Introductory Statistics 4th edition Gould Solutions Manual

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Chapter 1: Introduction to Data

Section 1.2: Classifying and Storing Data

1.1. There are eight variables: "Level of anxiety", "Commute time to campus", "Work at a job for pay", "Commute time to work place", "Hair color", "Previously taken a statistics course", "height", and "College units completed".

1.2. There are observations for fourteen students.

1.3. a. Commute time to campus is numerical since it's measured in minutes.

b. Hair color is categorical, the categories are "black" and "blonde".

c. Previously taken a statistics course is categorical, student either has taken course or not.

1.4. a. Commute time to work is numerical since it's measured in minutes.

b. Level of anxiety about course is categorical, the categories are 1, 2, 3, 4, and 5.

c. Height is numerical since it's measured in inches.

1.5. Answers will vary but could include such things as number of friends on Facebook or foot length. *Don't copy these answers*.

1.6. Answers will vary but could include such things as eye color or country of origin. *Don't copy these answers*.

1.7. 0 = no previous statistics course, 1 = has taken a previous statistics course. The sum represents the total number who had previously taken a statistics course.

1.8. There would be two 0's and twelve 1's.

1.9. a.

Freshman
0
1
1
0
0
0
0
1
1
1
0
0
1
1

b. College units completed is numerical.

c. Freshman is categorical.

1.10. a.

Upperclassman
0
0
0
0
1
0
0
0
0
0
1
0
0
0

b. College units completed is numerical.

c. Upperclassman is categorical.

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1.11 a. The data is stacked.

b. 0 = not a home game (away game), 1 = home game.

c.

Home Game	Away Game
4	8
4	7
10	2
6	

1.12 a. The data is unstacked.

b. Labels for columns will vary.

Home	Score
1	134
1	119
1	126
1	123
1	128
1	131
0	112
0	134
0	111
0	102
0	113
0	109

c. Home (Game location) is categorical, Score is numerical

1.13 a. Stacked and coded

Calories	Sweet
90	1
310	1
500	1
500	1
600	1
90	1
150	0
600	0
500	0
550	0

Alternatively, the second column could be labeled "Salty" with the 1's being 0's and the 0's being 1's.

b. Unstacked

Sweet	Salty
90	150
310	600
500	500
500	550
600	
90	

1.14 a. Stacked and coded

Cost	Male
10	1
15	1
15	1
25	1
12	1
8	0
30	0
15	0
15	0

Alternatively, the second column could be labeled "Female" with the 1's being 0's and the 0's being 1's.

b. Unstacked

Male	Female
10	8
15	30
15	15
25	15
12	

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Section 1.3: Investigating Data

1.15 Yes. Use Level of Anxiety and Previously Taken a Statistics Course.

1.16 Yes. Use Level of Anxiety and College Units Completed.

1.17 No. Data on student ages are not included in the table.

1.18 No. Data on number of hours worked weekly are not included in the table.

1.19 a. Yes. Use Date.

b. No. Data on temperature are not included in the table.

c. Yes. Use Fatal and Species of Shark.

d. Yes. Use Location.

1.20 Yes. Use Time and Activity.

Section 1.4: Organizing Categorical Data

1.21

	Men	Women	Total
Yes	33	32	$33+32=65$
No	7	13	20
Total	40	$32+13=45$	85

a. $33/40=82.5\%$

b. $32/45=71.1\%$

c. $33/65=50.8\%$

d. $33/40\times 250=206$

1.22

	Men	Women	Total
Yes	23	13	$23+13=36$
No	4	14	18
Total	27	$13+14=27$	54

a. $4/27=14.8\%$

b. $14/27=51.9\%$

c. $4/18=22.2\%$

d. $4/27\times 600=89$

1.23 a. Total number of faculty = 840 + 825 = 1665. Full time %: $840/1665\times 100\%=50.5\%$

b. Part-time: $0.59(1100)=649$

Full-time: $0.41(1100)=451$

c. $0.52(x)=130$

$$x=\frac{130}{0.52}$$

$=250$ faculty members

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1.24 a. Total number of nursing staff = 1250 + 250 = 1500. $1250/1500 \times 100\% = 83.3\%$

b. RN: $0.32(950) = 304$

LVN: $0.68(950) = 646$

c. $0.28(x) = 189$

$$x = \frac{189}{0.28}$$

$= 675$ nurses

1.25 The frequency of black-haired students is 12, the proportion is $12/14$, and the percentage is $12/14 \times 100\% = 85.7\%$.

