

Homework 3 Solutions

Chapter 4: #50, 52, 15.30 (Use R Commander, counts as 2 problems)

Chapter 5: #76, 102, 110

Chapter 6: #4, 8, 54

Assigned Wed, January 25

4.50 No. If the sample size of a study is small, there may not be enough information to declare statistical significance. Also, in some studies there may be an unfortunate “luck of the draw” in that sample results may not be consistent with the truth in the population.

4.52 a. Null hypothesis: age and having seen a ghost (or not) are not related
 Alternative hypothesis: age and having seen a ghost (or not) are related
b. There is a statistically significant relationship because p -value = .001 is less than .05. This means that we believe the relationship observed in the sample also holds in the population. Regarding the hypotheses stated in part (a), the alternative hypothesis is selected.
c. The probability is .001 that the relationship observed in the sample would have been as strong as it is if there is no relationship between the variables in the population. More specifically, the probability is .001 that the chi-square statistic would be as large as it is, or larger, if there is no relationship in the population.

15.30 a. Males: $15/22 = .682$; Females: $18/34 = .529$. (So the difference is $.682 - .529 = .153$.)

b. Note: In the first printing, the column totals “Yes” is incorrect. The correct value is 33. $\chi^2 = 1.282$, $df = (2 - 1)(2 - 1) = 1$, p -value = .258. We cannot reject the null hypothesis so we are not able to infer that males and females differ. Here is the output from R Commander: X-squared = 1.2819, df = 1, p-value = 0.2575

c. New observed counts are:

	No	Yes
Male	35	75
Female	80	90

$$\chi^2 = 5 \times 1.2819 = 6.41$$

From R Commander: X-squared = 6.4095, df = 1, p-value = 0.01135
 We can reject the null hypothesis and infer that males and females differ.

d. Increasing the sample size made a fixed amount of difference become statistically significant (when it wasn't with the smaller sample size).

Assigned Friday, January 27

5.76 a. The margin of error is $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{1016}} = .031$, or about 3.1%.

b This can be done by focusing on the results for the *first survey question*. For example, "About two-thirds of American adults favor teaching creationism in the public schools."

- c. The sentences would emphasize the results for the second survey question. For instance, "A majority of U.S. adults are opposed to teaching creationism in public schools, as indicated by a survey of 1016 adults in which 55% said they were opposed"
- d. A simple statement of the survey percentages should be sufficient. For example, "About 68% of U.S. adults favor teaching creationism along with evolution, while 29% are opposed to doing so. About 40% favor teaching creationism instead of evolution, while 55% are opposed to that option."
- e. This is an example of how deliberate bias can be used to favor one side of an issue.

- 5.102**
- a. Stratified random sample. The three occupational classifications are the strata, and separate random samples are taken from each of the three groups (strata).
 - b. Cluster sample. Cities are clusters. Ten cities (clusters) have been selected and all other cities are excluded.
 - c. Systematic sample.

- 5.110**
- a. $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{1024}} = .031$. As a percentage, $.031 \times 100\% = 3.1\%$
 - b. Population proportion: $.52 \pm .031$ or .489 to .551. Percentage: $52\% \pm 3.1\%$ or 48.9% to 55.1%.
 - c. No. The 95% confidence interval is 48.9% to 55.1%, so it includes some values that are less than 50%. Therefore, it's possible that less than half of the population at that time thought that genetically modified food was not safe.

Assigned Monday, January 30

- 6.4**
- a. Observational study because the teacher only observed student behavior and did not impose any conditions or treatments.
 - b. Randomized experiment because the teacher randomly assigned students to groups.
 - c. Observational study because the students picked their own groups. The teacher did not assign students to groups.
- 6.8**
- a. Child's IQ at age 10 and the likelihood of being a smoker may both be related to mother's educational level. Lower educational level may be associated with lower child's IQ and higher chance of being a smoker.
 - b. Number of missing/decayed teeth and child's past exposure to lead may both be related to number of visits a child has made to the dentist in the past three years> Lower income families may have more lead exposure and make fewer trips to the dentist.
- 6.54**
- a. Yes, confounding variables and the implication of causation is likely to be a problem since an observational study was done. A confounding variable, rather than pet ownership, could be what is causing the group without pets to have less satisfying marriages and higher stress levels. For example, couples who live in small apartments might be less likely to have pets and more likely to have added stress in their relationships due to low income, cramped space, and so on.
 - b. Placebo, Hawthorne, and experimenter effects won't be a problem because they are associated with experiments, rather than observational studies. Similar problems may be present, though. For instance, participants might rate their marriage satisfaction as higher than it really is to avoid revealing personal problems to the researcher.

c. Ecological validity may be a problem because couples were asked to discuss sore subjects while hooked up to blood pressure and heart monitoring equipment - not exactly a real world situation! The ability to generalize may be a problem. Volunteers were used, and they may be different from people who did not volunteer in terms of how pet ownership is related to their marriage satisfaction. Perhaps people with pets who have very satisfying marriages were more inclined to volunteer than people with pets who do not have very satisfying marriages.