

7.10: Homework

61.

Previously, De Anza statistics students estimated that the amount of change daytime statistics students carry is exponentially distributed with a mean of \$0.88. Suppose that we randomly pick 25 daytime statistics students.

1. In words, $X =$ _____
2. $X \sim$ _____ (_____, _____)
3. In words, $X \text{ \& \#xAf; } \bar{X}$ $\text{role="presentation" style="position: relative;"} \bar{X} =$ _____
4. $x \text{ \& \#xAf; } \bar{x}$ $\text{role="presentation" style="position: relative;"} \bar{x} \sim$ _____ (_____, _____)
5. Find the probability that an individual had between \$0.80 and \$1.00. Graph the situation, and shade in the area to be determined.
6. Find the probability that the average of the 25 students was between \$0.80 and \$1.00. Graph the situation, and shade in the area to be determined.
7. Explain why there is a difference in part e and part f.

62.

Suppose that the distance of fly balls hit to the outfield (in baseball) is normally distributed with a mean of 250 feet and a standard deviation of 50 feet. We randomly sample 49 fly balls.

1. If $x \text{ \& \#xAf; } \bar{x}$ $\text{role="presentation" style="position: relative;"} \bar{x} =$ average distance in feet for 49 fly balls, then $x \text{ \& \#xAf; } \bar{x}$ $\text{role="presentation" style="position: relative;"} \bar{x} \sim$ _____ (_____, _____)
2. What is the probability that the 49 balls traveled an average of less than 240 feet? Sketch the graph. Scale the horizontal axis for $x \text{ \& \#xAf; } \bar{x}$ $\text{role="presentation" style="position: relative;"} \bar{x}$. Shade the region corresponding to the probability. Find the probability.
3. Find the 80th percentile of the distribution of the average of 49 fly balls.

63.

According to the Internal Revenue Service, the average length of time for an individual to complete (keep records for, learn, prepare, copy, assemble, and send) IRS Form 1040 is 10.53 hours (without any attached schedules). The distribution is unknown. Let us assume that the standard deviation is two hours. Suppose we randomly sample 36 taxpayers.

1. In words, $X =$ _____
2. In words, $X \text{ \& \#xAf; } \bar{X}$ $\text{role="presentation" style="position: relative;"} \bar{X} =$ _____
3. $X \text{ \& \#xAf; } \bar{X}$ $\text{role="presentation" style="position: relative;"} \bar{X} \sim$ _____ (_____, _____)
4. Would you be surprised if the 36 taxpayers finished their Form 1040s in an average of more than 12 hours? Explain why or why not in complete sentences.
5. Would you be surprised if one taxpayer finished their Form 1040 in more than 12 hours? In a complete sentence, explain why.

64.

Suppose that a category of world-class runners are known to run a marathon (26 miles) in an average of 145 minutes with a standard deviation of 14 minutes. Consider 49 of the races. Let $x \text{ \& \#xAf; } \bar{x}$ $\text{role="presentation" style="position: relative;"} \bar{x}$ the average of the 49 races.

1. $X \text{ \& \#xAf; } \bar{X}$ $\text{role="presentation" style="position: relative;"} \bar{X} \sim$ _____ (_____, _____)
2. Find the probability that the runner will average between 142 and 146 minutes in these 49 marathons.
3. Find the 80th percentile for the average of these 49 marathons.
4. Find the median of the average running times.

65.

The length of songs in a collector's Apple Music album collection is uniformly distributed from two to 3.5 minutes. Suppose we randomly pick five albums from the collection. There are a total of 43 songs on the five albums.

1. In words, $X =$ _____
2. $X \sim$ _____
3. In words, $X \text{ \& \#xAf; } \bar{X}$ $\text{role="presentation" style="position: relative;"} \bar{X} =$ _____

4. $\bar{X} \sim \text{_____}(\text{_____, } \text{_____})$
5. Find the first quartile for the average song length, \bar{X} .
6. The IQR (interquartile range) for the average song length, \bar{X} , is from _____ - _____.

66.

In 1940 the average size of a U.S. farm was 174 acres. Let's say that the standard deviation was 55 acres. Suppose we randomly survey 38 farmers from 1940.

