Name Key

HW 14-7

In one high school, there are eight math classes during 2nd period. The number of students in each 2nd period math class is recorded below.

32 27 26 23 25 22 30 19

This data set is randomly divided into two equal size groups, and the group means are computed.

1. Will the two group means be the same? Why or why not?

No, the 2 group means tend to not be the same just due to chance.

The random division into two groups process is repeated many times to create a distribution of group mean class size.

2. What is the center of the distribution of group mean class size?

Distr. group mean class size is centered at mean of original 8 class sizes. $\frac{204}{8} = 25.5$ students

3. What is the largest possible range of the distribution of group mean class size?

largest group mean = $\frac{32+30+27+26}{4} = 28.75$ students

smallest group mean = $\frac{19+22+23+25}{4} = 22.25$ students

largest group mean range = $28.75 - 22.25 = 10.5$ students

4. What possible values for the mean class size are more likely to happen than others? Explain why you chose these values.

Mean class sizes closer to 25.5 are more likely to happen than sizes further from the distribution mean class size of 25.5.

most likely

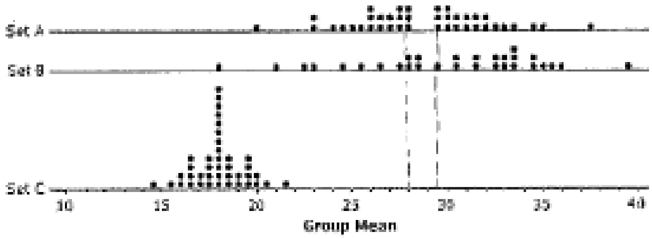
23, 24, 25, 26, 27, 28

There are 3 different sets of numbers: *Set A*, *Set B*, and *Set C*. Each set contains 10 numbers. In two of the sets, the 10 numbers were randomly divided into two groups of 5 numbers each, and the mean for each group was calculated. These two means are plotted on a dot plot. This procedure was repeated many times, and the dot plots of the group means are shown below.

The third set did not use the above procedure to compute the means.

For each set, the smallest possible group means and the largest possible group mean were calculated, and these two means are shown in the dot plots below.

Use the dot plots below to answer Problems 5-8.



5. Which set is NOT one of the two sets that were randomly divided into two groups of 5 numbers? Explain. Set B was not randomly ÷ into 2 subsets. When set of #s is ÷ into 2 = groups, resulting dot plot of group means will be symmetrical.

6. Estimate the mean of the original values in *Set A*. Show your work.

$$\frac{28+29.5}{2} = 28.75$$

7. Estimate the range of the group means shown in the dot plot for *Set C*. Show your work.

$$21.5 - 14.5 = 7$$

8. Is the range of the original values in *Set C* smaller or larger than your answer in Problem 7? Explain. Range of set C is larger than range of sample distr. from set C. Range of group means will always be smaller than range of orig. set of values.

QUIZ

Ruling Out Chance

Imagine that 10 tomatoes of varying shapes and sizes have been placed in front of you. These 10 tomatoes (all of the same variety) have been part of a nutrient experiment where the application of the nutrient is expected to yield larger tomatoes that weigh more. All 10 tomatoes have been grown under similar conditions regarding soil, water, and sunlight, but 5 of the tomatoes received the additional nutrient supplement. Using the weight data of these 10 tomatoes, you wish to examine the claim that the nutrient yields larger tomatoes on average.

1. Why would it be important in this experiment for the 10 tomatoes to all be of the same variety and grown under the same conditions (except for the treatment applied to 5 of the tomatoes)?

So any observed changes can be attributed to the trmt, because all other factors are the same.

Here are the 10 tomatoes with their weights shown. They have been ordered from largest to smallest based on weight.

9.1	8.4	8.0	7.7	7.3	6.4	5.9	5.2	4.4	3.8
#1	#2	#3	#4	#5	#6	#7	#8	#9	#10

For now, do not be concerned about which tomatoes received the additional nutrients. The object here is to randomly assign the tomatoes to the two groups.

Imagine that someone assisting you uses a random-number generator or some other impartial selection device and randomly selects Tomatoes #1, 4, 5, 7, and 10 to be in Group A. By default, Tomatoes #2, 3, 6, 8, and 9 will be in Group B. The result is illustrated to the right.

