AP Statistics 2018-19 Summer Work

Mr. Schoonover

Please print and complete the following assignment during the summer. I will collect it on the first day of class. This activity gives you a great introduction to statistical thinking. It will require you to describe data, conduct simulations of an experiment, and make an inference on the basis of the results of your simulations. In the process of completing this assignment, you will be exposed to the following topics that make up the core of AP Statistics: 1) describing data, 2) experimental design, 3) data-based inference, and 4) probability. As you work through the assignment, try to connect each part of the activity with its respective topic listed in the foregoing sentence (it will be fun)!

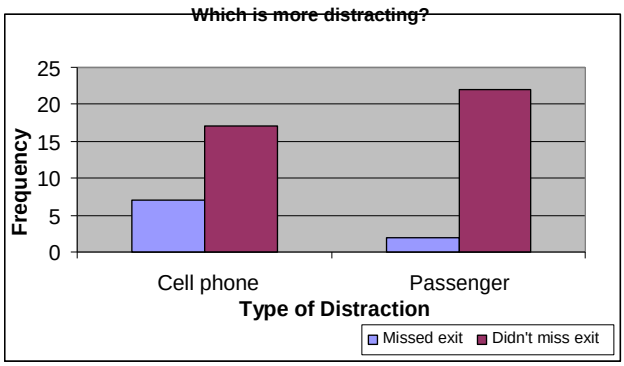
Are drivers more distracted when using a cell phone than when talking to a passenger in the car? Researchers wanted to find out, so they designed an experiment. Here are the details.

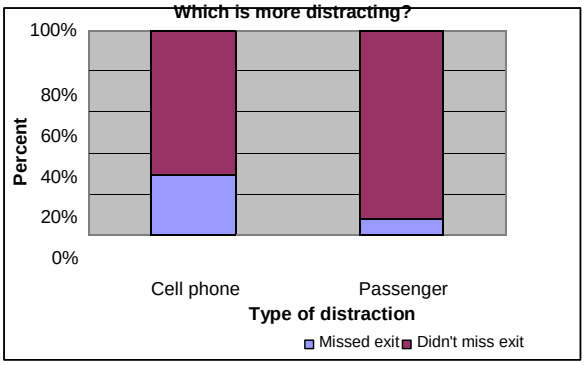
In a study involving 48 people, 24 people were randomly assigned to drive in a driving simulator while using a cell phone. The remaining 24 were assigned to drive in the driving simulator while talking to a passenger in the simulator. Part of the driving simulation for both groups involved asking drivers to exit the freeway at a particular exit. In the study, 7 of the 24 cell phone users missed the exit, while 2 of the 24 talking to a passenger missed the exit. (from the 2007 AP* Statistics exam, question 5)

- Let's start by summarizing the data from this study. Each of the 48 people in the experiment can be classified into one of the four cells in the table below based on the experimental condition to which they were assigned and whether they missed the designated exit. Use information from the previous paragraph to complete the table.

		Distraction	
		Cell phone	Passenger
Missed exit?	Yes		
	No		

To analyze data, we begin by making one or more graphs.





- Two types of Excel bar graphs are shown above. Explain the difference in what the two graphs display. Then tell which one you prefer and why!

Next, we add numerical summaries. We might be interested in comparing the counts, percents, or proportions of people in the two groups who missed the freeway exit.

- Fill in the missing entries in the table below for the passenger group.

	Missed exit		
	Number	Proportion	Percent
Cell phone group	7	0.292	29.2
Passenger group			

In the distracted driving experiment, 29.2% of the 24 drivers talking on cell phones missed the freeway exit, compared with only 8.3% of the 24 drivers who were talking to passengers. This seems like a pretty large difference—almost 21% higher for the drivers who used cell phones. Researchers might be tempted to conclude that the different experimental conditions—talking on a cell phone and talking to a passenger—actually caused the observed difference in the percent of drivers who missed the freeway exit. There is another possibility, however.

Suppose that the two experimental conditions—talking on a cell phone and talking to a passenger—actually have *the same effect* on drivers' distraction. In that case, the 9 people in this experiment who missed the freeway exit would have done so no matter which group they were assigned to. Likewise, the 39 people who did not miss the exit would have had the same result whether they talked on a cell phone or to a passenger. This leads us to the other possibility: if the two experimental conditions actually have the same effect on drivers' distraction, then the observed difference in the percentage of drivers that missed the exit in the two groups could simply have been due to chance. That is, the difference could be a result of which 24 people just happened to be assigned to each group. In the next activity, you will examine whether this second possibility seems plausible.