1. In words, $X = \text{_____}$
2. In words, $\bar{X} = \text{_____}$
3. $\bar{X} \sim \text{_____}(\text{_____, } \text{_____})$
4. The IQR for \bar{x} is from _____ acres to _____ acres.

67.

Determine which of the following are true and which are false. Then, in complete sentences, justify your answers.

1. When the sample size is large, the mean of \bar{X} is approximately equal to the mean of X .
2. When the sample size is large, \bar{x} is approximately normally distributed.
3. When the sample size is large, the standard deviation of \bar{x} is approximately the same as the standard deviation of X .

68.

The percent of fat calories that a person in America consumes each day is normally distributed with a mean of about 36 and a standard deviation of about ten. Suppose that 16 individuals are randomly chosen. Let \bar{x} = average percent of fat calories.

1. $\bar{x} \sim \text{_____}(\text{_____, } \text{_____})$
2. For the group of 16, find the probability that the average percent of fat calories consumed is more than five. Graph the situation and shade in the area to be determined.
3. Find the first quartile for the average percent of fat calories.

69.

The distribution of income in some developing countries is considered wedge shaped (many low income people, very few middle income people, and even fewer high income people). Suppose we pick a country with a wedge shaped distribution. Let the average salary be \$2,000 per year with a standard deviation of \$8,000. We randomly survey 1,000 residents of that country.

1. In words, $X = \text{_____}$
2. In words, $\bar{X} = \text{_____}$
3. $\bar{X} \sim \text{_____}(\text{_____, } \text{_____})$
4. How is it possible for the standard deviation to be greater than the average?
5. Why is it more likely that the average of the 1,000 residents will be from \$2,000 to \$2,100 than from \$2,100 to \$2,200?

70.

Which of the following is NOT TRUE about the distribution for averages?

1. The mean, median, and mode are equal.
2. The area under the curve is one.
3. The curve never touches the x-axis.
4. The curve is skewed to the right.

71.

The cost of unleaded gasoline in the Bay Area once followed an unknown distribution with a mean of \$4.59 and a standard deviation of \$0.10. Sixteen gas stations from the Bay Area are randomly chosen. We are interested in the average cost of gasoline for the 16 gas stations. The distribution to use for the average cost of gasoline for the 16 gas stations is:

1. $\bar{X} \sim N(4.59, 0.10)$
2. $\bar{X} \sim N(4.59, 0.1016)$
3. $\bar{X} \sim N(4.59, \frac{0.10}{16})$
4. $\bar{X} \sim N(4.59, \frac{0.10}{16})$

72.

Which of the following is NOT TRUE about the theoretical distribution of sums?

1. The mean, median and mode are equal.
2. The area under the curve is one.
3. The curve never touches the x-axis.
4. The curve is skewed to the right.

73.

Suppose that the duration of a particular type of criminal trial is known to have a mean of 21 days and a standard deviation of seven days. We randomly sample nine trials.

1. In words, $\Sigma X =$ _____
2. $\Sigma X \sim$ _____(_____, _____)
3. Find the probability that the total length of the nine trials is at least 225 days.
4. Ninety percent of the total of nine of these types of trials will last at least how long?

74.

Suppose that the weight of open boxes of cereal in a home with children is uniformly distributed from two to six pounds with a mean of four pounds and standard deviation of 1.1547. We randomly survey 64 homes with children.

1. In words, $X =$ _____
2. The distribution is _____.
3. In words, $\Sigma X =$ _____
4. $\Sigma X \sim$ _____(_____, _____)
5. Find the probability that the total weight of open boxes is less than 250 pounds.
6. Find the 35th percentile for the total weight of open boxes of cereal.

75.

Salaries for teachers in a particular elementary school district are normally distributed with a mean of \$44,000 and a standard deviation of \$6,500. We randomly survey ten teachers from that district.

1. In words, $X =$ _____
2. $X \sim$ _____(_____, _____)
3. In words, $\Sigma X =$ _____
4. $\Sigma X \sim$ _____(_____, _____)
5. Find the probability that the teachers earn a total of over \$400,000.
6. Find the 90th percentile for an individual teacher's salary.
7. Find the 90th percentile for the sum of ten teachers' salary.
8. If we surveyed 70 teachers instead of ten, graphically, how would that change the distribution in part d?
9. If each of the 70 teachers received a \$3,000 raise, graphically, how would that change the distribution in part b?

