- conditional probabilities and multiplication rule, 220–224
- independence of categorical variables, 224–227
- intersection, 216–218
- marginal probabilities, 218–220
- two-way tables, 213–215
- unions, 216–218

links in quantitative data

- about, 235
- correlation line, 237–240
- interpreting regression line, 242–244
- negative linear relationship, 235
- positive linear relationship, 235
- regression line, 240–242
- scatterplots, 235–237
- X-axis, 235–237
- Y-axis, 235–237

• M •

margin of error

- about, 117–118
- answers to problems, 126–128
- confidence intervals, 129
- decreasing, 122–123
- examples, 122–125
- increasing, 122–123
- interpreting, 123–125
- means and proportions, 119–121
- sample mean formulas, 266–267
- sample proportion formulas, 269–270
- sample size, 118
- standard deviation of population, 118
- statistical mistakes, 275
- Z* value, 117–118

marginal probabilities

- examples, 219–220
- links in categorical data, 218–220

marginal totals, two-way tables, 214

math review

- formulas, 256–257
- fractions, 254
- functions, 258–259
- operations order, 255–256
- partial credit, 260
- powers, 254
- roots, 254
- rounding errors, 256
- show your work, 260–261
- wrong answers, 259–260

math statistical mistakes, 277–278

math symbols, 253

mean

- examples, 119–121
- formulas, 263–264
- margin of error, 119–121
- test statistic for mean formulas, 268–269

mean difference

- examples, 166
- hypothesis test, 165–166

median

- about, 55
- formulas, 264
- histograms, 38

minus sign, 253

misconceptions, probability, 73–74

misleading histograms, 43–44

mistakes, statistical

- about, 274
- anecdotes, 278
- bias, 274
- confounding variables, 276–277
- correlation, 277
- designed experiment, 276
- graphs, 273–274
- margin of error, 275
- math, 277–278
- observational study, 276–277
- sample selection, 276
- scanning for sample size, 275
- selective reporting, 278

multiplication rule

- conditional probabilities, 220–224
- examples, 221–224
- links in categorical data, 220–224

multiplication sign, 2

multiplication symbol, 253

• **N** •

negative linear relationship, links in quantitative data, 235

negatively skewed, 64

nonlinear approach, 2

normal distribution

- about, 79–80
- answers, 93–100
- examples, 80–81

null hypothesis (H_0), 155–156

numerator, 254

numerical use statistics, 2

• **O** •

observational studies

- examples, 202–203
- versus experiments, 201–203
- statistical mistakes, 276–277

operations order, 255–256

organization of book, 3–4

organizing categorical data

- about, 19
- answers to problems, 29–33
- bar graphs, 25–28
- pie charts, 19–24

organizing quantitative data

- about, 35
- answers to problems, 48–51
- histograms, 35–44
- line graphs, 45–47

outliers, 53, 65

• **p** •

p-values

- about, 108, 175
- answers to problems, 186–188
- cutoff probabilities, 179
- examples, 176
- interpretation, 179–181
- measurement, 175–176
- test statistic, 177–179

paired t-test, 165–166

parentheses

- about, 255
- formulas, 257

PEMDAS (please excuse my dear aunt Sally), 255

percentage return histogram, 49

percentages, 254

percentiles, 85–87

percents, graphs, 273

pie charts

- answers to problems, 29–31
- examples, 20–24
- organizing categorical data, 19–24

planning surveys, 191–193

plus or minus sign, 253
 polls. *See* surveys
 population
 difference between two population means, 163–164
 margin of error, 118
 standard deviation of population, 118–119
 population mean
 confidence intervals, 132–133
 examples, 159–160
 hypothesis test, 159–160
 population proportion
 about, 134–135
 examples, 134–135, 161–162
 hypothesis test, 161–162
 positive linear relationship, links in quantitative data, 235
 positively skewed, 64
 powers, 254
 practice problems, about, 1
 probabilities for means and proportions, Central Limit Theorem, 106–107
 probabilities for normal distribution, 87–89
 probability
 about, 71
 answers, 77–78
 examples, 72–73
 misconceptions, 73–74
 rules, 71–73
 probability predictions, 75–76
 problem-solving skills, 2
 procedures, 2
 process surveys, 191
 proportions
 examples, 119–121
 margin of error, 119–121
 test statistic for proportion formulas, 271–272