1.26 The frequency of students who work at a job for pay is 13, the proportion is $13/14$, and the percentage is $13/14 \times 100\% = 92.9\%$.

1.27 The answers follow the guidance on page 40.

a. and b.

Previously Taken Statistics

Work for Pay	Yes	No	Total
Yes	8	5	13
No	0	1	1
Total	8	6	14

c. $6/14 \times 100\% = 42.9\%$

d. $8/8 \times 100\% = 100\%$

e. $13/14 \times 100\% = 92.9\%$

f. % of those who work for pay who had previously taken statistics: $8/13 \times 100\% = 61.5\%$; $0.615(20) = 12.3$; about 12 students.

1.28 a. and b.

Anxiety about Taking Course

Prev. Taken Stats	1	2	3	4	5	Total
Yes	1	2	0	1	4	8
No	0	0	1	2	3	6
Total	1	2	1	3	7	14

c. $5/10 \times 100\% = 50\%$

d. $0/3 \times 100\% = 0\%$

e. $6/14 \times 100\% = 42.9\%$

f. % of those who had not previously taken statistics with anxiety levels of 4 or 5: $5/6 \times 100\% = 83.3\%$; $0.833(40) = 33.3$; about 33 students.

1.29 $1.254x = 4560$

$$x = \frac{4560}{1.254}$$

$x = 3636.4$ thousand (final value could be rounded differently)

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1.30 $1.299x = 377,600$

$$x = \frac{377,600}{1.299}$$

$x = 290,685$ (final value could be rounded differently)

1.31 a.

State	Prison Population	Rank Prison Pop	Total Population	Population (thousands)	Prison per thousand	Rank Rate
Texas	135,906	1	29,527,941	29,528	$\frac{135,906}{29,528} = 4.60$	1
California	97,328	2	39,237,836	39,238	$\frac{97,328}{39,238} = 2.48$	5
Florida	81,027	3	21,781,128	21,781	$\frac{81,027}{21,781} = 3.72$	4
Georgia	47,141	4	10,799,566	10,800	$\frac{47,141}{10,800} = 4.36$	2
Ohio	45,036	5	11,780,017	11,780	$\frac{45,036}{11,780} = 3.82$	3

b. Texas has the highest prison population and the highest rate of imprisonment; however, California has the 2nd highest prison population but the lowest rate of imprisonment. The ranks are different because the total populations are different.

1.32 a.

City	Population	Area (square miles)	Population Density	Rank
New York City	8,622,357	303	$\frac{8,622,357}{303} = 28,457$	1
Los Angeles	4,085,014	469	$\frac{4,085,014}{469} = 8,710$	4
Chicago	4,670,406	228	$\frac{4,670,406}{228} = 20,484$	2
Houston	2,378,146	600	$\frac{2,378,146}{600} = 3,964$	5
Phoenix	1,743,469	517	$\frac{1,743,469}{517} = 3,372$	6
Philadelphia	1,590,402	134	$\frac{1,590,402}{134} = 11,869$	3

b. No, the least densely populated city is Phoenix.

1.33

Year	Uninsured	Total Population	% Uninsured
1990	34,719	249,778	$\frac{34,719}{249,778} = 13.9\%$
2000	36,586	279,282	$\frac{36,586}{279,282} = 13.1\%$
2021	28,227	328,221	$\frac{28,227}{328,221} = 8.6\%$

The percentage of uninsured people has been declining since 1990.

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1.34

Year	Ticket Sales (in $ million)	# Movie Screens	Ticket Sales per screen (in $ million)
1990	5,021.8	23,689	$\frac{5,021.8}{23,689} = 0.21$
2000	7,468.0	37,396	$\frac{7,468.0}{37,396} = 0.20$
2010	10,741.0	39,547	$\frac{10,741.0}{39,547} = 0.27$
2021	4,500.0	42,623	$\frac{4,500.0}{42,623} = 0.11$

Ticket sales per screen increased from 1990 through 2010 but then declined.

1.35

Year	Population	Older Population	% Older Population
2020	334	54.8	$\frac{54.8}{334} = 16.4\%$
2030	358	70.0	$\frac{70.0}{358} = 19.6\%$
2040	380	81.2	$\frac{81.2}{380} = 21.4\%$
2050	400	88.5	$\frac{88.5}{400} = 22.1\%$

The percentage of older population is projected to increase.