76.

The attention span of a two-year-old is exponentially distributed with a mean of about eight minutes. Suppose we randomly survey 60 two-year-olds.

1. In words, $X =$ _____

2. $X \sim \text{_____}(\text{_____,} \text{_____})$

3. In words, $X \sim \text{_____}$ $\bar{X} \sim \text{_____}$

4. $X \sim \text{_____}$ $\bar{X} \sim \text{_____}(\text{_____,} \text{_____})$

5. Before doing any calculations, which do you think will be higher? Explain why.

1. The probability that an individual attention span is less than ten minutes.

2. The probability that the average attention span for the 60 children is less than ten minutes?

6. Calculate the probabilities in part e.

7. Explain why the distribution for $X \sim \text{_____}$ $\bar{X} \sim \text{_____}$ is not exponential.

77.

The closing stock prices of 35 U.S. semiconductor manufacturers are given as follows.

8.625; 30.25; 27.625; 46.75; 32.875; 18.25; 5; 0.125; 2.9375; 6.875; 28.25; 24.25; 21; 1.5; 30.25; 71; 43.5; 49.25; 2.5625; 31; 16.5; 9.5; 18.5; 18; 9; 10.5; 16.625; 1.25; 18; 12.87; 7; 12.875; 2.875; 60.25; 29.25

1. In words, $X = \text{_____}$

2. 1. $x \sim \text{_____}$ $\bar{x} \sim \text{_____}$

2. $s_x = \text{_____}$

3. $n = \text{_____}$

3. Construct a histogram of the distribution of the averages. Start at $x = -0.0005$. Use bar widths of ten.

4. In words, describe the distribution of stock prices.

5. Randomly average five stock prices together. (Use a random number generator.) Continue averaging five pieces together until you have ten averages. List those ten averages.

6. Use the ten averages from part e to calculate the following.

1. $x \sim \text{_____}$ $\bar{x} \sim \text{_____}$

2. $s_x = \text{_____}$

7. Construct a histogram of the distribution of the averages. Start at $x = -0.0005$. Use bar widths of ten.

8. Does this histogram look like the graph in part c?

9. In one or two complete sentences, explain why the graphs either look the same or look different?

10. Based upon the theory of the **central limit theorem**, $X \sim \text{_____}$ $\bar{X} \sim \text{_____}(\text{_____,} \text{_____})$

Use the following information to answer the next three exercises: Richard's Furniture Company delivers furniture from 10 A.M. to 2 P.M. continuously and uniformly. We are interested in how long (in hours) past the 10 A.M. start time that individuals wait for their delivery.

78.

$X \sim \text{_____}(\text{_____,} \text{_____})$

1. $U(0,4)$

2. $U(10,2)$

3. $Exp(2)$

4. $N(2,1)$

79.

The average wait time is:

1. one hour.

2. two hours.

3. two and a half hours.

4. four hours.

80.

Suppose that it is now past noon on a delivery day. The probability that a person must wait at least one and a half **more** hours is:

1. $\frac{1}{4}$
2. $\frac{1}{2}$
3. $\frac{3}{4}$
4. $\frac{3}{8}$

Use the following information to answer the next two exercises: The time to wait for a particular rural bus is distributed uniformly from zero to 75 minutes. One hundred riders are randomly sampled to learn how long they waited.

81.

The 90th percentile sample average wait time (in minutes) for a sample of 100 riders is:

1. 315.0
2. 40.3
3. 38.5
4. 65.2

82.

Would you be surprised, based upon numerical calculations, if the sample average wait time (in minutes) for 100 riders was less than 30 minutes?

1. yes
2. no
3. There is not enough information.

Use the following to answer the next two exercises: The cost of unleaded gasoline in the Bay Area once followed an unknown distribution with a mean of \$4.59 and a standard deviation of \$0.10. Sixteen gas stations from the Bay Area are randomly chosen. We are interested in the average cost of gasoline for the 16 gas stations.

83.

What's the approximate probability that the average price for 16 gas stations is over \$4.69?

1. almost zero
2. 0.1587
3. 0.0943
4. unknown

84.

Find the probability that the average price for 30 gas stations is less than \$4.55.

1. 0.6554
2. 0.3446
3. 0.0142
4. 0.9858
5. 0

85.

