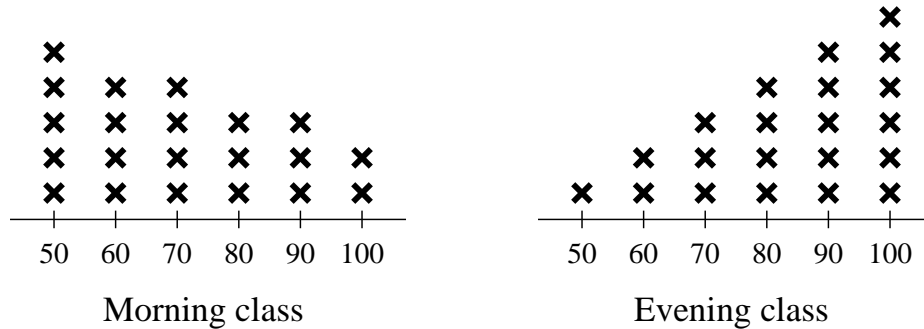


1. (12 pts) There have been a number of stories in the news lately about the gas pedals sticking on Toyota cars. Suppose a researcher conducts a study to determine whether the Toyota gas pedals really are prone to stick. He gathers a random sample of 100 Toyotas of various models and tests them.
 - (a) (4 pts) State the null and alternative hypothesis for this study.
 - (b) (4 pts) Suppose that his results have a p -value of 0.025. At the 5% level of significance, what is his decision?
 - (c) (2 pts) Is it possible that he made a Type I error?
 - (d) (2 pts) Is it possible that he made a Type II error?

2. (15 pts) A statistics professor teaches two sections of statistics, a morning class and an evening class. Each class has 21 students. He gave a quiz to both class. There were 10 true-false questions on the quiz. The distributions of scores on the quizzes for the two classes are shown below.



You meet a student who is in one of the two classes, but you do not know which one. She tells you that she scored 80 on the quiz. There are two possibilities.

H_0 : She is in the morning class.

H_1 : She is in the evening class.

- (a) (3 pts) What is the direction of extreme in this situation?
- (b) (6 pts) Using the decision rule “Reject H_0 if her score is more than 80, find the values of α and β .”
- (c) (3 pts) What is the p -value of her score of 80?
- (d) (3 pts) Describe a Type I error in this situation.

3. (23 pts) The following paragraphs are excerpted from the article “Study: Abstinence program most effective at delaying sex among youths”¹, appearing at the CNN Health website February 2, 2010.

An abstinence-only education program is more effective than other initiatives at keeping sixth- and seventh-graders from having sex within a two-year period, according to a study described by some as a landmark.

The study, published in the current issue of the Archives of Pediatrics & Adolescent Medicine, indicated that about one-third of the preteens and their young teen classmates who received an eight-hour abstinence lesson had sexual intercourse within two years of the class.

By comparison, more than half of the students who were taught about safe sex and condom use reported having intercourse by the two-year mark, and more than 40 percent of students who received either an eight- or 12-hour lesson incorporating both abstinence education and safe sex reported having sex at two years.

Among students who received instruction on overall good health, but not having to do with sex directly, nearly 47 percent had sexual activity in the two years after the class.

The study looked at 662 African-American sixth- and seventh-graders recruited from four public middle schools that serve low-income communities in an unidentified city in the northeastern United States. The adolescents were recruited between September 2001 and March 2002.

The participants’ average age was 12.2 years, and 53.5 percent were girls.

- (a) (3 pts) Describe the sample.
- (b) (3 pts) Describe the population of interest. (Be sure to distinguish the population from the sample.)
- (c) (3 pts) Identify one variable that was measured or observed as part of the study.
- (d) (3 pts) For the variable described in part (c), tell whether it is qualitative or quantitative.
- (e) (4 pts) Was this study observational or experimental? Explain.
- (f) (3 pts) The article states that among students in other programs, “about one-third of the preteens and their young teen classmates who received an eight-hour abstinence lesson had sexual intercourse within two years of the class.” This figure of one-third is (choose one)
 - (i) a statistic
 - (ii) a parameter
 - (iii) a variable
- (g) (4 pts) The opening paragraph compares the abstinence-only program with other initiatives. Write appropriate null and alternative hypotheses for this comparison.

¹<http://www.cnn.com/2010/HEALTH/02/02/abstinence.study/index.html>

4. (3 pts) A recent Rasmussen poll revealed that 75% of likely voters are either “somewhat angry” or “very angry” at the federal government². The question that was posed to each individual was “How angry are you at the current policies of the federal government?” A critic might object that this is a leading question. For example, Rasmussen could have asked “How pleased are you with the current policies of the federal government?” and given choices such as “very pleased.” If, in fact, this question is biased, what kind of bias is it?
5. (3 pts) In the Rasmussen poll of the previous example, suppose that Rasmussen had selected his sample from a list of registered voters who actually voted in the last election. What kind of bias would this method introduce?
6. (25 pts) The National Weather Service reported the snowfall amounts at 22 locations from the storm that passed through here Tuesday night and Wednesday morning. The following table shows the locations and amounts.

Location	Amount	Location	Amount
Norfolk	0.4	University of Richmond	3.5
James City County	2.0	Mechanicsville	3.5
Lake Louisa dam	3.8	Coatesville	3.0
Parksley	2.0	Western Henrico	4.0
Haleys Corner	4.8	Glen Allen	3.8
Ruther Glen	3.0	Lancaster	1.1
Midlothian	2.8	Grimstead	0.5
Woodlake	2.5	Prince Edward County	3.0
Winterpock	2.0	Newville	2.5
Newport News Park	1.0	Disputanta	2.0
Ginter Park	3.0	Newland	5.0

- (a) (8 pts) Create a stem-and-leaf display of these data.
- (b) (3 pts) Using appropriate statistical terminology, describe the shape of the distribution.
- (c) (3 pts) Explain why it would not be appropriate to use a pie chart to display these data.
- (d) (3 pts) Consider the above set to be a population. If we take a 1-in-4 system sample from this population, what are the two *possible* sample sizes?
- (e) (5 pts) Using a seed of 124, select a 1-in-4 sample from this population.
- (f) (3 pts) Is a 1-in-4 systematic sample a simple random sample? Explain.

²http://www.rasmussenreports.com/public_content/politics/general_politics/february_2010/75.are_angry_at_government_s_current_policies

7. (10 pts) Describe each of the following variables as (1) qualitative, (2) quantitative discrete, or (3) quantitative continuous.
- (a) (2 pts) The daily high temperature at a weather station.
 - (b) (2 pts) A person's response to Rasmussen's poll mentioned above (very angry, somewhat angry, not very angry, not at all angry, not sure).
 - (c) (2 pts) The ISBN number of the statistics text used by a professor (e.g., 0-13-149756-1).
 - (d) (2 pts) The number of students graduating from high school in a county in a particular year.
 - (e) (2 pts) The amount of snowfall at HSC December through March, measured in inches.
8. (9 pts) Suppose that researchers are testing the effectiveness of a new drug. For each of the following types of bias, describe very briefly steps the researchers can take to reduce or eliminate that type of bias.
- (a) (3 pts) Selection bias.
 - (b) (3 pts) Response bias.
 - (c) (3 pts) Experimenter bias.