

Name:

Chapter 7: Sampling Distributions

Multiple Choice

Identify the choice that best completes the statement or answers the question.

1. Following a dramatic drop of 500 points in the Dow Jones Industrial Average in September 1998, a poll conducted for the Associated Press found that 92% of those polled said that a year from now their family financial situation will be as good as it is today or better. The number 92% is a
- Statistic
 - Sample
 - Parameter
 - Population
 - None of the above.
2. In a large population, 46% of the households own VCR's. A simple random sample of 100 households is to be contacted and the sample proportion computed. The mean of the sampling distribution of the sample proportion is
- 46
 - 0.46
 - About 0.46, but not exactly 0.46
 - 0.00248
 - The answer cannot be computed from the information given
3. If a population has a standard deviation σ , then the standard deviation of the mean of 100 randomly selected items from this population is
- σ
 - 100σ
 - $\sigma/10$
 - $\sigma/100$
 - 0.1
4. A statistic is said to be *unbiased* if
- The survey used to obtain the statistic was designed so as to avoid even the hint of racial or sexual prejudice
 - The mean of its sampling distribution is equal to the true value of the parameter being estimated
 - Both the person who calculated the statistic and the subjects whose responses make up the statistic were truthful
 - It is used for honest purposes only
 - None of the above.
5. The number of undergraduates at Johns Hopkins University is approximately 2000, while the number at Ohio State University is approximately 40,000. At both schools a simple random sample of about 3% of the undergraduates is taken. Which of the following is the best conclusion?
- The sample from Johns Hopkins has less sampling variability than that from Ohio State.
 - The sample from Johns Hopkins has more sampling variability than that from Ohio State.
 - The sample from Johns Hopkins has almost the same sampling variability as that from Ohio State.
 - It is impossible to make any statement about the sampling variability of the two samples since the students surveyed were different.
 - None of the above.
6. In a large population, 46% of the households own VCRs. A simple random sample of 100

households is to be contacted and the sample proportion computed. What is the standard deviation of the sampling distribution of the sample proportion?

- a. 46
- b. 0.46
- c. 0.00248
- d. 0.005
- e. None of the above.

7. In a large population of adults, the mean IQ is 112 with a standard deviation of 20. Suppose 200 adults are randomly selected for a market research campaign. The distribution of the sample mean IQ is
- a. Exactly normal, mean 112, standard deviation 20.
 - b. Approximately normal, mean 112, standard deviation 0.1.
 - c. Approximately normal, mean 112, standard deviation 1.414.
 - d. Approximately normal, mean 112, standard deviation 20.
 - e. Exactly normal, mean 112, standard deviation 1.414.

8. Suppose we are planning on taking an SRS from a population. If we double the sample size, then $\sigma_{\bar{x}}$ will be multiplied by:
- a. $\sqrt{2}$
 - b. $1/\sqrt{2}$
 - c. 2
 - d. 1/2
 - e. 4

A factory produces plate glass with a mean thickness of 4 millimeters and a standard deviation of 1.1 millimeters. A simple random sample of 100 sheets of glass is to be measured, and the sample mean thickness of the 100 sheets \bar{x} is to be computed.

9. We know the random variable \bar{x} has approximately a normal distribution because of
- a. the law of large numbers.
 - b. the central limit theorem.
 - c. the law of proportions.
 - d. the fact that probability is the long run proportion of times an event occurs.

10. The probability that the average thickness \bar{x} of the 100 sheets of glass is less than 4.1 millimeters is approximately
- | | |
|------------|------------|
| a. 0.8186. | c. 0.1814. |
| b. 0.3183. | d. 0.6817. |

AP Statistics Chapter 7 Practice FR Test: Sampling Distributions

Show all work for the following on the answer sheet. Answer completely and clearly.

1. Consider the following set of numbers as a population: $\{1, 3, 5, 7, 9\}$
 - a) Show all possible samples of size 2 from this population (there are 10).
 - b) Construct a dot plot of the means of the samples found in part a.
 - c) What is the mean of the distribution in part b? Why would you expect that number?
 - d) How would the spread of the dot plot in part b change if we had taken samples of size 3 in part a? Explain.