Suppose in a local Kindergarten through 12th grade (K - 12) school district, 53 percent of the population favor a charter school for grades K through five. A simple random sample of 300 is surveyed. Calculate following using the normal approximation to the binomial distribution.

1. Find the probability that less than 100 favor a charter school for grades K through 5.
2. Find the probability that 170 or more favor a charter school for grades K through 5.
3. Find the probability that no more than 140 favor a charter school for grades K through 5.
4. Find the probability that there are fewer than 130 that favor a charter school for grades K through 5.
5. Find the probability that exactly 150 favor a charter school for grades K through 5.

If you have access to an appropriate calculator or computer software, try calculating these probabilities using the technology.

86.

Four friends, Janice, Barbara, Kathy and Roberta, decided to carpool together to get to school. Each day the driver would be chosen by randomly selecting one of the four names. They carpool to school for 96 days. Use the normal approximation to the binomial to calculate the following probabilities. Round the standard deviation to four decimal places.

1. Find the probability that Janice is the driver at most 20 days.
2. Find the probability that Roberta is the driver more than 16 days.
3. Find the probability that Barbara drives exactly 24 of those 96 days.

87.

$X \sim N(60, 9)$. Suppose that you form random samples of 25 from this distribution. Let \bar{X} be the random variable of averages. Let ΣX be the random variable of sums. For parts c through f, sketch the graph, shade the region, label and scale the horizontal axis for \bar{X} , and find the probability.

1. Sketch the distributions of X and \bar{X} on the same graph.
2. $\bar{X} \sim \text{_____}(\text{_____, } \text{_____})$
3. $P(\bar{x} < 60) = \text{_____}$
4. Find the 30th percentile for the mean.
5. $P(56 < \bar{x} < 62) = \text{_____}$
6. $P(18 < \Sigma x < 58) = \text{_____}$
7. $\Sigma x \sim \text{_____}(\text{_____, } \text{_____})$
8. Find the minimum value for the upper quartile for the sum.
9. $P(1,400 < \Sigma x < 1,550) = \text{_____}$

88.

Suppose that the length of research papers is uniformly distributed from ten to 25 pages. We survey a class in which 55 research papers were turned in to a professor. The 55 research papers are considered a random collection of all papers. We are interested in the average length of the research papers.

1. In words, $X = \text{_____}$
2. $X \sim \text{_____}(\text{_____, } \text{_____})$
3. $\mu_x = \text{_____}$
4. $\sigma_x = \text{_____}$
5. In words, $\bar{X} = \text{_____}$
6. $\bar{X} \sim \text{_____}(\text{_____, } \text{_____})$
7. In words, $\Sigma X = \text{_____}$
8. $\Sigma X \sim \text{_____}(\text{_____, } \text{_____})$
9. Without doing any calculations, do you think that it's likely that the professor will need to read a total of more than 1,050 pages? Why?
10. Calculate the probability that the professor will need to read a total of more than 1,050 pages.
11. Why is it so unlikely that the average length of the papers will be less than 12 pages?

89.

Salaries for teachers in a particular elementary school district are normally distributed with a mean of \$44,000 and a standard deviation of \$6,500. We randomly survey ten teachers from that district.

1. Find the 90th percentile for an individual teacher's salary.
2. Find the 90th percentile for the average teacher's salary.

90.

The average length of a maternity stay in a U.S. hospital is said to be 2.4 days with a standard deviation of 0.9 days. We randomly survey 80 women who recently bore children in a U.S. hospital.

1. In words, $X = \text{_____}$
2. In words, $\bar{X} = \text{_____}$

3. $\bar{X} \sim \text{_____}(\text{_____,} \text{_____})$
4. In words, $\Sigma X = \text{_____}$
5. $\Sigma X \sim \text{_____}(\text{_____,} \text{_____})$
6. Is it likely that an individual stayed more than five days in the hospital? Why or why not?
7. Is it likely that the average stay for the 80 women was more than five days? Why or why not?
8. Which is more likely:
 1. An individual stayed more than five days.
 2. the average stay of 80 women was more than five days.
9. If we were to sum up the women's stays, is it likely that, collectively they spent more than a year in the hospital? Why or why not?

For each problem, wherever possible, provide graphs and use the calculator.

91.

