Text Exercise Set 14 NAME:

14-1 In order to make a conclusion about the mean rainfall produced by a particular cloud seeding technique, a rainfall measurement is recorded for each of the next nine times that the cloud seeding technique is used.

(a) Identify the sample, the population of interest, the parameter of interest, and the statistic used to estimate the parameter.

(b) Is it reasonable to treat the data as a simple random sample? Why or why not?

14-2 In order to draw a conclusion about the mean weight of raisins in boxes being produced on an assembly line, a manager selects a box from the assembly line each hour for the next 60 hours that the assembly line is in operation.

(a) Identify the sample, the population of interest, the parameter of interest, and the statistic used to estimate the parameter.

(b) Is it reasonable to treat the data as a simple random sample? Why or why not?

14-3 In order to draw a conclusion about the mean weight of a certain variety of orange, 11 oranges are selected from the top of one arbitrary crate in a shipment.

(a) Identify the sample, the population of interest, the parameter of interest, and the statistic used to estimate the parameter.

(b) Are the population of interest and the accessible population the same? Why or why not?

(c) Is it reasonable to treat the data as a simple random sample? Why or why not?

14-4 In order to draw a conclusion about the mean nicotine content in Econo brand cigarettes, a one pack of Econo brand cigarettes is purchased from each of 20 different stores and one cigarette is arbitrarily chosen from each pack.

(a) Identify the sample, the population of interest, the parameter of interest, and the statistic used to estimate the parameter.

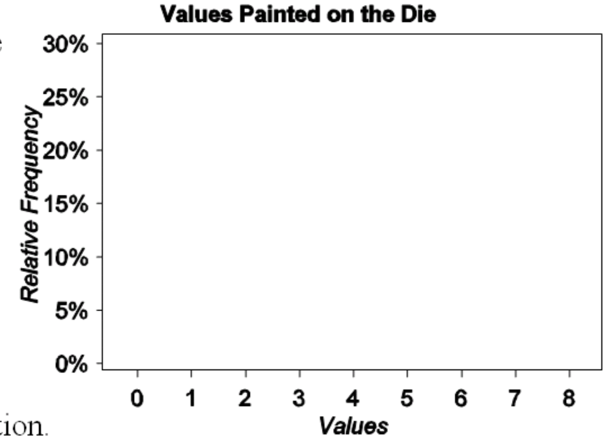
(b) Are the population of interest and the accessible population the same? Why or why not?

(c) Is it reasonable to treat the data as a simple random sample? Why or why not?

14-5 Each of the integers 1, 5, 7, and 8 is painted on one of the sides of a fair, four-sided die (where each side is a triangle). Suppose these four integers represent the parent population from which a simple random sample is to be selected by rolling the die *n* times, where each of the four integers is equally likely to be facing up on each roll.

(a) Complete the construction of the histogram for the equally likely possible values in the parent population with relative frequency on the vertical axis.

(b) Find the mean (μ) in the parent population.



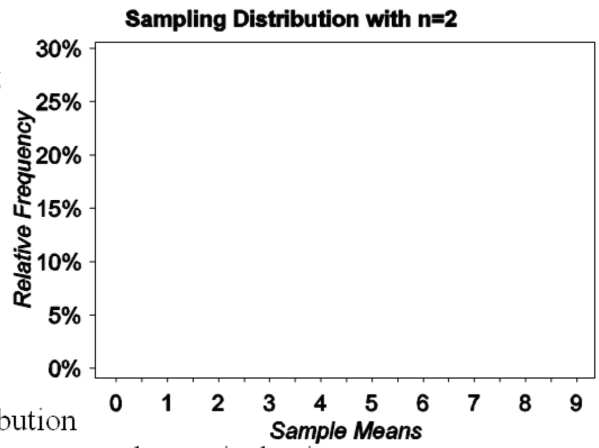
(c) Describe the shape of the distribution in the parent population.

(d) Complete the construction of the table which contains the list of all possible samples of size n = 2 rolls of the four-sided die, and the corresponding sample mean for each sample of size n = 2. (You should find that there are 16 possible samples of size n =2.)

Samples of Size n = 2	Sample Mean	Sample Mean	Relative Frequency

14-5 - *continued*

(e) Complete the construction of the frequency distribution displaying the possible values of $\bar{x}$ together with the corresponding relative frequency of times each value occurs with simple random sampling with $n = 2$, that is, the sampling distribution of $\bar{x}$ with $n = 2$.



(f) Complete the construction of the histogram for the sampling distribution of $\bar{x}$ with $n = 2$, with relative frequency on the vertical axis.

(g) Find the mean ($\mu_{\bar{x}}$) of the sampling distribution of $\bar{x}$ with $n = 2$, and verify that $\mu_{\bar{x}} = \mu$.

