Using Sample Data to Compare the Means of Two or More Populations

1. Do eleventh-grade males text more per day than eleventh-grade females do? To answer this question, two randomly selected samples were obtained from the Excel data file used in this lesson. Indicate how 20 randomly selected eleventh-grade females would be chosen for this study. Indicate how 20 randomly selected eleventh-grade males would be chosen.

2. Two randomly selected samples (one of eleventh-grade females and one of eleventh-grade males) were obtained from the database. The results are indicated below:

	Mean number of minutes per day texting	MAD (minutes)
Eleventh-grade females	102.55	1.31
Eleventh-grade males	100.32	1.12

Is there a meaningful difference in the number of minutes per day that eleventh-grade females and males text? Explain your answer.

1. Based on Ken's population database, compare the amount of sleep that sixth-grade females get on average to the amount of sleep that eleventh-grade females get on average.

    Find the data for 15 sixth-grade females based on the following random ID numbers:
    65 1 67 101 106 87 85 95 120 4 64 74 102 31 128

    Find the data for 15 eleventh-grade females based on the following random ID numbers:
    348 313 297 351 294 343 275 354 311 328 274 305 288 267 301

2. On the same scale, draw dot plots for the two sample data sets.

3. Looking at the dot plots, list some observations comparing the number of hours per week that sixth graders spend on doing homework and the number of hours per week that eleventh graders spend on doing homework.

4. Calculate the mean and MAD for each of the data sets. How many MADs separate the two sample means? (Use the larger MAD to make this calculation if the sample MADs are not the same.)

	Mean (hr.)	MAD (hr.)
Sixth-grade females		
Eleventh-grade females		

5. Recall that if the number of MADs in the difference of two sample means is greater than or equal to 2, then it would be reasonable to think that the population means are different. Using this guideline, what can you say about the average number of hours of sleep per night for all sixth-grade females in the population compared to all eleventh-grade females in the population?

1. **Do eleventh-grade males text more per day than eleventh-grade females? To answer this question, two randomly selected samples were obtained from the Excel data file used in this lesson. Indicate how 20 randomly selected eleventh-grade females would be chosen for this study. Indicate how 20 randomly selected eleventh-grade males would be chosen.**

   To pick 20 females, 20 randomly selected numbers from 266–363 would be generated from a random number generator or from a random number table. Duplicates would be disregarded, and a new number would be generated. To pick 20 males, 20 randomly selected numbers from 264 to 440 would be generated. Again, duplicates would be disregarded, and a new number would be generated.

2. **Two randomly selected samples (one of eleventh-grade females and one of eleventh-grade males) were obtained from the database. The results are indicated below:**

	Mean number of minutes per day texting	MAD (minutes)
Eleventh-grade females	102.55	1.31
Eleventh-grade males	100.32	1.12

   Is there a meaningful difference in the number of minutes per day eleventh-grade females and males text? Explain your answer.

   The difference in the means is $102.55\ min. - 100.32\ min.$, or $2.23\ min.$ (to the nearest hundredth of a minute).

   Divide this by $1.31\ min.$ or the MAD for females (the larger of the two MADs): $\frac{2.23}{1.31} = 1.70\ min.$ to the nearest hundredth of a minute. This difference is less than 2 MADs, and therefore, the difference in the male and female number of minutes per day of texting is not a meaningful difference.

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1. **Based on Ken's population database, compare the amount of sleep that sixth-grade females get on average to the amount of sleep that eleventh-grade females get on average.**

   Find the data for 15 sixth-grade females based on the following random ID numbers:
   $65\ \ 1\ \ 67\ \ 101\ \ 106\ \ 87\ \ 85\ \ 95\ \ 120\ \ 4\ \ 64\ \ 74\ \ 102\ \ 31\ \ 128$

   Find the data for 15 eleventh-grade females based on the following random ID numbers:
   $348\ \ 313\ \ 297\ \ 351\ \ 294\ \ 343\ \ 275\ \ 354\ \ 311\ \ 328\ \ 274\ \ 305\ \ 288\ \ 267\ \ 301$

   This problem compares the amount of sleep that sixth-grade females get on average to the amount of sleep that eleventh-grade females get on average.

   (Note to teachers: Random numbers are provided for students. Provide students access to the data file (a printed copy or access to the file at the website), or if that is not possible, provide them the following values to use in the remaining questions.)
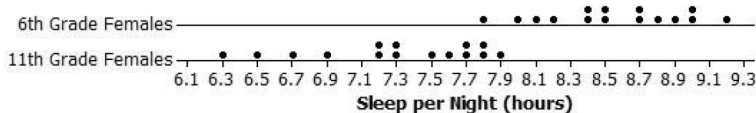
   Sixth-grade females number of hours of sleep per night:
   $8.2\ \ 7.8\ \ 8.0\ \ 8.1\ \ 8.7\ \ 9.0\ \ 8.9\ \ 8.7\ \ 8.4\ \ 9.0\ \ 8.4\ \ 8.5\ \ 8.8\ \ 8.5\ \ 9.2$

   Eleventh-grade females number of hours of sleep per night:
   $6.9\ \ 7.8\ \ 7.2\ \ 7.9\ \ 7.8\ \ 6.7\ \ 7.6\ \ 7.3\ \ 7.7\ \ 7.3\ \ 6.5\ \ 7.7\ \ 7.2\ \ 6.3\ \ 7.5$

2. On the same scale, draw dot plots for the two sample data sets.

3. Looking at the dot plots, list some observations comparing the number of hours per week that sixth graders spend on doing homework and the number of hours per week that eleventh graders spend on doing homework.

There is a small amount of overlap between the data sets for the two random samples. The distribution of sixth-grade hours of sleep is symmetric, whereas that for eleventh graders is skewed to the left. It appears that the mean number of hours of sleep for sixth-grade females is around 8.5, and the mean number for eleventh-grade females is around 7.3 or so. Whether or not the difference is meaningful depends on the amount of variability that separates them.

4. Calculate the mean and MAD for each of the data sets. How many MADs separate the two sample means? (Use the larger MAD to make this calculation if the sample MADs are not the same.)

	Mean (hr.)	MAD (hr.)
Sixth-grade females	8.55	0.33
Eleventh-grade females	7.29	0.40

The number of MADs that separate the two means is $\dfrac{8.55-7.29}{0.4} = 3.15.$

5. Recall that if the number of MADs in the difference of two sample means is greater than or equal to 2, then it would be reasonable to think that the population means are different. Using this guideline, what can you say about the average number of hours of sleep per night for all sixth-grade females in the population compared to all eleventh-grade females in the population?

Since 3.15 is well above the criteria of 2 MADs, it can be concluded that on average sixth-grade females get more sleep per night than do eleventh-grade females.