Activity: Could the observed difference be due to the chance assignment of people to groups?
Materials: Standard deck of playing cards

What would happen if we reassigned the 48 people in this experiment to the cell phone and passenger groups many times, assuming that the group assignment had no effect on whether each driver missed the exit? Let's try it and see.

1. Get a standard deck of playing cards. Make sure that your deck has 52 cards, not including jokers.

2. We need 48 cards to represent the 48 drivers in this study. In the original experiment, 9 people missed the exit and 39 people didn't miss the exit. If the group assignment had no effect on drivers' distraction, these results wouldn't change if we reassigned 24 people to each group at random. For a physical simulation of these reassignments, we need 9 cards to represent the people who will miss the exit and 39 cards to represent the people who won't miss the exit. Decide which 48 cards you chose and which nine cards you will use to represent the 9 drivers who missed the exit.

3. Explain how you decided which cards to use to represent the 48 people in the study, and how you chose the 9 cards to represent the 9 drivers who missed the exit (there is no one correct way to do this).

4. Now you're ready to simulate the process of reassigning people to groups. "***Shuffle*** and deal" two piles of 24 cards—the first pile representing the cell phone group and the second pile representing the passenger group. Record the number of drivers who missed the exit in each group.

5. Repeat this process 29 more times so that you have a total of 30 trials. Record your results in the table provided.

Trial #	Number who missed exit in cell phone group	Number who missed exit in passenger group
1/11/21	_____/_____/_____	_____/_____/_____
2/12/22	_____/_____/_____	_____/_____/_____
3/13/23	_____/_____/_____	_____/_____/_____
4/14/24	_____/_____/_____	_____/_____/_____
5/15/25	_____/_____/_____	_____/_____/_____
6/16/26	_____/_____/_____	_____/_____/_____
7/17/27	_____/_____/_____	_____/_____/_____
8/18/28	_____/_____/_____	_____/_____/_____
9/19/29	_____/_____/_____	_____/_____/_____
10/20/30	_____/_____/_____	_____/_____/_____

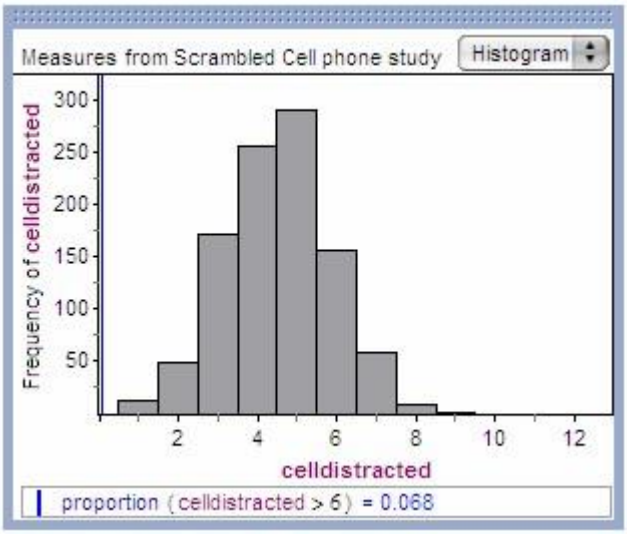
In the original experiment, 7 of the 24 drivers using cell phones missed the freeway exit, compared to only 2 of the 24 drivers who were talking to a passenger. *How surprising would it be to get a difference this large or larger simply due to chance if the effects of the two experimental conditions on drivers' distraction were actually the same?* You can estimate the chance of this happening with the results of your simulation!

6. In how many of your 30 simulation trials did 7 or more drivers in the cell phone group miss the exit? Based on this number, what is the probability that 7 or more drivers in the cell phone group will miss their exit?

7. Make a histogram of the number of drivers who missed the exit in the cell phone group of your simulations. If you don't know how to make a histogram, look it up!

8. Based on your simulation results, do you think it's possible that cell phones and passengers are equally distracting to drivers, and that the difference observed in the original experiment could have been due to the chance assignment of people to the two groups? Why or why not? Why do you not have to consider the number of people who missed their exit in the passenger group in order to make an inference based on your simulations?

Here are the results of 1000 trials of a computer simulation, like the one you did with the playing cards, showing the number of drivers who missed the exit in the cell phone group.



9. In the computer simulation, how often did 7 or more drivers in the cell phone group miss the exit when there is no difference in the effects of the experimental conditions? Do these results agree or disagree with your simulations? Do you think the results of the original experiment could be due to chance and not to a difference in the effects of cell phone use and talking to a passenger on driver distraction? Explain your reasoning.

10. Review the activity you've just completed and identify which parts of the activity belong to each of the four topics that we will be learning about this year. Based only on this activity, try your best to describe what descriptive statistics, experimental design, probability, and inferential statistics are.