Math and Society - Math 111

Midterm 3 Review

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

- 1. At one prison, 80% of prisoners released on parole had been convicted of non-violent offenses while the other 20% had been convicted of violent offenses. Suppose that 25% of non-violent paroles are re-incarcerated within five years while 50% of violent paroles are re-incarcerated within five years.
 - (a) Complete the tree diagram below by adding the correct weights to the branches.



(b) What percent of all paroles are re-incarcerated after five years?

(c) Given that a parole is not re-incarcerated after five years, what is the probability that they were originally convicted of a violent offense?

2. A group of students are asked how many siblings they each have. The results are shown below.

# of Siblings	0	1	2	3	4	5
% of Students	20%	35%	25%	5%	10%	5%

What is the average number of siblings for these students?

- 3. The *Student Monitor* surveys 1200 undergraduates from 100 colleges semiannually to understand trends among college students. Recently, the *Student Monitor* reported that the average amount of time spent on the internet was 15.1 hours. Assume that the standard deviation is 5 hours.
 - (a) Use the formula $\bar{x} \pm 2\frac{s}{\sqrt{n}}$ to find a 95% confidence interval for the mean time spent per week on the internet.

- (b) What was the population in this study?
 - A. The 1200 undergraduates.
 - B. Everyone in the United States.
 - C. All college students in the United States.
 - D. The amount of time spent on the internet.
- (c) What was the variable in this study?
 - A. The 1200 undergraduates.
 - B. Everyone in the United States.
 - C. All college students in the United States.
 - D. The amount of time spent on the internet.
- (d) Which of the following best describes the confidence interval from part (a)?
 - A. There is a 95% chance that the population mean is in the interval.
 - B. There is a 95% chance that any college student is in the interval.
 - C. 95% of college students are in the interval.
 - D. There is a 95% chance that the average of a future survey will be in the interval.
- 4. A survey of 1124 likely voters in the Democratic primary in California before the 2016 election found that 584 planned to vote for Hillary Clinton.
 - (a) Use the formula

$$\hat{p} \pm 2\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

to find a 95% confidence interval for the proportion of all Democratic primary voters who are planning to vote for Clinton.

(b) What is the margin of error for this poll?

- (c) What would decrease the margin of error for the poll?
 - A. If we took a larger sample.
 - B. If we took a smaller sample.
 - C. If we took a random sample.
 - D. If we carefully selected the sample to avoid bias.
- 5. The game of Texas hold'em starts with each player receiving two cards. Here is the probability model for the number of aces in two-card hands:

Number of aces	0	1	2
Probability	0.559	0.382	?

(a) What is the missing number in the table above?

(b) What is the probability of getting at least one ace in a two-card hand?

6. The expected number of heads if you flip a fair coin once is 0.5, but of course you can't really get 0.5 heads. Give a one or two sentence explanation of what we mean by "expected value".

7. 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 convervative Republicans (i.e., what is the relative risk)?

(d) The row proportion 326/444 is a conditional probability, so it can be expressed using the notation $P(A \mid B)$. What is A and what is B for this particular conditional probability?

- 8. In the United States Senate in 2016, there were 44 Democrats, 54 Republicans, and 2 Independents. There were 20 women in the Senate (14 Democrats and 6 Republicans).
 - (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 in 2016.

(b) If you randomly picked a senator, what is the probability that you would pick a woman or a Democrat?

(c) Were gender and political party associated or independent in the Senate?