(h) How does the dispersion in the sampling distribution of $\bar{x}$ with $n = 2$ compare with the dispersion in the distribution of the parent population?

(i) How does the shape of the sampling distribution of $\bar{x}$ with $n = 2$ compare with the shape of the distribution of the parent population?

(j) Without actually doing it, just suppose we were to obtain the sample mean for each possible sample of $n = 20$, and construct a histogram for these sample means; then, this histogram would display the sampling distribution of $\bar{x}$ with simple random samples if size $n = 20$. What would we find the value of the mean ($\mu_{\bar{x}}$) of this sampling distribution be equal to?

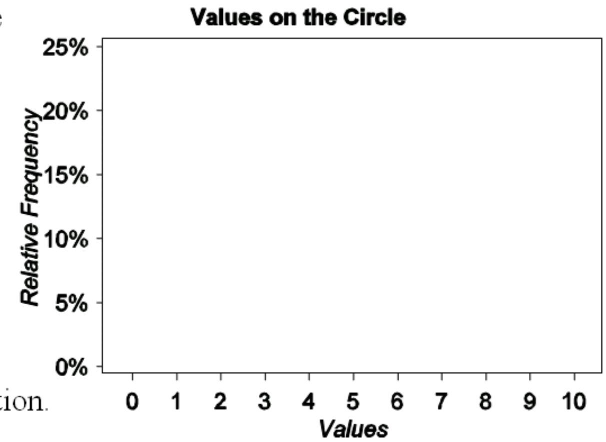
(k) How does the dispersion in the sampling distribution of $\bar{x}$ with $n = 20$ compare with the dispersion in the sampling distribution of $\bar{x}$ with $n = 2$?

(l) How does the shape of the sampling distribution of $\bar{x}$ with $n = 20$ compare with the shape of the sampling distribution of $\bar{x}$ with $n = 2$?

(m) In a simple random sample of n rolls of the four-sided die, will the probability of obtaining a sample mean ($\bar{x}$) within 1.5 of the population mean $\mu = 5.25$ (i.e., between 3.75 and 6.75) be different for $n = 5$ and $n = 25$? Why or why not?

14-6 The circumference of a circle is divided into five equal parts and labeled with the integers 0, 1, 3, 6, and 10. A pointer is then mounted at the center of the circle so that each time the pointer is spun, each of the five integers is equally likely to be selected. Suppose these five integers represent the parent population from which a simple random sample is to be selected by spinning the pointer n times.

(a) Complete the construction of the histogram for the equally likely possible values in the parent population with relative frequency on the vertical axis.



(b) Find the mean (μ) in the parent population.

(c) Describe the shape of the distribution in the parent population.

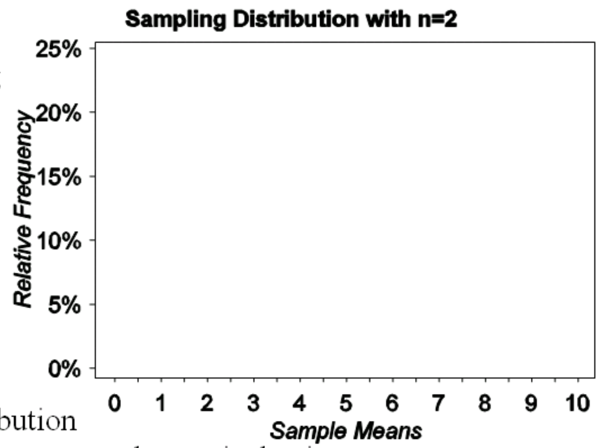
(d) Complete the construction of the table which contains the list of all possible samples of size n = 2 spins of the pointer, and the corresponding sample mean for each sample of size n = 2. (You should find that there are 25 possible samples of size n =2.)

Samples of Size n = 2	Sample Mean

Sample Mean	Relative Frequency

14-6 - *continued*

(e) Complete the construction of the frequency distribution displaying the possible values of $\bar{x}$ together with the corresponding relative frequency of times each value occurs with simple random sampling with $n = 2$, that is, the sampling distribution of $\bar{x}$ with $n = 2$.



(f) Complete the construction of the histogram for the sampling distribution of $\bar{x}$ with $n = 2$, with relative frequency on the vertical axis.

(g) Find the mean ($\mu_{\bar{x}}$) of the sampling distribution of $\bar{x}$ with $n = 2$, and verify that $\mu_{\bar{x}} = \mu$.

(h) How does the dispersion in the sampling distribution of $\bar{x}$ with $n = 2$ compare with the dispersion in the distribution of the parent population?

(i) How does the shape of the sampling distribution of $\bar{x}$ with $n = 2$ compare with the shape of the distribution of the parent population?

