4.1 RANDOM SAMPLING - SHOW ME THE MONEY!

INTRODUCTION

1. Name your favorite movie of all time.

2. On average, how much money do you think a movie grosses (earns) in theaters?

3. Take a guess at the title of the top-grossing movie of 2017.

4. What do you think was the maximum amount grossed by a movie in 2017?
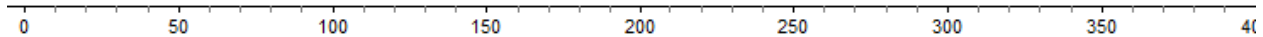
SAMPLING METHODS

5. Take a look at the list of the 200 top-grossing movies of 2017 and select 10 that you saw (or wanted to see) in theaters. For purposes of this activity, we will consider these 200 movies as a small population. In practice, populations are often much larger than 200 individuals, sometimes reaching the hundreds of millions or more. Write the titles of those movies in the table below, along with the amount they grossed in 2017. Notice that the listing of movies gives the gross income rounded to the nearest tenth of a million, so that a movie listed as earning $264.6 really grossed $264,600,000. The order in which you write the movies in the table below does not matter.

Movie Title	Gross Income (Millions)

6. Compute and record the mean gross income for the 10 movies you selected. This number is called the **sample mean**.

7. Is your sample mean the same as all the other sample means computed by the other students in your class?

It's probably not surprising to you that your sample mean differs from those of other students because you have most likely chosen different samples. The fact that different samples yield different statistics (in this case different sample means) is called **sampling variability**.

8. Combine your results with those of your classmates by creating a dotplot of sample means on the board. Then, record this dotplot on the number line below, carefully labeling the axis.

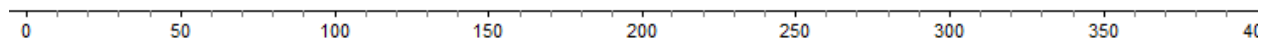| 0 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 4(|

9. Based on the previous dotplot, without any calculations, what do you suppose the mean gross income for the population of all 200 movies might be?

The method you used to take samples from the population is based on your experience and interest in movies. It turns out that this is not a particularly good way to sample if you wish to generate samples that are representative (good images) of the population. Instead of using human experience, judgment, or interest to choose samples, statisticians use chance to select samples from large populations. Samples selected by a chance process are called **random samples**.
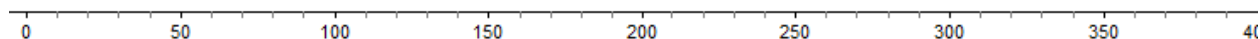
10. Your instructor will give you instructions on how to use random chance to select 10 movies from the population of 200 movies. You will draw chips from a container, use a table of random digits, or use technology to generate 10 random numbers from 1-200. Find the ID numbers in the table below that match your randomly chosen numbers. Record the ID number, title of the movie, and gross income in the following table.

ID Number	Movie Title	Gross Income (Millions)

11. Compute and record the mean gross income for the 10 movies you selected. This number is called the **sample mean**, but this time the sample mean has been generated by a **random sample**. Is your sample mean the same as all the other sample means computed by the other students in your class?

12. Combine your results with those of your classmates by creating a dotplot of sample means on the board. Then, record this dotplot on the number line below, carefully labeling the axis.

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0        50      100      150      200      250      300      350      4(
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13. Based on the previous dotplot, without any calculations, what do you suppose the mean gross income for the population of all 200 movies might be?

14. Is your guess for the mean gross income from a random sample somewhat different from your guess when you chose your own sample?

15. The population's mean gross income for the population of all 200 movies is $54.98 million. Go back to your dotplots in #8 and #12 and draw a vertical line on your number line at 54.98. Did the sample means from you and your classmates do a pretty good job of estimating the population mean when you chose your sample by thinking of movies you saw or wished to see? How about when you obtained your samples through chance? What have you learned about the use of random samples from populations?

16. With enough time, you and your classmates could continue drawing *random samples* of 10 movies, computing the sample mean for each sample, and building the dotplot in #12 above. In order to save time, your instructor will show you a simulation of this process using Fathom software. When the simulation is finished, create a rough sketch of the resulting dotplot below. Label the horizontal axis and draw two vertical lines: one at the center of all the dots and one at the population mean.

| 0 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 4(|

It should be clear that rather than producing haphazard results, random sampling actually follows regular patterns that can be predicted with advanced mathematics and statistics. These patterns can then be used to make inferences (conclusions) about the population from random samples.