## Sample Means

**Student Activity**

Name _____

Class _____

In these activities you will describe and compare the mean and MAD of different samples. After completing the activities, discuss and/or present your findings to the rest of the class.

### Activity 1 [Page 1.3]

1. Select **menu> Measures> Mean +/-MAD**.

   a. The mean maximum recorded speed of all of the land animals is about 27 mph and the MAD is about 12 mph. How do the mean and mean absolute deviations of the sample and of all the land animals compare?

   b. Generate another sample and estimate the difference between the mean speed of the animals in the sample and the mean speed of all the land animals. Estimate the difference between the MAD of the sample and the MAD of the population.

   c. Generate four more samples and answer question b for each sample. Then compare your answers to the answers someone else found. Overall, how would you describe the difference between the mean speed and the MAD for the sample and for all the land animals?

|   | Estimated sample mean speed | Difference: pop (27)-sample | Estimated sample MAD | Difference: pop (12)-sample |
|---|---|---|---|---|
| 1 |   |   |   |   |
| 2 |   |   |   |   |
| 3 |   |   |   |   |
| 4 |   |   |   |   |

2.  Use the TNS activity to determine which of the following statements seem to be true.

    a.  Over a lot of samples, the mean maximum speeds of the samples of land animals were close to the mean of the maximum speeds of the land animals.

    b.  Many of the sample distributions were relatively similar to the population distribution in terms of center and spread.

    c.  When the sample contained the cheetah at 75 mph, the mean maximum speed of the sample of land animals was larger than the mean speed of all of the land animals.

    d.  The mean speed of the sample of land animals was always larger than the mean maximum speed of all of the land animals in the TNS activity.

**Activity 2 [Page 1.3]**

1.  Select **menu> Measures> IQR = UQ-LQ**.

    a.  Select **Sample**. How do the IQRs of the sample and the population compare?

b. Select **Sample** again and record the IQRs. Do this four times and record your results in the table. Make a conjecture about the difference between the IQR of the sample of land animals and the IQR of all the animals.

| Sample | Sample IQR | Difference: All: IQR about $30 - 20 = 10$ |
|--------|------------|-------------------------------------------|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |

c. Compare your work with several other students and see if your conjectures agree. What might explain your thinking?

**Activity 3 [Pages 1.3 and 1.5]**

1. Select **menu> Population> all animals mph**. Then select **Sample**.

   a. Describe the difference between the points on the number line at the top left and the points on the number line at the right.

   b. Generate ten samples. Would you expect to get a sample mean of 150 mph in any of your samples? Why or why not?

   c. Would you expect to get a sample mean of 15 mph? Why or why not?

2.  Return to page 1.3.

    a.  Change the population to **all animals mph** and describe the shape of the distribution of maximum speeds of all animals.

    b.  Return to page 1.5. Make a conjecture about the shape of the simulated distribution of sample means (on the number line on the right) after taking many, many samples: include a description of the general shape of the simulated distribution, where you think the central cluster of the sample means will be.

    c.  Generate at least 200 samples. Were you surprised by the simulated distribution? Compare your simulated distribution to the conjecture you had for question b.

    d.  Reset and generate another simulated distribution of 100 or more sample means. What changed in your description from question b?

3.  Select **menu> Population> all animals mph**.

    a.  Generate several samples. How do the samples relate to the population? How do the distributions of the speeds in samples of size 10 compare to the distribution of the speeds of all the animals? (Note that to see all of the animal types in a sample, you need to scroll through the list.)

b. Change the sample size to 20. Generate several samples. How do the distributions of the speeds in samples of size 20 compare to the distribution of the speeds of all the animals?

c. Pauleen noted that as the sample size increased, the simulated distribution of sample means seems to get more mound shaped and symmetric. Do you agree?

4. Kelli was worried about sampling from a population that was skewed, like the maximum speeds or life spans of the animal types. She thought the sampling distributions would be skewed as well. Work with a partner to explain how she might use the files to explore the connection between simulated distributions of sample means and sample size.

**Activity 4 [Page 1.5]**

1. What would you say to each of the following statements? Use examples from the TNS activity to support your thinking.

   a. A sample will always have the same shape as the population.

   b. A distribution of sample means will have the same shape as the population.

   c. A distribution of sample means will be fairly mound-shaped and symmetric.

   d. A simulated distribution of sample means will be symmetric around the mean of the population.

**Activity 5** [Page 2.2]

1.  Go to page 2.2. Choose **Population> all animals yrs**.

    a.  Change the sample size to 5. Generate a simulated distribution of the sample
        mean life spans and describe the spread of the mean life spans represented by
        the bar on the right.

    b.  Change the sample size to 10 and generate a sample. Repeat for samples of size
        15 and samples of size 20. What observations can you make about sample size
        and the spread of the mean life spans in the simulated sampling distributions?

2.  Match the Sentence Starters to the Sentence Enders to make at least four true
    sentences. Explain your reasoning in each case.

| Sentence Starters | Sentence Enders |
|---|---|
| a. For a simulated distribution of sample means | 1. the variability decreases. |
| b. As the sample size increases, | 2. the variability increases. |
| c. As the sample size decreases | 3. the distribution will be skewed. |
| d. If the population is skewed | 4. the variability does not change. |
| e. If the population is mound shaped and | 5. the distribution of sample means will be mound shaped and symmetric. |
| | 6. the sampling distribution will become more symmetric around the population mean as the sample size increases. |