Name Key Algebra 2 Homework 14-6

1. A factory has machines that fill 12 ounce soda bottles repeatedly with an average volume of 12.2 ounces and standard deviation of 0.9 ounces. A new machine was installed and 30 bottles were sampled. It was found that they had an average volume of 11.8 ounces. We want to investigate whether this mean is significantly lower than that of the original population.

   a. You simulate 100 samples that come from a ~~Run NORMSAMP with a mean~~ of 12.2 and a standard deviation of 0.9. ~~Run 100 simulations~~. What percent of these simulations resulted in a sample mean of 11.8 ounces or ~~higher~~ lower (~~this will vary based on the simulation~~)?

   You find only 1 w/ a sample mean of 11.8 or <.

   $$\frac{1}{100} = 1\%$$

   b. Based on your findings from (a), can you conclude that this sample mean likely came from the same population or a different population with a lower mean? Explain.

   Since there was only a 1% chance of getting a sample mean of 11.8 or lower if the actual pop mean was 12.2 ounces, there is convincing evidence that the new machine has a lower pop mean than 12.2 ounces

2. If 45% of a population likes a particular soda, then what range below shows all sample proportions within two standard deviations of the population proportion if the standard deviation is 0.059?

   (1) 38% to 52% (2) 33% to 57% (3) 20% to 70% (4) 28% to 62%

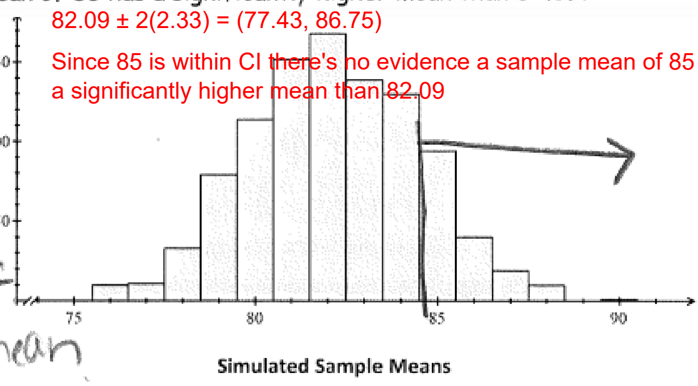
   $$.45 \pm 2(.059) = (.332, .568)$$

3. A simulation is done using a population with a mean of 82, a standard deviation of 15 and samples of size 40. When 1000 samples are simulated, the distribution of simulated sample means is created and shown. The mean of these sample means is 82.09 and the standard deviation is 2.33. Do you have evidence that a sample mean of 85 has a significantly higher mean than 82.09?

$$\frac{100+40+20+10}{1000} = \frac{170}{1000} = .17$$

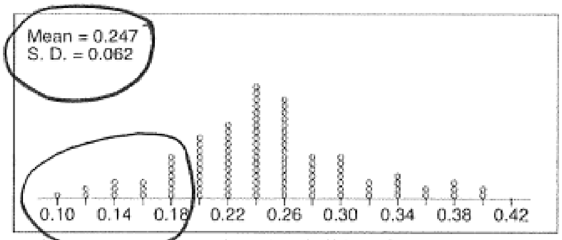
82.09 ± 2(2.33) = (77.43, 86.75)

Since 85 is within CI there's no evidence a sample mean of 85 has a significantly higher mean than 82.09



Since there's a 17% chance of getting a sample mean of 85 or higher if the pop mean is 82.09, there is not convincing evidence that a sample mean of 85 has a sign. higher mean than 82.09

4. Stephen's Beverage Company is considering whether to produce a new brand of cola. The company will launch the product if at least 25% of cola drinkers will buy the product. Fifty cola drinkers are randomly selected to take a blind taste-test of products A, B, and the new product. Nine out of fifty participants preferred Stephen's new cola to products A and B. The company then devised a simulation based on the requirement that 25% of cola drinkers will buy the product. Each dot in the graph shown below represents the proportion of people who preferred Stephen's new product, each of sample size 50, simulated 100 times.



Proportion Preferring Stephen's Product

Assume the set of data is approximately normal and the company wants to be 95% confident of its results. Does the sample proportion obtained from the blind taste-test, nine out of fifty, fall within the margin of error developed from the simulation? Justify your answer.

$ME = 2(.062) = .124$ $\hat{p} = \frac{9}{50} = .18$

$CI = .247 \pm .124 = (.123, .378)$

.18 is within CI $\therefore$ yes

The company decides to continue developing the product even though only nine out of fifty participants preferred its brand of cola in the taste-test. Describe how the simulation data could be used to support this decision. The company has evidence that the pop. prop. could be at least 25%. The dot plot shows that if pop. prop = .25, $\frac{16}{\cancel{50}\ 100}$ = .16, occurs several times (16 % of the time). Given this info, the results of the survey don't provide evidence to suggest the true pop. prop. is not .25, so the development of the product should continue at this time.