1.36

Year	# marriages	Total population	Total population (in thousands)	Marriage rate (per thousand)
2016	2,251,411	323,127,513	323,128	$\frac{2,251,411}{323,128} = 7.0$
2017	2,236,496	325,719,178	325,719	$\frac{2,236,496}{325,719} = 6.9$
2018	2,132,853	327,167,434	327,167	$\frac{2,132,853}{327,167} = 6.5$
2019	2,015,603	328,239,523	328,240	$\frac{2,015,603}{328,240} = 6.1$
2020	1,676,911	329,484,123	329,484	$\frac{1,676,911}{329,484} = 5.1$

The marriage rate has been declining since 2016.

1.37 We don't know the total number of students in each class, so we cannot compare the percentage of student athletes in each section. The larger number of student athletes at 8 a.m. may just result from a larger number of students at 8 a.m., which may be because the class can accommodate more students because perhaps it is in a large lecture hall.

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1.38 No. We need to know the population of each state to compare the rates. (In fact, using the population of each state to compute ranks, California ranks 11th in pedestrian fatalities; Florida ranks 4th.)

Section 1.5: Collecting Data to Understand Causality

1.39. a. The comparison groups are formed by diet: vegan, vegetarian, and neither.

b. This is an observational study because subjects placed themselves into groups based on their diet type.

1.40. a. The treatment group consists of those taking the new drug; the comparison group consists of those taking the placebo.

b. This is a controlled experiment because the subjects were placed into treatment and control groups by the researcher.

1.41. a. The treatment groups are determined by the volume of music: quiet, loud, and no music.

b. This is a controlled experiment because students were placed into treatment and control groups by the researcher.

1.42. a. The treatment group consists of those taking the new drug; the comparison group consists of those taking the placebo.

b. This is a controlled experiment because the subjects were placed into treatment and control groups by the researcher.

1.43. a. The treatment group consists of those who watch violent cartoons; the comparison group consists of those who watch non-violent cartoons.

b. This is a controlled experiment because the boys were randomly divided into treatment and control groups by the researcher.

1.44. a. The treatment group consists of those who wore uniforms; the comparison group consists of those who did not.

b. This is an observational study because students themselves determined which group they would belong to.

1.45 Anecdotal evidence consists of stories about individual cases. No cause-and-effect conclusions can be drawn from anecdotal evidence.

1.46 These testimonials are anecdotal evidence. There is no control group and no comparison. No cause-and-effect conclusions can be drawn from anecdotal evidence.

1.47 This was an observational study, and from it you cannot conclude that the tutoring raises the grades. Possible confounders (answers may vary): 1. It may be the more highly motivated who attend the tutoring, and this motivation is what causes the grades to go up. 2. It could be that those with more time attend the tutoring, and it is the increased time studying that causes the grades to go up.

1.48 a. If the doctor decides on the treatment, you could have bias.

b. To remove this bias, randomly assign the patients to the different treatments.

c. If the doctor knows which treatment a patient had, that might influence his opinion about the effectiveness of the treatment.

d. To remove that bias, make the experiment double-blind. The talk-therapy only patients should get a placebo, and no patients should know whether they have a placebo or antidepressant. In addition, the doctor should not know who took the antidepressants and who did not.

1.49. The sample size was 102. Patients were randomly assigned to one of the two groups. The study was not double-blind since researchers knew to which group patients had been assigned. There was no placebo used in the study.

1.50. The sample size was fairly large, 2000 children. The study did not use random assignment. Children were divided into groups by self-reported activity levels. The study was not double-blind and did not use a placebo.

1.51 a. The sample size was 49. This was a controlled experiment because participants were randomly assigned to a control group or treatment group (IG). The study was not double-blind and did not report using a placebo.

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1.52 a. The sample size was 240. This was a controlled experiment because it used a double-blind randomized trial. There is no need for a placebo because we are comparing two treatments.

1.53. a. This was an observational study. Subjects were not randomly assigned to treatment/control groups; they simply completed a questionnaire.

b. No, a causal conclusion cannot be drawn from an observational study because there might be confounding factors. For example, some students might have heavier workloads than others, causing both sleep loss and increased stress.

1.54 No. There was no control group and no comparison. From observation of 12 children, it is not possible to come to a conclusion that the vaccine causes autism. It may simply be that autism is usually noticed at the same age the vaccine is given.

1.55 a. Intervention remission %: $11/33 = 33.3\%$ Control remission: $3/34 = 8.8\%$

b. Controlled experiment. There was random assignment to treatment/control groups.

c. While this study did use random assignment to treatment/control groups, the sample size was fairly small (67 total) and there was no blinding in the experimental design. The difference in remission may indicate that the diet approach is promising and further research in this area is needed.

