Random Sampling

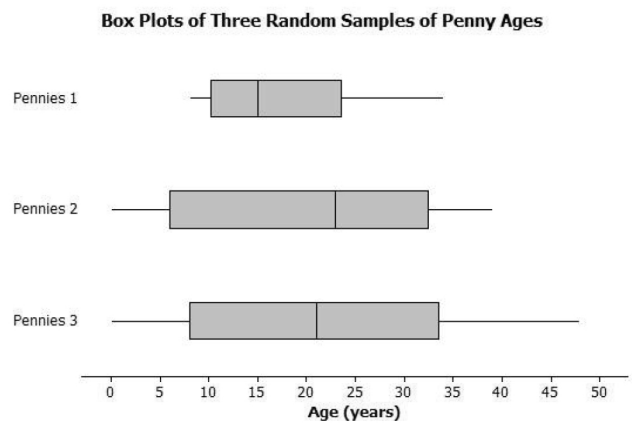
Identify each as true or false. Explain your reasoning in each case.

1. The values of a sample statistic for different random samples of the same size from the same population will be the same.

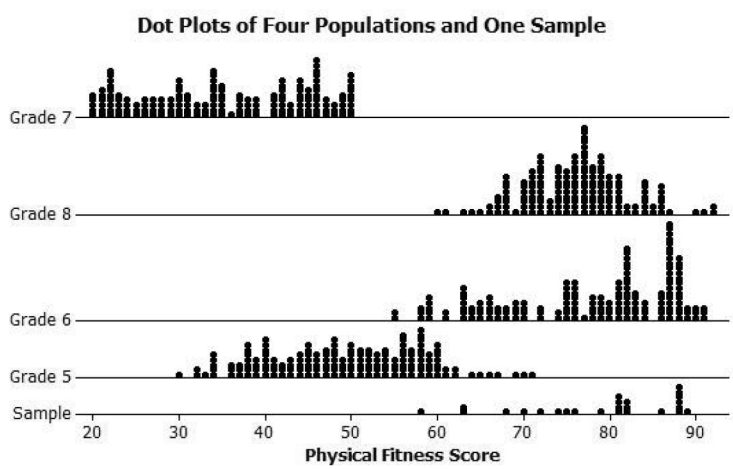
2. Random samples from the same population will vary from sample to sample.

3. If a random sample is chosen from a population that has a large cluster of points at the maximum, the sample is likely to have at least one element near the maximum.

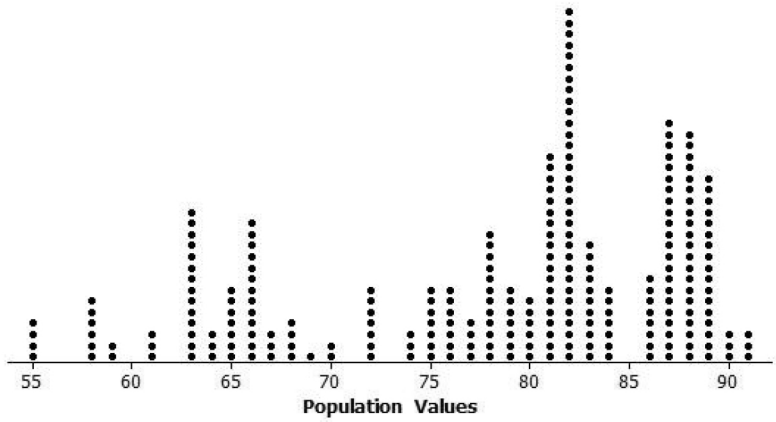
1. Look at the distribution of years since the pennies were minted from Example 1. Which of the following box plots seem like they might not have come from a random sample from that distribution? Explain your thinking.



2. Given the following sample of scores on a physical fitness test, from which of the following populations might the sample have been chosen? Explain your reasoning.