2. 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 are the mean and standard deviation 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) Justify the use of a normal approximation for the sampling distribution of \hat{p} in this setting.
 - c) What is the probability that more than half of the sample are in favor? Show all work.

3. A study of college freshmen's study habits found that the time (in hours) that college freshmen use to study each week follows a skewed right distribution with a mean of 7.2 hours and a standard deviation of 5.3 hours.
 - a) What are the mean and standard deviation for the average number of hours \bar{x} spent studying by an SRS of 55 freshmen?
 - b) Find the probability that the average number of hours spent studying by an SRS of 55 students is greater than 9 hours. Show your work.
 - c) Explain why you can use a normal distribution to answer question b even though the distribution of study times is skewed right.

Name:

Score: 0 / 10 points (0%)

Chapter 7: Sampling Distributions

Multiple Choice

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- 1. Following a dramatic drop of 500 points in the Dow Jones Industrial Average in September 1998, a poll conducted for the Associated Press found that 92% of those polled said that a year from now their family financial situation will be as good as it is today or better. The number 92% is a
- Statistic
 - Sample
 - Parameter
 - Population
 - None of the above.

ANSWER: A

Since the 92% came from a **sample**, it is a **statistic**.

POINTS: 0 / 1

- 2. In a large population, 46% of the households own VCR's. A simple random sample of 100 households is to be contacted and the sample proportion computed. The mean of the sampling distribution of the sample proportion is
- 46
 - 0.46
 - About 0.46, but not exactly 0.46
 - 0.00248
 - The answer cannot be computed from the information given

ANSWER: B

The mean of any sampling distribution will always be equal to the mean of the population, so the answer is .46 (46%).

POINTS: 0 / 1

- 3. If a population has a standard deviation σ , then the standard deviation of the mean of 100 randomly selected items from this population is
- σ
 - 100σ
 - $\sigma/10$
 - $\sigma/100$
 - 0.1

ANSWER: C

The standard deviation of a sample mean is $\frac{\sigma}{\sqrt{n}}$. Here, $n=100$, so the standard

deviation will be $\frac{\sigma}{\sqrt{100}} = \frac{\sigma}{10}$.

POINTS: 0 / 1


- 4. A statistic is said to be *unbiased* if
- The survey used to obtain the statistic was designed so as to avoid even the hint of racial or sexual prejudice

- b. The mean of its sampling distribution is equal to the true value of the parameter being estimated
- c. Both the person who calculated the statistic and the subjects whose responses make up the statistic were truthful
- d. It is used for honest purposes only
- e. None of the above.

ANSWER: B

Unbiased means that the statistic is properly estimating the parameter. So the mean of all of the samples should equal the population parameter.


POINTS: 0 / 1

-  — 5. The number of undergraduates at Johns Hopkins University is approximately 2000, while the number at Ohio State University is approximately 40,000. At both schools a simple random sample of about 3% of the undergraduates is taken. Which of the following is the best conclusion?
- a. The sample from Johns Hopkins has less sampling variability than that from Ohio State.
 - b. The sample from Johns Hopkins has more sampling variability than that from Ohio State.
 - c. The sample from Johns Hopkins has almost the same sampling variability as that from Ohio State.
 - d. It is impossible to make any statement about the sampling variability of the two samples since the students surveyed were different.
 - e. None of the above.

ANSWER: B

Since 3% of the student body at Johns Hopkins will be smaller in size than 3% of the Ohio State University, the sampling variability will be greater for the Johns Hopkins sample. Remember that larger sample sizes possess smaller sampling variability.

POINTS: 0 / 1

-  — 6. In a large population, 46% of the households own VCRs. A simple random sample of 100 households is to be contacted and the sample proportion computed. What is the standard deviation of the sampling distribution of the sample proportion?
- a. 46
 - b. 0.46
 - c. 0.00248
 - d. 0.005
 - e. None of the above.


ANSWER: E

The formula for the standard deviation of a sample proportion is $\sqrt{\frac{p(1-p)}{n}}$.