1.56 Ask whether there was random assignment to groups. Without random assignment there could be bias, and we cannot infer causation.

1.57 No. This is an observational study.

1.58 This is likely a conclusion from observational studies since it would not be ethical to randomly assign a subject to a group that drank large quantities of sugary drinks. Since this was likely based on observational studies, we cannot conclude drinking sugary beverages causes lower brain volume.

Chapter Review Exercises

1.59 a. $68/96 \times 100\% = 70.8\%$

b. $1/50 \times 100\% = 2\%$

c. Yes, this was a randomized, double-blind controlled experiment and indicated that the intervention may have been effective.

1.60 No. This study must have been observational because one could not enforce coffee consumption over a long enough period of time to observe mortality. Cause-and-effect conclusions cannot be drawn from observational studies. Possible confounding variables might be educational level, income, or even psychological or genetic variations.

1.61 a. Gender (categorical) and whether students had received a speeding ticket (categorical).

b.

	Male	**Female**	**Total**
Yes	6	5	11
No	4	10	14
Total	10	15	25

c. Males % yes: $6/10 = 60\%$

Females % yes: $5/15 = 33.3\%$

So, a greater percentage of males reported receiving a speeding ticket.

1.62 a. Gender (categorical) and whether students had driven over 100 mph (categorical).

b.

	Male	**Female**	**Total**
Yes	6	5	11
No	3	10	13
Total	9	15	24

c. Males % yes: $6/9 = 66.7\%$ Females % yes: $5/15 = 33.3\%$

So, a greater percentage of males reported driving over 100 mph.

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1.63 Answers will vary. Students should not copy the words they see in these answers. Randomly divide the group in half, using a coin flip for each woman: Heads she gets the vitamin D, and tails she gets the placebo (or vice versa). Make sure that neither the women themselves nor any of the people who come in contact with them know whether they got the treatment or the placebo ("double-blind"). Over a given length of time (such as three years), note which women had broken bones and which did not. Compare the percentage of women with broken bones in the vitamin D group with the percentage of women with broken bones in the placebo group.

1.64 Answers will vary. Students should not copy the words they see here. Randomly divide the group in half, using a coin flip for each person: Heads they get Coumadin, and tails they get aspirin (or vice versa). Make sure that neither the subjects nor any of the people who come in contact with them know which treatment they received ("double-blind"). Over a given length of time (such as three years), note which people had second strokes and which did not. Compare the percentage of people with second strokes in the Coumadin group with the percentage of people with second strokes in the aspirin group. There is no need for a placebo because we are comparing two treatments. However, it would be acceptable to have three groups, one of which received a placebo.

1.65 a. Treatment variable: participation in a mindfulness-based program. Response variables: number of depressive symptoms and amount of impulsivity.
b. This was a controlled experiment.
c. This study did not have a placebo and had a very small sample size and may not be double-blinded (we're not told). These shortcomings weaken the ability to conclude that mindfulness training can decrease impulsivity.

1.66 a. Treatment variable: activity type (challenging dance program or conventional fitness program); Response variable: brain volume and cognition assessments.
b. This was a controlled experiment.
c. We don't have all of the information we need, specifically whether the study was double-blind. The similarity of the two groups means that perhaps the participants were blinded as to the treatment of the study, but the researchers might not have been. Still, it was randomized, so the differences are suggestive of causality.

1.67 No. There was no control group and no random assignment to treatment or control groups.

1.68 a. Long course antibiotics: $39 / 238 = 16.4\%$

Short course antibiotics: $77 / 229 = 33.6\%$

The longer course recipients did better.

b.

	10 days	**5 days**	**Total**
Failu	39	77	116
Succ	199	152	351
Total	238	229	467

c. Controlled experiment (random assignment to treatment/control groups).
d. Yes. This was a controlled, randomized experiment with a large sample size.

1.69 a. LD: $\frac{4}{4+46} = \frac{2}{25} = 8\%$ tumors; LL: $\frac{14}{14+36} = \frac{7}{25} = 28\%$ tumors
b. A controlled experiment. You can tell by the random assignment.
c. Yes, we can conclude cause and effect because it was a controlled experiment, and random assignment will balance out potential confounding variables.

1.70 a. $\frac{43}{43+10} = \frac{43}{53}$, or about 81.1%, of the males who were assigned to Scared Straight were rearrested.
$\frac{37}{37+18} = \frac{37}{55}$, or about 67.3%, of those receiving no treatment were rearrested. So, the group from Scared Straight had a higher arrest rate.
b. No, Scared Straight does not cause a lower arrest rate, because the arrest rate was highe

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