

**Math and Society - Math 111****Midterm 2 Review**

*The following problems are similar to ones you might see on the midterm exam.*

1. (10 points) A 2010 Pew Research poll asked 1,306 Americans “From what you’ve read and heard, is there solid evidence that the average temperature on earth has been getting warmer over the past few decades, or not?”. The two-table below shows the responses by party and ideology.

	Earth is warming	Not warming	Don’t know	Total
Conservative Republican	144	261	26	431
Mod/Lib Republican	78	79	13	170
Mod/Cons Democrat	326	91	26	444
Liberal Democrat	235	13	13	261
Total	784	444	78	1306

- (a) What percent of all of the people in the sample were conservative Republicans?
- (b) What percent of people who believe that the Earth is warming are conservative Republicans?
- (c) How many times more likely are liberal Democrats to believe in global warming than conservative Republicans (i.e., what is the relative risk)?
2. (10 points) 1,500 randomly selected American adults were asked, “*Have you ever seen anything that you believe was a spacecraft from another planet?*” by ABC News. 150 of the respondents answered that they had, in fact, seen an alien spacecraft.
- (a) What population is the target of this study?
- A. All American adults.
  - B. Alien spacecraft that have visited Earth.
  - C. Americans who believe in UFO’s.
  - D. The 1,500 American adults selected.
  - E. The 150 people who have seen alien spacecraft.
- (b) What was the sample in this study?
- A. All American adults.
  - B. Alien spacecraft that have visited Earth.
  - C. Americans who believe in UFO’s.
  - D. The 1,500 American adults selected.
  - E. The 150 people who have seen alien spacecraft.

3. (15 points) The average annual rainfall total for Farmville, VA is 44.0 inches, with a standard deviation of 7.0 inches. You may assume that annual rainfall is normally distributed.
- (a) Draw a rough sketch of this normal distribution, and label the x-axis with the number of inches of rainfall that are 0, 1, or 2 standard deviations away from the mean.
  - (b) Approximately how often (as a percent) will Farmville get an annual rainfall total of more than 51 inches?
  - (c) 95% of the time, Farmville gets between \_\_\_\_\_ and \_\_\_\_\_ inches of rainfall each year.
4. (15 points) Suppose you want to determine whether the death penalty acts as a deterrent against homicide, so you compare homicide rates between states that have the death penalty and states that do not.
- (a) What are the individuals in the example above?
  - (b) In the study above, there are two variables. What are they? For each variable, say whether it is explanatory or response.
  - (c) Is this an experiment or an observational study?
  - (d) Identify one possible confounding variable that might prevent us from making any solid conclusions from this study.

5. (5 points) A researcher studying the math skills of elementary school teachers conducted a survey with a group of volunteer teachers. Before agreeing to take the survey, teachers were told that the survey included some questions addressing confidence in mathematics and a quick word problem.

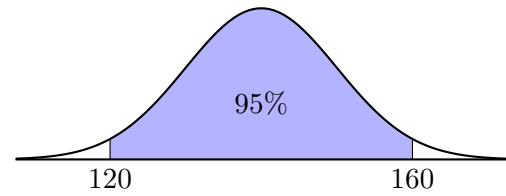
Which of the following best describes the results of this survey.

- A. The results will not be biased, because the sample is randomly selected.
  - B. The results will be biased, because elementary math teachers might not remember very much math.
  - C. As long as enough people complete the survey, the results won't be biased.
  - D. The results will be biased because the teachers are free to choose whether to participate in the survey.
6. (15 points) In the United States Senate there are currently 44 Democrats, 54 Republicans, and 2 Independents. There are 20 women in the Senate (14 Democrats and 6 Republicans). **You can skip this problem, we haven't covered two-way tables or segmented bar graphs yet.**
- (a) Make a **two-way table** and a **segmented bar graph** (with one bar for each party) to display the relationship between gender and political party in the Senate.

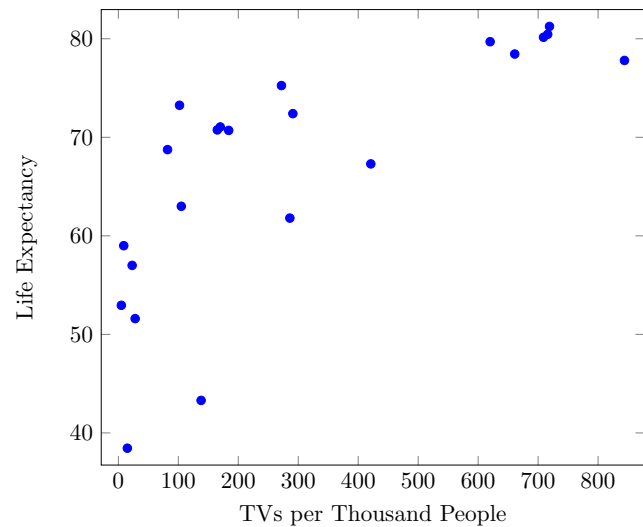
- (b) Are gender and political party associated or independent in the Senate? Circle the right answer.

7. (5 points) Mr. Jones and Mrs. Smith are running in an election for Governor. A sample of over 1,000 voters participated in a poll the night before the election. In the poll, 70% of the voters say they will vote for Mr. Jones, but when the official results arrived, Mrs. Smith ends up winning 60% of the vote. Assuming the election is fair, which is the most likely explanation for what went wrong in the poll?
- A. Since the sample was large, the reason the poll was not accurate is probably sample bias.
  - B. Since the sample was large, the reason the poll was not accurate is probably random error.
  - C. Since the sample was large, the reason the poll was not accurate is probably Simpson's paradox.

8. (5 points) If 95% of the data in a normal distribution is between the two numbers shown below, find the mean  $\mu$  and the standard deviation  $\sigma$ . (You may assume the shaded region is symmetric.)



9. (5 points) What is the main advantage of an experiment over and observational study?
- A. Experiments don't have random error.
  - B. In an experiment, you don't need to worry about bias.
  - C. Experiments let you determine if there is a cause and effect relationship between two variables.
  - D. Experiments let you determine if there is an association between two variables.
10. (15 points) A study of 22 countries found a strong correlation ( $r=0.743$ ) between the number of televisions per 1000 people and life expectancy.



- (a) Does this study imply that more televisions **cause** people to live longer? Explain.
- (b) The scatter-plot above has least squares regression line  $y = 0.0324x + 55.34$ . (i) What is the slope, and (ii) what does the slope tell us about this particular situation in words?