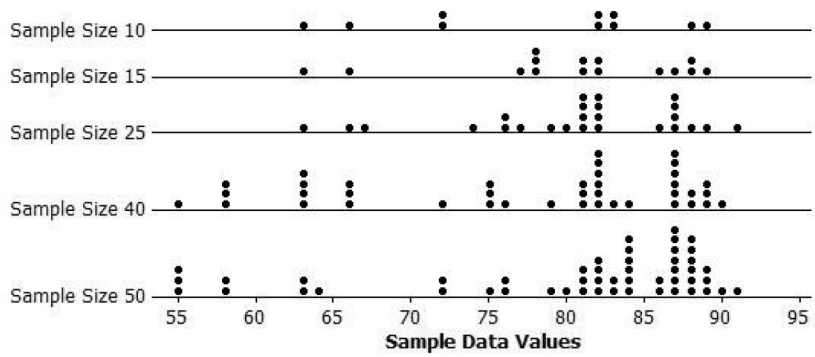
3. Consider the distribution below:



a. What would you expect the distribution of a random sample of size 10 from this population to look like?

b. Random samples of different sizes that were selected from the population in part (a) are displayed below. How did your answer to part (a) compare to these samples of size 10?

Dot Plots of Five Samples of Different Sizes



c. Why is it reasonable to think that these samples could have come from the above population?

d. What do you observe about the sample distributions as the sample size increases?

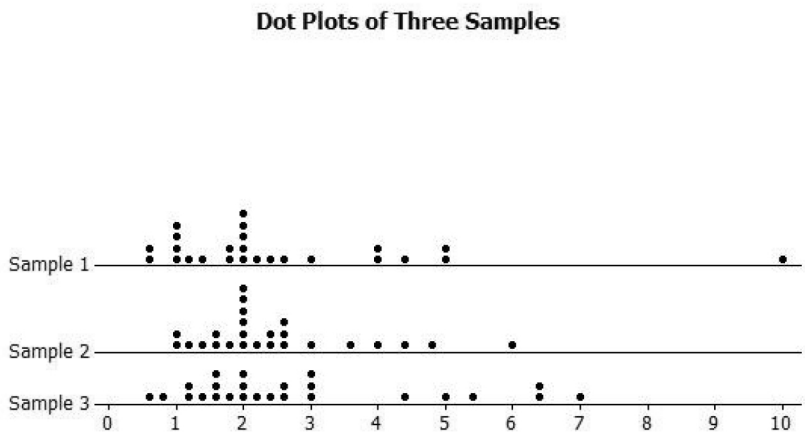
4. Based on your random sample of prices from Exercise 2, answer the following questions:

a. It looks like a lot of the prices end in 9. Do your sample results support that claim? Why or why not?

b. What is the typical price of the items in your sample? Explain how you found the price and why you chose that method.

5. The sample distributions of prices for three different random samples of 25 items from a grocery store are shown below.

   a. How do the distributions compare?



   b. Thomas says that if he counts the items in his cart at that grocery store and multiplies by $2.00, he will have a pretty good estimate of how much he will have to pay. What do you think of his strategy?

Identify each as true or false. Explain your reasoning in each case.

1. **The values of a sample statistic for different random samples of the same size from the same population will be the same.**

   False. By chance the samples will have different elements, so the values of summary statistics may be different.

2. **Random samples from the same population will vary from sample to sample.**

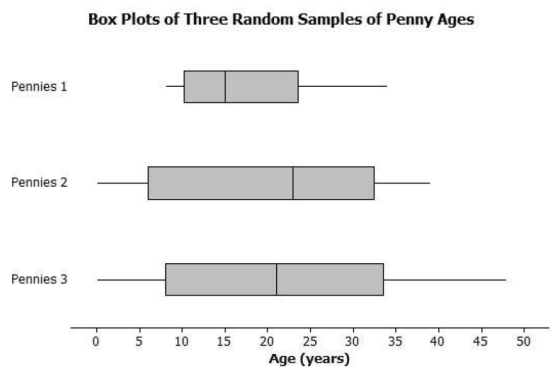
   True. Each element has the same chance of being selected, and you cannot tell which ones will be chosen; it could be any combination.

