

1. For each description below, identify each underlined number as a parameter or statistic. Use appropriate notation to describe each number, e.g.,  $\hat{p} = 0.96$ .
- (a) A 1993 survey conducted by the *Richmond Times-Dispatch* one week before election day asked voters which candidate for the state's attorney general they would vote for. 37% of the respondents said they would vote for the Democratic candidate. On election day, 41% actually voted for the Democratic candidate.
- (b) The National Center for Health Statistics reports that the mean systolic blood pressure for males 35 to 44 years of age is 128 and the standard deviation is 15. The medical director of a large company looks at the medical records of 72 executives in this age group and finds that the mean systolic blood pressure for these executives is 126.07.
2. Suppose two different statistics—call them Statistic A and Statistic B—can be used to estimate the same population parameter. Statistics A has lower bias than B, but A also has high variability compared to B. On the two axes below, draw two parallel dotplots showing 8 values of each statistic that are consistent with these characteristics. Assume that the parameter value is at the arrow on the axes.

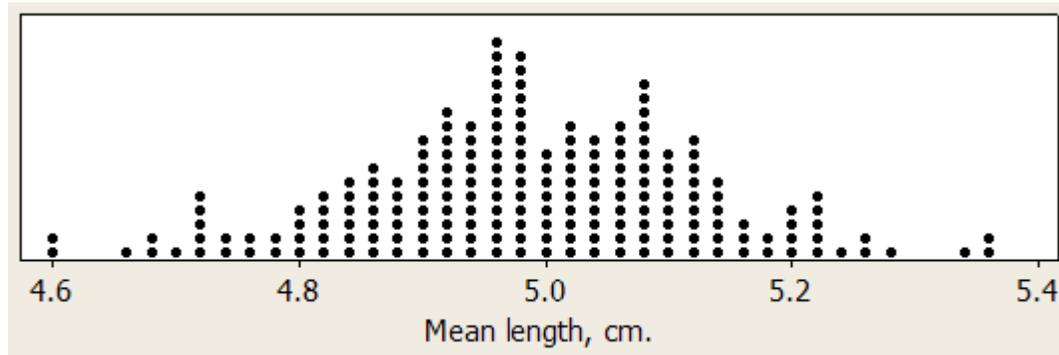
Statistic A



Statistic B



3. A large pet store that specializes in tropical fish has several thousand guppies. The store claims that the guppies have a mean length of 5 cm and a standard deviation of 0.5 cm. You come to the store and buy 10 randomly-selected guppies and find that the mean length of your 10 guppies is 4.8 cm. This makes you suspect that the mean fish length is not what the store says it is. To explore this further, you assume that the length of guppies is Normally distributed and use a computer to simulate 200 samples of 10 guppies from the store's claimed population. Below is a dotplot of the means from these 200 samples.



- (a) What is the population in this situation, and what population parameters have we been given?
- (b) The distribution of one sample is described in the opening paragraph. What information have we been given about this sample?
- (c) Is the dotplot above a sampling distribution? Explain.
- (d) Do you think the store is being honest about the length of its guppies? Justify your answer.

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4. According to the 2000 U.S. Census, 80% of Americans over the age of 25 have earned a high school diploma. Suppose we take a random sample of 120 Americans and record the proportion,  $\hat{p}$ , of individuals in our sample that have a high school diploma.

(a) What are the mean and standard deviation of the sampling distribution of  $\hat{p}$ ?

(b) What is the approximate shape of the sampling distribution? Justify your answer.

(c) Suppose our sample size was 30 instead of 120. Compare the shape, center, and spread of this sampling distribution to the one in parts (a) and (b).

(d) You live in a small town with only 500 residents over the age of 25. What is the largest possible sample you can take from your town and still be able to calculate the standard deviation of sampling distribution of  $\hat{p}$  using the method presented in the textbook? Explain.

5. George is a big fan of music from the 1960s, and 26% of the songs on his smartphone are Beatles songs. Suppose George sets his mp3 player to “shuffle,” so that it selects songs randomly (assume the shuffle function permits repetition of songs, so the “population” of songs is essentially infinite). During a long drive, George plays 50 randomly-selected songs.

(a) What are the mean and standard deviation of the proportion of the 50 randomly-selected songs that are Beatles songs?

(b) Calculate the probability that more than 30% of the 50 randomly-selected songs are Beatles songs.

6. The customer care manager at a cell phone company keeps track of how long each help-line caller spends on hold before speaking to a customer service representative. He finds that the distribution of wait times for all callers has a mean of 12 minutes with a standard deviation of 5 minutes. The distribution is moderately skewed to the right. Suppose the manager takes a random sample of 10 callers and calculates their mean wait time,  $\bar{x}$ .

(a) What is the mean of the sampling distribution of  $\bar{x}$ ?

(b) Is it possible to calculate the standard deviation of  $\bar{x}$ ? If it is, do the calculation. If it isn't, explain why.

(c) Do you know the approximate shape of the sampling distribution of  $\bar{x}$ ? If so, describe the shape and justify your answer. If not, explain why not.

7. The weights of Granny Smith apples from a large orchard are Normally distributed with a mean of 380 gm and a standard deviation of 28 gm.
- (a) A single apple is selected at random from this orchard. What is the probability that it weighs more 400 gm?
- (b) Three apples are selected at random from this orchard. What is the probability that their mean weight is greater than 400 gm.?
- (c) Explain why the probabilities in (a) and (b) are not equal.