CHAPTER 4

HW #1 pg. 229

6. This is a voluntary response sample — the proportion of letters opposed to the insurance is probably not a fair representation of the attitudes of her constituents. Only those who have very strong opinions will write in. It is likely that the true proportion of constituents who oppose the bill is less than 871/1128.

8. This is a convenience sample. The sample is likely to overestimate the unemployment rate because people without jobs have more time to be at the mall than those who are employed.

18. a) Each tree would need to be identified and numbered, which would take too much time.
    b) This convenience sampling method is biased because trees along the main road are more likely to be damaged by cars and people, and may be more susceptible to infestation.
    c) The percentage is unlikely to be exactly 35% because of sampling variability; however, it should be close to 35%.

30. Because administrators are only sampling from students who take the bus and not including other students, this will likely produce an estimate that is too large, as students who take the bus probably need to wake up earlier so they don't miss the bus.

HW #2 pg. 259

48. a) Observational study, because children weren't assigned to different amounts of child care.

b) Explanatory: amount of time in child care from birth to age $4\frac{1}{2}$

Response: adult ratings of their behavior

c) No, this study is an observational study so we cannot make a cause-and-effect conclusion. It is possible that children who spend more time in child care have less time with their parents and get less instruction about proper behavior.

50. Level of academic motivation. For example, students with low academic motivation will spend less time studying, leaving time to go binge drinking. We can't know if the lower GPAs were caused by the binge drinking or by low academic motivation.

56. Experimental units: 30 students

Explanatory variables: step height, metronome pace

Response variable: increase in heart rate

Treatments: ① 5.75", 14 steps/min
② 5.75", 21 steps/min
③ 5.75", 28 steps/min
④ 11.5", 14 steps/min
⑤ 11.5", 21 steps/min
⑥ 11.5", 28 steps/min

58. There was no control group this year. The increase could have been due to the bonus or to other changes during the year, including the state of the economy and the cost of hiring new workers.

HW #3 pg. 261

70. a) The company won't know if pain relief was caused by the drug or by the expectation of pain relief (the placebo effect).

b) The subjects should not know what drug they are getting. For example, a patient told that she is receiving a placebo will probably not experience any pain relief, while a patient told that she is receiving a real treatment might experience pain relief due to the drug and the placebo effect. We won't know if any difference in response between the groups was due to the drug or to expectations of the subjects.

72. "Double-blind" means that the treatment assigned to a subject (testosterone or placebo) was unknown to both the subject and those responsible for assessing the effectiveness of that treatment. "Randomized" means that patients were randomly assigned to a treatment. "Placebo-controlled" means that some of the subjects were given placebos so researchers could separate the effects of testosterone from the expectations of subjects receiving a treatment.

78. a) A randomized block design would help us account for the variability in weight loss that is due to the differences in initial weight, making it easier to determine if one diet plan is better than the others.

b) How overweight the subjects are. There should be a stronger association between amount overweight and future weight loss than last name and future weight loss.

c) Ordered by increasing weight, the five blocks are
① Williams-22, Deng-34, Hernandez-25, Moses-25
② Santiago-27, Kendall-28, Mann-28, Smith-29
③ Brunk-30, Obrach-30, Rodriguez-30, Loren-32
④ Jackson-33, Stall-33, Brown-34, Cruz-34
⑤ Birnbaum-35, Tran-35, Neresky-39, Wilansky-42
For each block, number the subjects from 1 to 4. At the beginning of line 101 of Table D, look for a digit from 1 to 4. Assign the corresponding person to Treatment A. Continue reading digits from the same line until you get to a different number from 1 to 4. Assign this person to Treatment B, and so on. Here are the results, using lines 101 to 105 of Table D:
① Williams-A, Deng-B, Hernandez-C, Moses-D
② Santiago-C, Kendall-D, Mann-A, Smith-B
③ Brunk-B, Obrach-D, Rodriguez-C, Loren-A
④ Jackson-B, Stall-A, Brown-C, Cruz-D
⑤ Birnbaum-C, Tran-A, Neresky-D, Wilansky-B

HW #4 pg. 273

98. In a well-designed experiment, we can make inferences about cause and effect, but not in an observational study. In either case, we can make inferences about a larger population if the individuals were randomly selected from that population.

100. Because this study involved random assignment to the treatments, we can infer that being stored in the freezer caused the increase in average charge. Also, because the batteries were randomly chosen from the warehouse, we can generalize this result to the entire population of batteries in the warehouse.

102. Because this study involved a random sample of adults, we can make an inference that adults who attend religious services regularly have a lower risk of dying. However, because subjects were not randomly assigned to attend religious services or not, we cannot infer cause and effect.

HW #5 pg. 278

4. Stratified, because it is likely that the opinions of professors will vary based on which type of institution they teach at. Then a stratified random sample will provide a more precise estimate than the other methods. Furthermore, the other methods might miss faculty from one particular type of institution.

10. a) Randomly assign 15 students to easy mazes and the other 15 to hard mazes. Use 30 identical slips of paper and write the name of each subject on a slip. Mix the slips in a hat, select 15 of them at random, and assign these subjects to hard mazes. The remaining 15 will be assigned to easy mazes. After the experiment, compare the time estimates of the two groups.

b) Each student does the activity twice, once with each type of maze. Randomly determine which set of mazes is used first by flipping a coin for each subject. Heads: easy, then hard. Tails: hard, then easy. After the experiment, compare each students easy maze and hard maze time estimate.

c) The matched pairs design would be more likely to detect a difference because it accounts for the variability between subjects.