

1. (18 pts) Suppose there are two groups: Group A and Group B. Group A consists entirely of males and Group B consists entirely of females. There are 20 people in each group. The distributions of heights of the members of the two groups are given in the following tables.

Height (in)	No. of members
62	0
64	0
66	2
68	3
70	3
72	5
74	7

Group A

Height (in)	No. of members
62	7
64	6
66	3
68	3
70	1
72	0
74	0

Group B

You will be told the height of a person selected randomly from one of the groups. Based on this information, you will decide whether you believe the person is male or female, i.e., from Group A or Group B. Let the hypotheses be

H_0 : The person is male.

H_1 : The person is female.

- (a) (3 pts) State a reasonable decision rule for deciding whether the person is male or female.
- (b) (3 pts) What is the direction of extreme in this problem?
- (c) (3 pts) For your decision rule in part (a), what is the value of α ?
- (d) (3 pts) For your decision rule in part (a), what is the value of β ?
- (e) (3 pts) If the height of the randomly selected person is 72 inches, what is the p -value of this observation?
- (f) (3 pts) If you decide the person is male and it turns out that the person is female, what type of error did you make?
2. (22 pts) The City of Richmond is considering passing an ordinance that would require that dog owners not keep their dogs on a chain for more than one hour a day¹. The rationale is that dogs that are chained up for longer periods of time become mean. A researcher decides to test whether this rationale is valid. He selects a group of 100 dogs from the local dog pound and randomly divides them into two groups, with 50 dogs in each group. Over a period of 6 months, the dogs in Group I are kept on a leash no longer than one hour a day, while the dogs in Group II are kept on a leash for 8 hours a day. At the end of 6 months the meanness of each dog is judged by the researcher. He finds that the dogs in Group II are significantly meaner than the dogs in Group I.

¹<http://www.inrich.com/cva/ric/news.apx.-content-articles-RTD-2007-09-18-0168.html>.

- (a) (4 pts) State appropriate null and alternative hypotheses for this situation.
- (b) (6 pts) Which of the following are possible types of bias in this situation? For each type that you select, explain why it is possible.
- i. Selection bias.
 - ii. Response bias.
 - iii. Nonresponse bias.
 - iv. Experimenter bias.
- (c) (4 pts) Assume that the dogs were numbered 1 through 100. Using your calculator and a seed of 250, write down the numbers of the first 5 dogs that were selected to be in Group I.
- (d) (2 pts) What is the explanatory variable in this situation?
- (e) (2 pts) What is the response variable in this situation?
- (f) (4 pts) Is this an experimental study or an observational study? Explain.
3. (12 pts) A recent article in the Richmond Times-Dispatch stated that “30 percent of Virginia’s 496 homicides in 2005 were the result of ‘family or intimate-partner conflict.’ Of those 147 victims, 67 were adults killed by a partner and 20 were children killed by their caregivers.”² We will assume that the remainder of the 147 victims were in the “other” category.
- (a) (5 pts) Draw a pie chart showing these three categories.
- (b) Suppose that some researchers decide to take a 1-in- k systematic sample from the population of 496 homicide victims. They would like the sample size to be 20.
- i. (3 pts) What value of k should they use?
 - ii. (4 pts) Using your calculator and a seed of 75, and your value of k from the previous question, find the first five members selected for the sample.
4. (20 pts) The article cited in the previous problem goes on to state that “And another recent report shows that most health-care providers in Virginia don’t ask about domestic violence when their patients show signs of abuse. Published by Project RADAR, an initiative of the state health department, that study found that 90 percent of 2061 providers who responded to a survey have never been trained in domestic-violence prevention—and of those, 77 percent said they don’t think they need such training. A total of 5581 surveys were mailed out.”³
- (a) (2 pts) What percentage of those responding to the survey have never been trained in domestic-violence prevention and, furthermore, do not think they need such training?

²<http://www.inrich.com/cva/ric/search.apx.-content-articles-RTD-2007-08-30-0260.html>.

³Ibid.

- (b) (4 pts) What is the most likely type of bias present in this survey? Explain.
 - (c) (5 pts) What are the two variables of interest in this survey?
 - (d) (3 pts) Describe the population of interest in this study.
 - (e) (3 pts) Describe the sample.
 - (f) (3 pts) Is the 77% figure a parameter or a statistic?
5. (8 pts) The information in the table below comes from the 2007 Small Arms Survey⁴.

Country	Per capita GDP	Population	Low est. of total firearms
Brazil	2,900	175,000,000	15,300,000
Columbia	1,900	43,000,000	2,300,000
England and Wales	29,900	60,400,000	2,000,000
Morocco	1,500	30,000,000	1,500,000
Turkey	3,400	71,000,000	7,000,000
United States	37,800	300,000,000	175,000,000

For each of the variables in the table (and listed below), tell whether it is qualitative, quantitative discrete, or quantitative continuous.

- (a) Country
 - (b) Per capita GDP
 - (c) Population
 - (d) Low estimate of total firearms
6. (14 pts) A recent article in the Richmond Times-Dispatch made the following statement: “According to new U.S. Census Bureau estimates, 13.3 percent of Virginians were without health insurance in 2006, compared with a 12.8 percent uninsured rate in 2005. Nationally, the uninsured rate was 15.8 percent in 2006, up from 15.3 percent in 2005—a statistically significant increase.”⁵
- (a) (4 pts) What would the null and alternative hypotheses be?
 - (b) (3 pts) Based on the last statement cited above, which hypothesis did the researchers accept?
 - (c) (3 pts) If the level of significance was 0.05, give a possible p -value for this test.
 - (d) (4 pts) Suppose that these data were collected by visiting New York City, Seattle, and Dallas and gathering comprehensive information on how many people in those cities are uninsured. What sampling method would this be?

⁴<http://www.smallarmssurvey.org/files/sas/publications/yearb2007.html>

⁵<http://www.inrich.com/cva/ric/search.apx.-content-articles-RTD-2007-08-29-0162.html>

7. (6 pts) Explain how researchers can control for each of the following types of bias.
- (a) Selection bias in selecting which subjects will be in the treatment group and which will be in the control group.
 - (b) Response bias in a study of the effectiveness of a proposed new drug.
 - (c) Experimenter bias in a study of the effectiveness of a proposed new drug.