Group A	Group B
9.1	8.4
7.7	8.0
7.3	6.4
5.9	5.2
3.8	4.4

2. Confirm that the mean for Group A is 6.76 ounces, and calculate the mean for Group B. Since we have two sets of data, we can use our calculator: **Stat→Calc→2: 2-Var Stats L_1, L_2**

$\bar{x}_A = 6.76$ $\bar{x}_B = 6.48$

3. Calculate the difference between the mean of Group A and the mean of Group B (that is, calculate $\bar{x}_A - \bar{x}_B$).

$\bar{x}_A - \bar{x}_B = 6.76 - 6.48 = .28$ oz

The statistic of interest that you care about is the difference between the mean of the 5 tomatoes in Group A and the mean of the 5 tomatoes in Group B. For now, call that difference "Diff." "Diff" = $\bar{x}_A - \bar{x}_B$.

4. Explain what a "Diff" value of "1.64 ounces" would mean in terms of which group has the larger mean weight and the number of ounces by which that group's mean weight exceeds the other group's mean weight.

Group A has a mean weight that's 1.64 oz. higher than Group B's mean weight.

5. Explain what a "Diff" value of "-0.4 ounces" would mean in terms of which group has the larger mean weight and the number of ounces by which that group's mean weight exceeds the other group's mean weight.

Group A has a mean weight that is 0.4 oz. lower than Group B's mean weight.

6. Explain what a "Diff" value of "0 ounces" would mean regarding the difference between the mean weight of the 5 tomatoes in Group A and the mean weight of the 5 tomatoes in Group B.

Group A's mean weight is the same as Group B's mean weight.

7. Below is a second random assignment of the 10 tomatoes to two groups. Calculate the mean of each group, and then calculate the value of "Diff" for this second case. Also, interpret the "Diff" value in context using your responses to the previous questions as a guide.

Group A	Group B
9.1	7.7
8.4	5.9
8.0	5.2
7.3	4.4
6.4	3.8

Group A: $\bar{x} = 7.84$ oz.

Group B: $\bar{x} = 5.4$ oz.

Diff $= 7.84 - 5.4 = 2.44$ oz.

Interpret: Group A has a mean weight that is 2.44 oz. greater than Group B's mean weight.

8. Here is a third random assignment of the 10 tomatoes. Calculate the mean of each group, and then calculate the value of "Diff" for this case. Interpret the "Diff" value in context using your responses to the previous questions as a guide.

Group A	Group B
9.1	8.4
7.7	8.0
7.3	6.4
5.2	5.9
3.8	4.4

Group A: $\bar{x} = 6.62$ oz

Group B: $\bar{x} = 6.62$ oz

"Diff": 0 oz.

Interpret: There's no difference betw. Group A and B's mean weight.

most (+)

9. Using the 10 tomatoes, what arrangement of tomatoes would yield the largest value of "Diff"? How would you explain your reasoning without performing calculations to verify your answer? How big is the largest value of "Diff"?

Largest "Diff" would be Group A is largest 5 tomatoes, Group B is 5 smallest tomatoes. "Diff" would be:

$\bar{x}_L = 8.10$ $\bar{x}_S = 5.14$ Diff = 2.96 oz

10. Using your logic above, what arrangement of tomatoes would yield the most negative value of "Diff"? How would you explain your reasoning without performing calculations to verify your answer? What is this "Diff" value?

Most negative "Diff" would be Group A is 5 smallest tomatoes, Group B is 5 largest tomatoes. "Diff" would be: $5.14 - 8.10 = -2.96$ oz

11. What would it mean for the mean of all "Diff" values to be close to zero?

Tomatoes in each group were mixed, no group had only largest or smallest values. Ex. 8 showed this

Summary:

- When the single group of observations was randomly divided into two groups, the means of these two groups differed by chance.
- In some cases the difference in the means of these two groups was very small (or "0"), but in other cases, this difference was larger.

****Set up HW #1 together**

HW. 0, 3, 6, 9, 12, 18

1.

Group A			Group B			$\bar{X}_A$	$\bar{X}_B$	Diff
0	3	6	9	12	18	3	13	-10
0	3	9	6	12	18	4	12	-8
0	3	12						
0	3	18						
0	6	9						
0	6	12						
0	6	18						
0	9	12						
0	9	18						
0	12	18						
3	6	9						
3	6	12						
3	6	18						
3	9	12						
3	9	18						
3	12	18						
6	9	12						
6	9	18						
6	12	18						
9	12	18						