

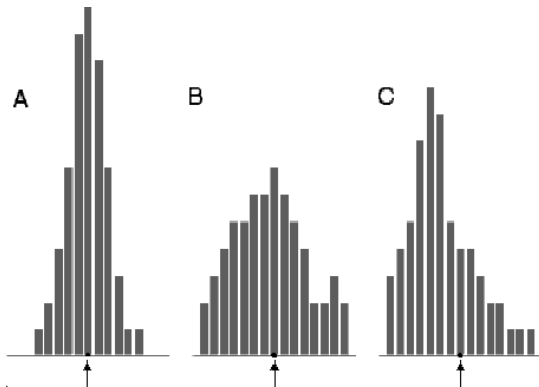
Name: _____
Ch7 Problem Set:

Per. _____ Date: _____
AP. Statistics

1) Suppose that in a certain community, 40% of the residents would answer “Yes” to the question, “Do you know the names of at least five other people who live on your block?” Suppose you plan to take a random sample of 100 people from this community and calculate the proportion of people in your sample whose response to this question is “Yes”.

- (a) What are the parameter and the statistic in this situation?
- (b) What does the sampling distribution of this statistic describe?
- (c) What does it mean to say that the statistic in this case is an unbiased estimator of the parameter?
- (d) Suppose that in a much larger community, 40% of the residents would also answer “Yes” to the question. If you took a sample of 100 individuals from this much larger community, would the sampling distribution of the statistic be different? In what way?
- (e) If you took a sample of 50 individuals instead of 100 from the original community, would the sampling distribution of the statistic change? In what way?

2) Below are histograms of the values taken by three sample statistics in several hundred samples from the same population. The true value of the population parameter is marked on each histogram.



- (a) Which statistic has the largest bias among these three? Justify your answer.
- (b) Which statistic has the lowest variability among these three? Justify your answer.
- (c) Based on the performance of the three statistics in many samples, which is preferred as an estimate of the parameter? Why?

3) Suppose you are going to roll a fair six-sided die 60 times and record the proportion of times that a 1 or a 2 is showing.

- (a) What is the mean of the sampling distribution of \hat{p} ?
- (b) What is the standard deviation of the sampling distribution of \hat{p} ?
- (c) Describe the shape of the sampling distribution of \hat{p} . Justify your answer.
- (d) Suppose that when you actually roll the die 60 times, you get 30 rolls of 1 or 2, for a \hat{p} of 0.5. Are you suspicious about whether the die is fair? Justify your answer.

4) Are attitudes toward shopping changing? Sample surveys show that fewer people enjoy shopping than in the past. A recent survey asked a nationwide random sample of 2500 adults if they agreed or disagreed with the statement, “I like buying new clothes, but shopping is often frustrating and time-consuming.” In this survey, 1520 agreed. Suppose that in fact 60% of all adult U.S. residents would say “Agree” if asked the same question.

(a) What is the sample proportion of U.S. adults who agreed with the statement?

(b) If, in fact, the proportion of all U.S. adults who would agree with the statement is 0.60, what is the probability that the proportion in a random sample of 2500 adults is as far from 0.60—above or below—as the results of this survey? Check that the necessary conditions are met before calculating this probability.

5) The distribution of actual weights of 8-ounce chocolate bars produced by a certain machine is Normal with mean 8.1 ounces and standard deviation 0.1 ounces. Company managers do not want the weight of a chocolate bar to fall below 7.85 ounces, for fear that consumers will complain.

(a) Find the probability that the weight of a randomly selected candy bar is less than 7.85 ounces.

Four candy bars are selected at random and their mean weight, \bar{x} , is computed.

(b) Describe the center, shape, and spread of the sampling distribution of \bar{x} .

(c) Find the probability that the mean weight of the four candy bars is less than 7.85 ounces.

(d) Would your answers to (a), (b), or (c) be affected if the weights of chocolate bars produced by this machine were distinctly non-Normal? Explain.

6) Suppose you roll a six-sided die 50 times and calculate the mean roll, \bar{x} .

(a) We can consider these 50 rolls as a SRS of rolls from the population of all possible rolls of this die. Using formulas from Chapter 6, we can determine that if the die is fair, the mean of this population is 3.5 and the standard deviation 1.71. How would you describe the shape of this population distribution?

