Homework 3 Solutions
Chapter 6: # 44*, 45*, 50bcde, 52 (*44 and 45 count together for one point)
Chapter 3: #13, 23, 63, 86
Chapter 4: #13, 21, 36

Assigned Friday, October 8

6.44 No. For instance, with a very large sample size we may be able to declare statistical significance even for very weak relationships (small differences). The magnitude of the difference may not be important in a practical sense.

6.45 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.

6.50 **b.** The chance is .19 that we would get a chi-square value as large as (or larger than) 1.714 if there really is no relationship between the variables in the population.
c. Using R Commander gives the following results:
   X-squared = 17.1429, df = 1, p-value = 3.467e-05
   Therefore, the chi-square value is 17.14. You could compute it by hand if you prefer.
d. Yes, with a p-value of 0.000035 the null hypothesis is rejected.
e. The sample size was 10 times larger in the second case. Therefore, the same row proportions as in the first case resulted in a chi-square test statistics that was 10 times larger. That resulted in a much smaller p-value.

6.52 *Step 1:* H_0: There is no relationship between hormone therapy and death from CHD.
         H_a: There is a relationship between hormone therapy and death from CHD.

You can do Steps 2 and 3 by hand or using R Commander. You get credit either way.
Steps 2 and 3 by hand: *Step 2:* The expected counts:

Therapy	Death from CHD	No Death from CHD	Total
Hormones	$\dfrac{8506 \times 59}{16608} = 30.22$	$\dfrac{8506 \times 16549}{16608} = 8475.78$	8506
Placebo	$\dfrac{8102 \times 59}{16608} = 28.78$	$\dfrac{8102 \times 16549}{16608} = 8073.22$	8102
Total	59	16549	16608

The chi-squared statistic:
$$\frac{(33-30.22)^2}{30.22} + \frac{(8473-8475.78)^2}{8475.78} + \frac{(26-28.78)^2}{28.78} + \frac{(8076-8073.22)^2}{8073.22} \approx 0.527 \, .$$
Step 3: Because the value of the chi-square statistic is less than 3.84, we know the *p*-value is greater than .05.

Steps 2 and 3 using R Commander: X-squared = 0.527, df = 1, p-value = 0.4679

Step 4: Fail to reject the null hypothesis because the *p*-value is greater than .05.
Step 5: We conclude that there is not enough evidence to say that there is a relationship between using hormone therapy (or not) and the risk of death from CHD.

Assigned Monday, October 11

3.13 **a.** *Selection bias* would be introduced because the sample would not be representative of the population of interest. The sample would be representative of all registered automobile owners, not all homeowners.
b. *Non-response bias* would be introduced because some people will not fill out and mail back the survey.
c. *Response bias* would be introduced because the interviewers are college students. People may not feel comfortable telling these students they want to forbid loud music at parties.
d. *Non-response bias* would be introduced because some subscribers will not respond to the survey. The readers who feel strongly about the issue will be more likely to respond.
e. *Response bias* would be introduced. When asked, most people will say they are going to vote, even if they are not likely to do so.

3.23 **a.** $\frac{1}{\sqrt{n}} \times 100\% = \frac{1}{\sqrt{1031}} \times 100\% = 3.1\%$. (It's okay to round off to 3%.)
b. $66\% \pm 3.1\%$, or 62.9% to 69.1%. (It's okay to report it as 63% to 69%.)

3.63 **a.** The margin of error is $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{1016}} = .031$, or about 3.1%. (Okay to round to 3%.)
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.

3.86 **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.

Assigned Wed, October 13

4.13 **a.** This is an observational study. People could not be assigned to be "owls" or "larks". These groups occur naturally.
b. Yes, income is a possible confounding variable. People who make more money can afford better health care, better doctors, and more schooling, so may have better health overall. They may also be more likely to set their own working hours, so might be more likely to be an "owl." Income may be affecting bout health and typical bedtime.

c. This will differ for each student. One possibility is whether or not the person is retired. Retirement status might change sleeping habits (explanatory variable) and may also affect health (response variable).

d.

Figure for Exercise 4.13d
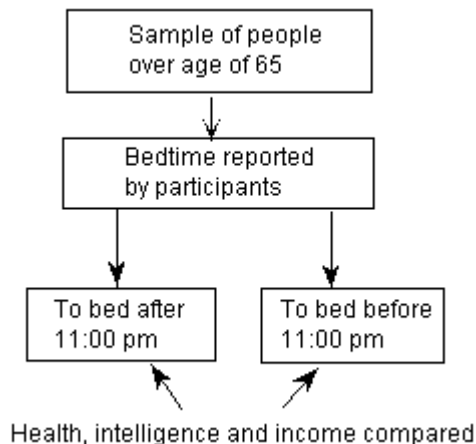
4.21 **a.** No. A participant will know whether his or her treatment is to be applied to the skin or taken as a capsule, so a double-blind procedure is not possible.
b. Yes. It may be possible to prevent the evaluator of the skin condition from knowing which treatment was used, so a single-blind procedure is possible.
c. Yes. One group could use the treatment cream and a placebo capsule, while the other group could use a placebo cream and a treatment capsule. A participant would not know which active treatment he or she received, and this information could also be kept from the evaluator.

4.36 Gather a sample of people over 50 who have skin cancer (cases) and a sample of people over 50 who do not have skin cancer (controls). Ask each individual to recall his or her lifetime sun exposure and compare them.