Since .18 (9/50) is within CI above, and 25% is also within CI above, so the company should continue development

5. In an election poll, 200 people were surveyed and 45% expressed their likelihood to vote for a particular candidate. The standard deviation is 0.035. The margin of error on this estimated support is closest to

(1) 2% (2) 7% (3) 3% (4) 12%

$2(.035) = .07$

Differences Due to Random Assignment Alone

Twenty adult drivers were asked the following question:

"What speed is the fastest that you have driven?"

The table below summarizes the fastest speeds driven in miles per hour (mph).

70	60	70	95	50	60	80	75	55	90
110	65	65	65	55	70	75	70	65	40

← These are the "fastest speeds"

1. What is the mean fastest speed driven?

   $\overline{x} = 69.25$ mph

2. What is the range of fastest speed driven?

   Range = 110 − 40 = 70 mph

3. Imagine that the fastest speeds were randomly divided into two groups. How would the means and ranges compare to one another? To the means and ranges of the whole group? Explain your thinking.

Let's investigate what happens when the fastest speeds driven are randomly divided into equal-size groups.

4. You were given a packet of slips of paper. The 20 slips of paper represent the twenty fastest speeds driven.
   - Turn the squares upside down. Mix well.
   - Separate the squares into 2 piles of 10, identifying one pile as Group 1 and the other pile as Group 2.
   - Turn the slips of paper over.
   - Record the numbers for Group 1 and Group 2 in the table.

answers vary

											Mean
Group 1	70	40	65	75	65	70	65	110	60	55	67.5
Group 2	75	70	65	60	70	95	50	55	90	80	71

5. Do you expect the means of these two groups to be equal? Why or why not?

   No due to Random selection groups could be similar but unlikely to be same

6. Compute the means of these two groups. Write the means in the chart on the previous page.

7. How do these two means compare to each other?

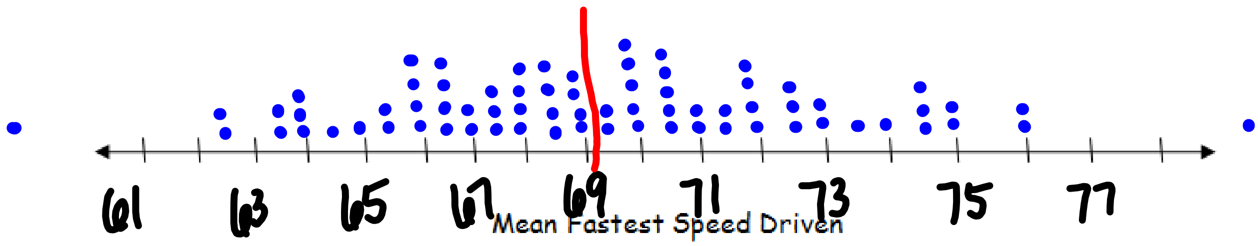
8. How do these two means compare to the mean fastest speed driven for the entire group (Exercise 1)?

   The values of the 2 means are close to the population mean. One is larger and one is smaller.

9. Use the instructions provided for Exercise 4 to repeat the random division process two more times. Compute the mean of each group for each of the random divisions into two groups. Record your results in the tables below.

											Mean
Group 3											
Group 4											
Group 5											
Group 6											

10. Based on the class simulations, plot the means of all six groups on a class dot plot.



11. Based on the class dot plot, what can you say about the possible values of the group means?

Group sample means are centered at orig. mean of 69.25 mph.

Group means closer to orig. mean of 69.25 mph occur more often than group means further from 69.25 mph.

12. What is the smallest possible value for a group mean? Largest possible value?

Mean of Lowest 10 = 58 mph

Largest Possible = 80.5 mph

13. What is the largest possible range for the distribution of group means?

Max - Min = 80.5 - 58 = 22.5 mph

14. How does the largest possible range in the group means compare to the range of the original data set (Exercise 2)?

Range of original data is 70 mph. Lgst possible range for distr. of group means is 22.5 mph, which is much smaller. This diff. is due to the use of means. The means of the 2 groups of 10 don't vary as much as indiv. obs in data set.

15. What is the shape of the distribution of group means?

Mound / Symmetrical

16. Will your answer to the above question always be true? Explain.

Yes. When a single set of values is divided into 2 groups, the group means will be equidistant from the single set's mean, ∴ always producing a symmetrical distribution.

17. When a single set of values is randomly divided into two equal groups, explain how the means of these two groups may be very different from each other and may be very different from the mean of the single set of values.

It's possible that the random division could result in most of the smaller values being in one group and most of the larger in another. This would produce means that were very diff. from each other and from single set's mean; but w/ random division, this is not very likely to occur.

Summary:

- The two group means will tend to differ just by chance.
- The distribution of random groups' means will be centered at the single set's mean.
- The range of the distribution of the random groups' means will be smaller than the range of the data set.
- The shape of the distribution of the random groups' means will be symmetrical.