(j) Without actually doing it, just suppose we were to obtain the sample mean for each possible sample of $n = 20$, and construct a histogram for these sample means; then, this histogram would display the sampling distribution of $\bar{x}$ with simple random samples if size $n = 20$. What would we find the value of the mean ($\mu_{\bar{x}}$) of this sampling distribution be equal to?

(k) How does the dispersion in the sampling distribution of $\bar{x}$ with $n = 20$ compare with the dispersion in the sampling distribution of $\bar{x}$ with $n = 2$?

(l) How does the shape of the sampling distribution of $\bar{x}$ with $n = 20$ compare with the shape of the sampling distribution of $\bar{x}$ with $n = 2$?

(m) In a simple random sample of n spins of the pointer, will the probability of obtaining a sample mean ($\bar{x}$) within 1.5 of the population mean $\mu = 4$ (i.e., between 2.5 and 5.5) be different for $n = 5$ and $n = 25$? Why or why not?

14-7 Table 14-2b (reproduced on the right) displays the sampling distribution of $\bar{x}$ with n = 2 rolls of a cube where the integers 0, 6, 9, 10, 11, and 12 are painted on the six sides. From the table, find the probability that $\bar{x}$ is between 7 and 9 inclusive with n = 2 rolls of the cube; then, decide whether this probability will be smaller, the same, or larger with n = 5 rolls of the cube, and explain your answer.

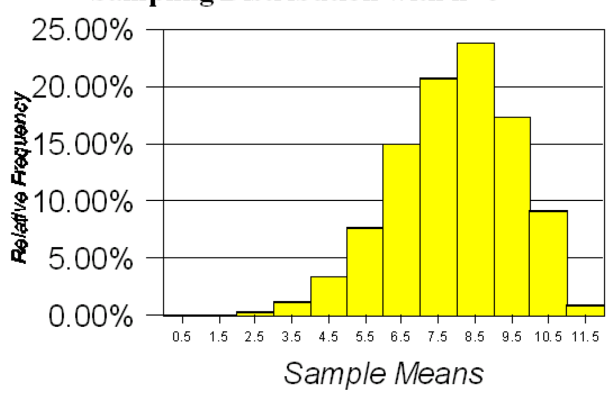
Table 14-2b
Sampling Distribution of $\bar{x}$ with n = 2 Rolls

Sample Mean	Relative Frequency
0	1/36 = 2.8%
3	2/36 = 5.6%
4.5	2/36 = 5.6%
5	2/36 = 5.6%
5.5	2/36 = 5.6%
6	3/36 = 8.3%
7.5	2/36 = 5.6%
8	2/36 = 5.6%
8.5	2/36 = 5.6%
9	3/36 = 8.3%
9.5	2/36 = 5.6%
10	3/36 = 8.3%
10.5	4/36 = 11.1%
11	3/36 = 8.3%
11.5	2/36 = 5.6%
12	1/36 = 2.8%

14-8 Figure 14-4 (reproduced on the right) displays a histogram of the sampling distribution of $\bar{x}$ with n = 6 rolls of a cube where the integers 0, 6, 9, 10, 11, and 12 are painted on the six sides. From this histogram, estimate the probability that $\bar{x}$ is between 7 and 9 inclusive in n = 6 rolls of the cube; then, decide whether this probability will be smaller, the same, or larger with n = 10 rolls of the cube, and explain your answer.

Figure 14-4

Sampling Distribution with n=6



14-9 The mean weight of cereal per box on an assembly line is 15.1 ounces. Circle true or false for each of the following statements:

(a) As the sample size increases, the mean of the population of all sample means from simple random sampling becomes larger. True False

(b) As the sample size increases, the population of all sample means from simple random sampling shows more variation. True False

14-9 - *continued*

(c) With smaller sample sizes, the population of all sample means from simple random sampling will tend to be more bell-shaped and symmetric, even if the distribution of weight of cereal per box is skewed.

True False

(d) The probability of obtaining a sample mean weight $\bar{x}$ between 15.0 and 15.2 ounces is the same when n = 5 and when n = 25.

True False

14-10 The mean weight for a particular variety of orange is 7.81 ounces. Circle true or false for each of the following statements:

(a) No matter what the sample size is, the mean of the population of all sample means from simple random sampling is equal to 7.81 ounces.

True False

(b) As the sample size increases, the population of all sample means from simple random sampling shows less variation.

True False

(c) With larger sample sizes, the population of all sample means from simple random sampling will tend to be more bell-shaped and symmetric, even if the distribution of orange weights is skewed.

True False

(d) The probability of obtaining a sample mean weight $\bar{x}$ between 7.71 and 7.91 ounces is larger when n = 5 and when n = 25.

True False