3. **If a random sample is chosen from a population that has a large cluster of points at the maximum, the sample is likely to have at least one element near the maximum.**

   True. If many of the elements are near the same value, it seems the chance of getting one of those elements in a random sample would be high.

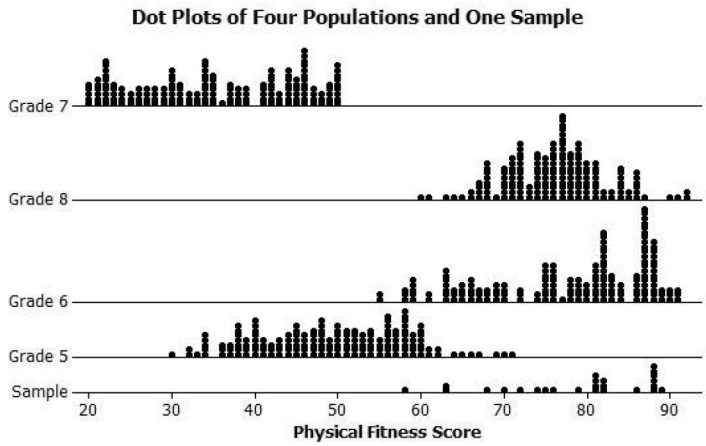
The Problem Set is intended to reinforce material from the lesson and have students think about sample variation and how random samples from the same population might differ.

1. **Look at the distribution of years since the pennies were minted from Example 1. Which of the following box plots seem like they might not have come from a random sample from that distribution? Explain your thinking.**



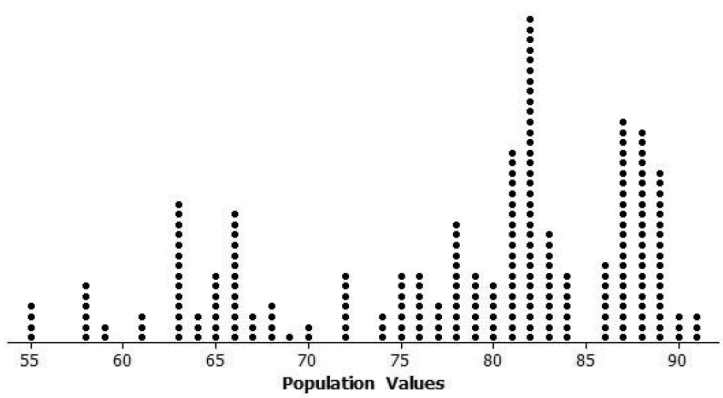
Sample response: Given that the original distribution had a lot of ages that were very small, the Pennies 1 sample seems like it might not come from that population. The middle half of the ages are close together with a small interquartile range (about 12 years). The other two samples both have small values and a much larger IQR than Pennies 1, which both seem more likely to happen in a random sample given the spread of the original data.

2. **Given the following sample of scores on a physical fitness test, from which of the following populations might the sample have been chosen? Explain your reasoning.**



Sample response: These sample values were not in Grades 5 or 7, so the sample could not have come from those grades. It could have come from either of the other two grades (Grades 6 or 8). The sample distribution looks skewed like Grade 6, but the sample size is too small to be sure.