Here $p=.46$ and $n=100$, so the standard deviation is $\sqrt{\frac{.46(.54)}{100}} = .0498$

So the answer is “None of the above”

POINTS: 0 / 1

-  — 7. In a large population of adults, the mean IQ is 112 with a standard deviation of 20. Suppose 200 adults are randomly selected for a market research campaign. The distribution of the sample mean IQ is
- a. Exactly normal, mean 112, standard deviation 20.
 - b. Approximately normal, mean 112, standard deviation 0.1.


- c. Approximately normal, mean 112, standard deviation 1.414.
- d. Approximately normal, mean 112, standard deviation 20.
- e. Exactly normal, mean 112, standard deviation 1.414.

ANSWER: C

The sampling distribution for a sample mean is $N(\mu, \sigma/\sqrt{n})$.

Here that would be a mean of 112 and a standard deviation of $20/\sqrt{200} = 1.414$

POINTS: 0 / 1

-  8. Suppose we are planning on taking an SRS from a population. If we double the sample size, then $\sigma_{\bar{x}}$ will be multiplied by:
- a. $\sqrt{2}$
 - b. $1/\sqrt{2}$
 - c. 2
 - d. 1/2
 - e. 4


ANSWER: B

Doubling the sample size makes the standard deviation

$$\frac{\sigma}{\sqrt{2n}} = \frac{\sigma}{\sqrt{2} \sqrt{n}} = \frac{1}{\sqrt{2}} \frac{\sigma}{\sqrt{n}}$$

POINTS: 0 / 1


A factory produces plate glass with a mean thickness of 4 millimeters and a standard deviation of 1.1 millimeters. A simple random sample of 100 sheets of glass is to be measured, and the sample mean thickness of the 100 sheets \bar{x} is to be computed.

-  9. We know the random variable \bar{x} has approximately a normal distribution because of
- a. the law of large numbers.
 - b. the central limit theorem.
 - c. the law of proportions.
 - d. the fact that probability is the long run proportion of times an event occurs.

ANSWER: B

The Central Limit Theorem tells us what to do for the sampling distribution of a sample mean. Here it tells us that this statistics will follow a normal distribution because the sample size is large (n=100).

POINTS: 0 / 1

-  10. The probability that the average thickness \bar{x} of the 100 sheets of glass is less than 4.1 millimeters is approximately
- a. 0.8186.
 - b. 0.3183.
 - c. 0.1814.
 - d. 0.6817.

ANSWER: A

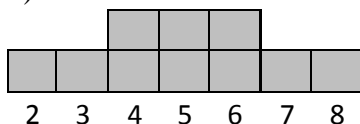
$z = \frac{4.1 - 4}{1.1/\sqrt{100}} = .91$. Using Table A, we find the area to the left of the z-score .91 is .8186.

POINTS: 0 / 1

AP Statistics Chapter 7 Practice FR Test: SOLUTIONS

1. a) (1,3), (1,5), (1,7), (1,9), (3,5), (3,7), (3,9), (5,7), (5,9), (7,9)

b)



c) 5 – because the mean of all sample means will always equal the mean of the population. Here the mean of the population is also 5.

d) It would be smaller since increasing the sample size decreases the spread of the sampling distribution

2. a) mean = $p = .45$ SD = $\sqrt{p(1-p)/n} = \sqrt{.45(.55)/500} = .0222$

b) **10% Condition:** 500 is clearly less than 10% of the number all adults in the U.S.
Large Counts Condition: $np = 500(.45) = 225$ and $n(1-p) = 500(.55) = 275$. Both of these numbers are greater than 10.

c) Need to find $P(\hat{p} > 0.5)$

$$z = \frac{.50 - .45}{.0222} = 2.25 \quad \text{and} \quad \text{normalcdf}(.50, E99, .45, .0222) = .0122$$

3. a) mean = $\mu = 7.2$ SD = $\sigma/\sqrt{n} = 5.3/\sqrt{55} = 0.7147$

b) Need to find $P(\bar{x} > 9)$

$$z = \frac{9 - 7.2}{.7147} = 2.52 \quad \text{and} \quad \text{normalcdf}(9, E99, 7.2, .7147) = .0059$$

c) **Central Limit Theorem:** The CLT says that if the sample size is greater than 30, the sampling distribution of sample means will be approximately normal. Here, $55 > 30$.