• Q •

quantitative data organization
 about, 35
 answers to problems, 48–51
 histograms, 35–44
 line graphs, 45–47
 quantitative data summaries
 about, 53
 answers, 64–68
 Empirical Rule, 60–63, 67
 finding and interpreting measures of center, 53–54
 finding and interpreting measures of spread, 57–59
 shape of data histograms, 53–54
 skewed data sets, 59–60

• R •

random samples
 examples, 194
 selection, 193–195
 range
 about, 57
 histograms, 38
 recording data, bias, 274
 regression line
 answers to problems, 247–250
 extrapolation, 242
 interpreting, 242–244
 links in quantitative data, 240–242
 regression line fit
 about, 244–246
 examples, 245–246
 regression lines formulas, 240–241
 relating with percentages, categorical data summary, 11–12
 relative frequency, 11
 relative frequency histogram, 35
 relative frequency table, 11–12
 reliability of data, experiments, 203
 response rates, 200, 277
 right skewed histograms, 38
 roots, 254
 rounding errors, math review, 256

• S •

sample selection, statistical mistakes, 276
 sample size
 margin of error, 118
 needed for formulas, 267–271
 sample space, 71
 sampled population, 193
 sampling distribution
 about, 101–102
 answers, 111–114
 examples, 103
 sampling process, bias, 274
 scale, graphs, 273
 scanning for sample size, statistical mistakes, 275
 scatterplots
 examples, 236–237
 links in quantitative data, 235–237
 section examples, 2
 selection, random samples, 193–195
 selective reporting, statistical mistakes, 278
 self-selected sample, 200
 shape, histograms, 38
 shape of data histograms
 about, 53–54
 examples, 53–54

show your work, math review, 260–261
 side by side bar graph, 28
 skewed data sets, 59–60
 spread
 finding and interpreting measures of spread, 57–59
 histograms, 38
 standard deviation
 about, 57
 formulas, 264–265
 histograms, 38
 standard deviation of population
 examples, 118–119
 margin of error, 118
 standard error, 102
 standard normal distribution, 82–84
 standard score, 82
 statistical mistakes
 about, 274
 anecdotes, 278
 bias, 274
 confounding variables, 276–277
 correlation, 277
 designed experiment, 276
 graphs, 273–274
 margin of error, 275
 math, 277–278
 observational study, 276–277
 sample selection, 276
 scanning for sample size, 275
 selective reporting, 278
 statistics
 dual use, 2
 numerical use, 2
Statistics For Dummies, 1, 2
 strategies, 2
 subtraction symbol, 253
 summarizing quantitative data
 about, 53
 answers, 64–68
 Empirical Rule, 60–63, 67
 finding and interpreting measures of center, 53–54
 finding and interpreting measures of spread, 57–59
 shape of data histograms, 53–54
 skewed data sets, 59–60
 summation symbol, 253
 survey results
 evaluation, 196–198
 examples, 197–198
 interpretation, 196–198
 surveys
 answers to problems, 199–200
 designing, 191–193

examples, 195–196
 implementing, 195–196
 planning, 191–193
 process, 191
 symmetric histograms, 38

• T •

target population, 193
 T-distribution
 about, 108–110
 examples, 109–110
 test statistic
 about, 177–179
 examples, 177–179
 mean formulas, 268–269
 p-values, 177–179
 proportion formulas, 271–272
 testing hypothesis
 about, 155–157
 answers to problems, 169–173
 confidence intervals, 129
 critical values, 156–157
 difference between two population means, 163–164
 examples, 157–158
 mean difference, 165–166
 population mean, 159–160
 population proportion, 161–162
 two population proportions, 167–168
 time charts, 274
 tips, 2
 total sample size, 19
 t-test, paired, 165–166
 two population proportions
 examples, 167–168
 hypothesis test, 167–168
 two-way tables
 crosstabs, 213
 examples, 213–215
 links in categorical data, 213–215
 marginal totals, 214
 Type I errors
 about, 182–183
 answers to problems, 186–188
 examples, 182–183
 Type II errors
 about, 183–185
 answers to problems, 186–188

• U •

unbiased data, experiments designing, 203
 uniform distribution, 53

uniform histograms, 38
union probability
 examples, 217–218
 links in categorical data, 216–218
u-shaped histograms, 38

• *V* •

validity of data, experiments designing, 203
variation, 57

• *W* •

warnings, 2
workspace, 1
wrong answers, math review, 259–260

• *X* •

X-axis
 links in quantitative data, 235–237
 scale, 48

• *Y* •

Y-axis, links in quantitative data, 235–237

• *Z* •

Z-distribution, 108
Z* values
 confidence intervals, 129–130
 margin of error, 117–118

