INSTRUCTOR'S SOLUTIONS MANUAL

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ESSENTIAL STATISTICS: EXPLORING THE WORLD THROUGH DATA

THIRD EDITION

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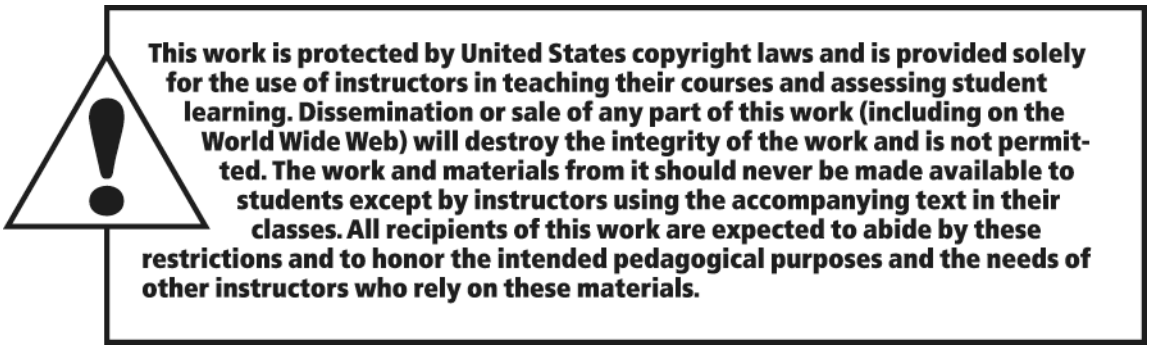

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Chapter 1: Introduction to Data

Section 1.2: Classifying and Storing Data

1.1 There are eight variables: “Female”, “Commute Distance”, “Hair Color”, “Ring Size”, “Height”, “Number of Aunts”, “College Units Acquired”, and “Living Situation”.

1.2 There are eleven observations.

1.3 a. Living situation is categorical.

b. Commute distance is numerical.

c. Number of aunts is numerical.

1.4 a. Ring size is numerical.

b. Hair color is categorical.

c. Height is numerical.

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 class standing (“Freshman”, “Sophomore”, “Junior”, or “Senior”) or favorite color. *Don’t copy these answers*.

1.7 0 = male, 1 = female. The sum represents the total number females in the data set.

1.8 There would be seven 1’s and four 0’s.

1.9 Female is categorical with two categories. The 1’s represent females, and the 0’s represent males. If you added the numbers, you would get the number of females, so it makes sense here.

1.10 a. Freshman

0
1
1
0
1
1
0
1
1
0
0

b. numerical

c. categorical

1.11 a. The data is stacked.

b. 1 = male, 0 = female.

c.

Male	Female
1916	9802
183	153
836	1221
95	
512	

1.12 a. The data is unstacked.

b. Labels for columns will vary.

Gender	Age
1	29
1	23
1	30
1	32
1	25
0	24
0	24
0	32
0	35
0	23

c. Gender is categorical; Age 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

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

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	

Section 1.3: Investigating Data

1.15 Yes. Use College Units Acquired and Living Situation.

1.16 Yes. Use Female and Height.

1.17 No. Data on number of hours of study per week are not included in the table.

1.18 Yes. Use Ring Size and Height.

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 Use Time and Activity.

Section 1.4: Organizing Categorical Data

1.21 a. 33/40 = 82.5%

b. 32/45 = 71.1%

c. 33/65 = 50.8%

d. 82.5% of 250 = 206 men

1.22 a. 4/27 = 14.8%

b. 14/27 = 51.9%

c. 4/18 = 22.2%

d. 14.8% of 600 = 89 men

1.23 a. 15/38 = 39.5% of the class were male.

b. 0.641(234) = 149.994, so 150 men are in the class.

c. $0.40(x) = 20$, so 20/0.40 = 50 total students in the class.

1.24 a. 0.35(346) = 121 male nurses.

b. 66/178 = 37.1% female engineers.

c. $0.65(x) = 169$ so 169/0.65 = 260 lawyers in the firm.

1.25 The frequency of women 6, the proportion is 6/11, and the percentage is 54.5%.

1.26 The frequency is 8, the proportion is 8/11, and the percentage is 72.7%.

1.27 a. and b.

	Men	**Women**	**Total**
Dorm	3	4	7
Commuter	2	2	4
Total	5	6	11

c. 4/6 = 66.7%

d. 4/7 = 57.1%

e. 7/11 = 63.6%

f. 66.7% of 70 = 47

1.28 a. and b.