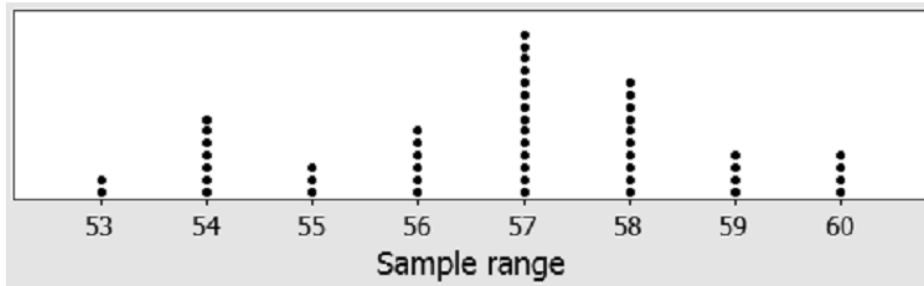
(b) Find the shape, center, and spread of the sampling distribution of \bar{x} .

(c) Suppose that the mean of your 50 rolls is $\bar{x} = 3.25$. Are you suspicious about the fairness of the die? Justify your answer.

7) A small internet mail-order company keeps track of the number of orders it fills per day for many years and determines that the distribution of the variable “orders filled per day” is roughly symmetric and has the following five-number summary:

Minimum = 20 Quartile 1 = 32 Median = 46 Quartile 3 = 63 Maximum = 80

8) Suppose we take random samples of size 40 from this distribution and calculate the range for each of our samples. Below is a dotplot of the ranges from 50 such samples.



Is the sample range an unbiased estimator of the population range? Use the dotplot to justify your answer.

9) A certain beverage company is suspected of under-filling its cans of soft drink. The company advertises that its cans contain, on average, 12 ounces of soda with standard deviation 0.4 ounce.

For the questions that follow, suppose that the company is telling the truth.

(a) Can you calculate the probability that a single randomly selected can contains 11.9 ounces or less? If so, do it. If not, explain why you cannot.

(b) A quality control inspector measures the contents of an SRS of 50 cans of the company's soda and calculates the sample mean \bar{x} . What are the mean and standard deviation of the sampling distribution of \bar{x} for samples of size $n=50$?

(c) The inspector in part (b) obtains a sample mean of 11.9 ounces. Calculate the probability that a random sample of 50 cans produces a sample mean amount of 11.9 ounces or less. Be sure to explain why you can use a Normal calculation.

(d) What would you conclude about whether the company is under-filling its cans of soda? Justify your answer.

10) An opinion poll asks a sample of 500 adults (an SRS) whether they favor giving parents of school-age children vouchers that can be exchanged for education at any public or private school of their choice. Each school would be paid by the government on the basis of how many vouchers it collected. Suppose that in fact 45% of the population favor this idea.

(a) What is the mean of the sampling distribution of \hat{p} , the proportion of adults in samples of 500 who favor giving parents of school-age children these vouchers?

(b) What is the standard deviation of \hat{p} ?

(c) Check that you can use the Normal approximation for the distribution of \hat{p} .

(d) What is the probability that more than half of the sample are in favor? Show your work

11) A local radio station plays 40 rock-and-roll songs during each 4-hour show. The program director at the station needs to know the total amount of airtime for the 40 songs so that time can also be programmed during the show for news and advertisements. The distribution of the lengths of rock-and-roll songs, in minutes, is roughly symmetric with a mean length of 3.9 minutes and a standard deviation of 1.1 minutes.

(a) Describe the sampling distribution of the sample mean song lengths for random samples of 40 rock-and-roll songs.

(b) If the program manager schedules 80 minutes of news and advertisements for the 4-hour (240-minute) show, only 160 minutes are available for music. Approximately what is the probability that the total amount of time needed to play 40 randomly selected rock-and-roll songs exceeds the available airtime?

12) A tire manufacturer designed a new tread pattern for its all-weather tires. Repeated tests were conducted on cars of approximately the same weight traveling at 60 miles per hour. The tests showed that the new tread pattern enables the cars to stop completely in an average distance of 125 feet with a standard deviation of 6.5 feet and that the stopping distances are approximately normally distributed.

(a) What is the 70th percentile of the distribution of stopping distances?

(b) What is the probability that at least 2 cars out of 5 randomly selected cars in the study will stop in a distance that is greater than the distance calculated in part (a) ?

(c) What is the probability that a randomly selected sample of 5 cars in the study will have a mean stopping distance of at least 130 feet?