NeverReady batteries has engineered a newer, longer lasting AAA battery. The company claims this battery has an average life span of 17 hours with a standard deviation of 0.8 hours. Your statistics class questions this claim. As a class, you randomly select 30 batteries and find that the sample mean life span is 16.7 hours. If the process is working properly, what is the probability of getting a random sample of 30 batteries in which the sample mean lifetime is 16.7 hours or less? Is the company's claim reasonable?

92.

Men have an average weight of 172 pounds with a standard deviation of 29 pounds.

1. Find the probability that 20 randomly selected men will have a sum weight greater than 3600 lbs.
2. If 20 men have a sum weight greater than 3500 lbs, then their total weight exceeds the safety limits for water taxis. Based on (a), is this a safety concern? Explain.

93.

M&M candies large candy bags have a claimed net weight of 396.9 g. The standard deviation for the weight of the individual candies is 0.017 g. The following table is from a stats experiment conducted by a statistics class.

Red	Orange	Yellow	Brown	Blue	Green
0.751	0.735	0.883	0.696	0.881	0.925
0.841	0.895	0.769	0.876	0.863	0.914
0.856	0.865	0.859	0.855	0.775	0.881
0.799	0.864	0.784	0.806	0.854	0.865
0.966	0.852	0.824	0.840	0.810	0.865
0.859	0.866	0.858	0.868	0.858	1.015
0.857	0.859	0.848	0.859	0.818	0.876
0.942	0.838	0.851	0.982	0.868	0.809
0.873	0.863			0.803	0.865
0.809	0.888			0.932	0.848
0.890	0.925			0.842	0.940
0.878	0.793			0.832	0.833
0.905	0.977			0.807	0.845
	0.850			0.841	0.852

Red	Orange	Yellow	Brown	Blue	Green
	0.830			0.932	0.778
	0.856			0.833	0.814
	0.842			0.881	0.791
	0.778			0.818	0.810
	0.786			0.864	0.881
	0.853			0.825	
	0.864			0.855	
	0.873			0.942	
	0.880			0.825	
	0.882			0.869	
	0.931			0.912	
				0.887	

Table 7.7

The bag contained 465 candies and he listed weights in the table came from randomly selected candies. Count the weights.

1. Find the mean sample weight and the standard deviation of the sample weights of candies in the table.
2. Find the sum of the sample weights in the table and the standard deviation of the sum of the weights.
3. If 465 M&Ms are randomly selected, find the probability that their weights sum to at least 396.9.
4. Is the Mars Company's M&M labeling accurate?

94.

The Screw Right Company claims their 3434" role="presentation" style="position: relative;">> $\frac{3}{4}\frac{3}{4}$ inch screws are within ± 0.23 of the claimed mean diameter of 0.750 inches with a standard deviation of 0.115 inches. The following data were recorded.

0.757	0.723	0.754	0.737	0.757	0.741	0.722	0.741	0.743	0.742
0.740	0.758	0.724	0.739	0.736	0.735	0.760	0.750	0.759	0.754
0.744	0.758	0.765	0.756	0.738	0.742	0.758	0.757	0.724	0.757
0.744	0.738	0.763	0.756	0.760	0.768	0.761	0.742	0.734	0.754
0.758	0.735	0.740	0.743	0.737	0.737	0.725	0.761	0.758	0.756

Table 7.8

The screws were randomly selected from the local home repair store.

1. Find the mean diameter and standard deviation for the sample
2. Find the probability that 50 randomly selected screws will be within the stated tolerance levels. Is the company's diameter claim plausible?

95.

Your company has a contract to perform preventive maintenance on thousands of air-conditioners in a large city. Based on service records from previous years, the time that a technician spends servicing a unit averages one hour with a standard deviation of one hour. In the coming week, your company will service a simple random sample of 70 units in the city. You plan to budget an average of 1.1 hours per technician to complete the work. Will this be enough time?

96.

A typical adult has an average IQ score of 105 with a standard deviation of 20. If 20 randomly selected adults are given an IQ test, what is the probability that the sample mean scores will be between 85 and 125 points?

97.

Certain coins have an average weight of 5.201 grams with a standard deviation of 0.065 g. If a vending machine is designed to accept coins whose weights range from 5.111 g to 5.291 g, what is the expected number of rejected coins when 280 randomly selected coins are inserted into the machine?

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