	Men	**Women**	**Total**
Brown	3	5	8
Black	2	0	2
Blonde	0	1	1
Total	5	6	11

c. 5/6 = 83.3%

d. 5/8 = 62.5%

e. 8/11 = 72.7%

f. 83.3% of 60 = 50

1.29 1.26(x) = 160328 so 160328/1.26 = 127,244 personal care aids in 2014

1.30 .1295(x) = 3480000 so 3480000/.1295 = $26,872,587.87 total candy sales

1.31

State	Prison	Rank Prison	Population	Population (thousands)	Prison per 1000	Rank Rate
California	136,088	1	39,144,818	39145	3.48	4
New York	52518	2	19,795,791	19796	2.65	5
Illinois	48278	3	12,859,995	12860	3.75	3
Louisiana	30030	4	4,670,724	4671	6.43	1
Mississippi	18793	5	2,992,333	2992	6.28	2

California has the highest prison population. Louisiana has the highest rate of imprisonment.

The two answers are different because the state populations are different.

1.32 a. Miami: 4,919,000/2891 = 1701 Detroit: 3,903,000/3267 = 1195

Atlanta: 3,500,000/5083 = 689 Seattle: 2,712,000/1768 = 1534

Baltimore: 2,076,000/1768 = 1174

Ranks: 1- Miami, 2- Seattle, 3- Detroit, 4- Baltimore, 5- Atlanta

b. Atlanta

c. Miami

1.33

Year	%Uncovered
1990	$\frac{34,719}{249,778} = 13.9\%$
2000	$\frac{36,586}{279,282} = 13.1\%$
2015	$\frac{29758}{316574} = 9.4\%$

The percentage of uninsured people have been declining.

1.34

Year	% Subscribers
2012	$\frac{103.6}{114.7} = 90.3\%$
2013	$\frac{103.3}{114.1} = 90.5\%$
2014	$\frac{103.7}{115.7} = 89.6\%$
2015	$\frac{100.2}{116.5} = 86.0\%$
2016	$\frac{97.8}{116.4} = 84.0\%$

The percentage of cable subscribers rose slightly between 2012 and 2013 but has declined each year since then.

1.35

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

The percentage of older population is projected to increase.

1.36

Year	D/M %
2000	$\frac{4.0}{8.2} = 48.8\%$
2005	$\frac{3.6}{7.6} = 47.4\%$
2010	$\frac{3.6}{6.8} = 52.9\%$
2014	$\frac{3.2}{6.9} = 46.4\%$

The rate has fluctuating over this period, decreasing, then increasing, and then decreasing again.

1.37 We don't know the percentage of female students in the two classes. The larger number of women at 8a.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.

1.38 No, we need to know the population of each city so we can compare the rates.

Section 1.5 Collecting Data to Understand Causality

1.39 Observational study.

1.40 Controlled experiment.

1.41 Controlled experiment.

1.42 Controlled experiment.

1.43 Controlled experiment.

1.44 Observational study.

1.45 Anecdotal evidence are 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 a. The sample size of this study is not large (40). The study was a controlled experiment and used random assignment. It was not double-blind since researchers new what group each participant was in.

b. The sample size of the study was small, so we should not conclude that physical activity while learning caused higher performance.

1.50 This is an observational study because researchers did not determine who received PCV7 and who did not. You cannot conclude causation from an observational study. We must assume that it is possible that there were confounding factors (such as other advances in medicine) that had a good effect on the rate of pneumonia.

1.51 a. Controlled experiment. Researchers used random assignment of subjects to treatment or control groups.

b. Yes. The experiment had a large sample size, was controlled, randomized, and double-blind; and used a placebo.

1.52 a. Observational study. There was no random assignment to treatment/control groups. The subjects kept a food diary and had their blood drawn.

b. We cannot make a cause-and-effect conclusion since this was an observational study.

1.53 No, this was not a controlled experiment. There was no random assignment to treatment/control groups and no use of a placebo.

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. 61/98 = 62.2%

b. 37/82 = 45.1%

c. Yes, this was a controlled experiment with random assignment. The difference in percentage of homes adopting smoking restrictions indicates the intervention may have been effective.

1.60 No. Cause-and-effect conclusions cannot be drawn from observational studies.

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

b.

	Male	**Female**
Yes	6	5
No	4	10

c. Men: 6/10=60%; Women: 5/15 = 33.3%; a greater percentage of men reported receiving a speeding ticket.

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

b.

	Male	**Female**
Yes	6	5
No	3	10

c. Men: 6/9 = 66.7%; Women: 5/15 = 33.3%; a greater percentage of men reported driving over 100 mph.

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. The treatment variable is mindful yoga participation. The response variable is alcohol use.

b. Controlled experiment (random assignment to treatment/control groups).

c. No, since the sample size was fairly small; however, the difference in outcomes for treatment/control groups may indicate that further research into the use of mindful yoga may be warranted.

1.66 a. The treatment variable was neurofeedback; the response variable is ADHD symptoms.

b. Controlled experiment (random assignment to treatment/control groups).

c. No because there were no significant differences in outcomes between any of the groups.

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**
Failure	39	77
Success	199	152

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: 8% tumors; LL: 28% tumors A greater percentage of the 24 hours of light developed 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. 43/53, or about 81.1%, of the males who were assigned to Scared Straight we rearrested. 37/55, or 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 higher.