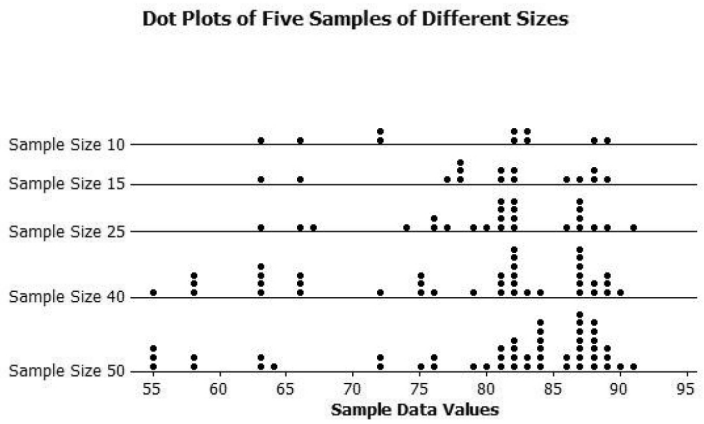
3. **Consider the distribution below:**



a. **What would you expect the distribution of a random sample of size 10 from this population to look like?**

Sample response: The sample will probably have at least one or two elements between 80 and 90 and might go as low as 60. The samples will vary a lot, so it is hard to tell.

b. **Random samples of different sizes that were selected from the population in part (a) are displayed below. How did your answer to part (a) compare to these samples of size 10?**



Sample response: My description was pretty close.

c. **Why is it reasonable to think that these samples could have come from the above population?**

Sample response: Each of the samples is centered about where the population is centered, although this is easier to see with a larger sample size. The spread of each sample also looks like the spread of the population.

d. **What do you observe about the sample distributions as the sample size increases?**

Sample response: As the sample size increases, the sample distribution more closely resembles the population distribution.

4. **Based on your random sample of prices from Exercise 6, answer the following questions:**

a. **It looks like a lot of the prices end in 9. Do your sample results support that claim? Why or why not?**

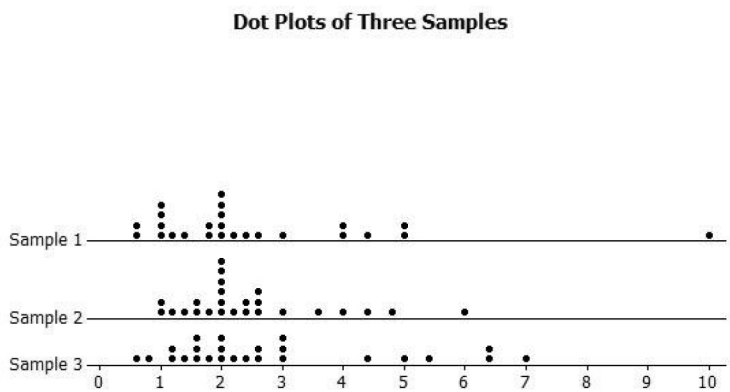
Sample response: Using the prices in the random sample, about 84% of them end in a 9. The results seem to support the claim.

b. **What is the typical price of the items in your sample? Explain how you found the price and why you chose that method.**

Sample response: The mean price is $\$2.50$, and the median price is $\$2.00$. The distribution of prices seems slightly skewed to the right, so I would probably prefer the median as a measure of the typical price for the items advertised.

5. **The sample distributions of prices for three different random samples of 25 items from a grocery store are shown below.**

a. **How do the distributions compare?**



Sample response: The samples are slightly skewed right. They all seem to have a mean around $\$2.50$ and a median around $\$2.00$. Sample 1 has one item that costs a lot more than the others. Most of the prices vary from a bit less than $\$1.00$ to around $\$5.00$.

b. **Thomas says that if he counts the items in his cart at that grocery store and multiplies by $\$2.00$, he will have a pretty good estimate of how much he will have to pay. What do you think of his strategy?**

Answers will vary. Sample response: Looking at the three distributions, $\$2.00$ is about the median, so half of the items will cost less than $\$2.00$, and half will cost more, but that will not tell you how much they cost. The mean would be a better estimate of the total cost because the mean is calculated in a way that is similar to how Thomas wants to estimate the total cost. In this case, the mean (or balance point) of the distributions looks like it is about $\$2.50$, so he would have a better estimate of the total cost if he multiplied the number of items by $\$2.50$.