Name Answer Key

Chapter 7 – Test Review

AMAZING!

Date ______________

1. A survey conducted by Black Flag asked whether or not the action of a certain type of roach disk was effective in killing roaches. 79% of the respondents agreed that the roach disk was effective. The number 79% is a

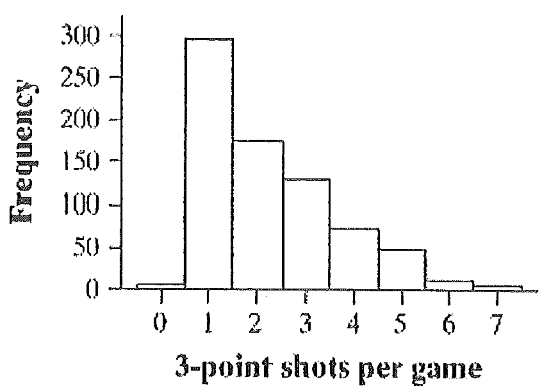
A. parameter.
B. population.
C. statistic.
D. sample.
E. sampling distribution.

2. If we take many simple random samples from the same population, we expect

A. the same values of the statistic for each sample
B. the values of the statistic will vary from sample to sample
C. a different value of the parameter for each sample
D. a problem with voluntary response
E. a problem with bias

Scenario 7-6

The histogram below was obtained from data on 750 high school basketball games in a regional athletic conference. It represents the number of three-point baskets made in each game.



← population Distribution

3. Use Scenario 7-6. A researcher takes a simple random sample of size $n = 40$ from this population and calculates the mean number of 3-point baskets. Which of the following best describes the shape of the sampling distribution of means?

A. Skewed left
B. Skewed right
C. Approximately uniform
D. Approximately Normal
E. Symmetric, but distinctly non-Normal.

4. Use Scenario 7-6. What is the range of sample sizes the research could take from this population without violating conditions required for the application of the formula $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$ and the central limit theorem?

A. $n \geq 30$
B. $30 \leq n \leq 50$
C. $30 \leq n \leq 75$
D. $50 \leq n \leq 75$
E. $n \leq 75$

CLT $n \geq 30$

N

$10n \leq N$

$10(n) \leq 750$

$n \leq 75$

Scenario 7-7
An automobile insurer has found that repair claims have a mean of \$920 and a standard deviation of \$870. Suppose that the next 100 claims can be regarded as a random sample from the long-run claims process.

5. Use Scenario 7-7. The mean and standard deviation of the mean of the next 100 claims is
A. mean = \$920 and standard deviation = \$87.
B. mean = \$920 and standard deviation = \$8.70.
C. mean = \$92 and standard deviation = \$87.
D. mean = \$92 and standard deviation = \$870.
E. none of these.

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{870}{\sqrt{100}}$

6. Use Scenario 7-7. The probability that the mean of the next 100 claims is larger than \$1000 is approximately
A. 0.9200.
B. 0.8212.
C. 0.1788.
D. 0.0800.
E. close to 0.

normalcdf(1000, 1E99, 920, 87) =

7. The central limit theorem refers to which of the following characteristic of the sampling distribution of the sample mean?
(a) Regardless of the shape of the population's distribution, the sampling distribution of the sample mean from sufficiently large samples will be approximately Normally distributed.
(b) Regardless of the shape of the population's distribution, the standard deviation of the sampling distribution of the sample mean from sufficiently large samples will be $\frac{\sigma}{\sqrt{n}}$
(c) Regardless of the shape of the population's distribution, the mean of the sampling distribution of the sample mean from sufficiently large samples will be equal to the mean of the population.
(d) As you take larger and larger samples from a Normally distributed population, the standard deviation of the sampling distribution of the sample mean gets smaller and smaller.
(e) As you take larger and larger samples from a Normally distributed population, the mean of the sampling distribution of the sample mean gets closer and closer to the population mean.

Scenario 7-8
The scores of individual students on the American College Testing (ACT) Program composite college entrance examination have an approximately Normal distribution with mean 18.6 and standard deviation 6.0. At Northside High, 36 seniors take the test. Assume that the scores at this school have the same distribution as national scores.

8. Use Scenario 7-8. What is the standard deviation of the sampling distribution of mean scores for the 36
students?

$\frac{6}{\sqrt{36}}$

A. 0.41.
B. 1.0.
C. 3.1.
D. 6.0.
E. 18.6.

Part 2: Free Response

Show all your work. Indicate clearly the methods you use, because you will be graded on the correctness of your methods as well as on the accuracy and completeness of your results and explanations.

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9. 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?

$P(X > 400) = P\left(Z > \frac{400-380}{28}\right) = P(Z > .71) = .2375$

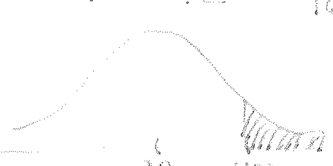
$N(400, 28)$

← normalcdf(400, 1E99, 380, 28) = .2375
LB Upper μ σ

(b) Three apples are selected at random from this orchard. What is the probability that their mean weight is greater than 400 gm.?

$N\left(380, \frac{28}{\sqrt{3}}\right) = N(380, 16.17)$

$P(\bar{X} > 400) = P\left(Z > \frac{400-380}{16.17}\right) = P(Z > 1.24) = .107$



← normalcdf(400, 1E99, 380, 16.17) = .107

(c) Explain why the probabilities in (a) and (b) are not equal.

Because the standard deviation changed.
As n increased, the st. dev. decreased.

10. Suppose a sample of 50 MP3 players is drawn randomly from a population of MP3 players and the weight, x, of each MP3 player is recorded. Prior experience has shown that the weight of a single MP3 player has a mean of 6 ounces and a standard deviation of 2.5 ounces.

(a) Describe the shape of the sampling distribution of $\bar{x}$ and justify your answer.

Approximately Normal because of the C.L.T

$n \geq 30 \rightarrow 50 \geq 30$

(b) What is the mean and standard deviation of the sampling distribution?

$\mu_{\bar{x}} = 6$ $\quad \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{2.5}{\sqrt{50}} = .35$

10% condition

$10n \leq N$

$10(50) \leq N$

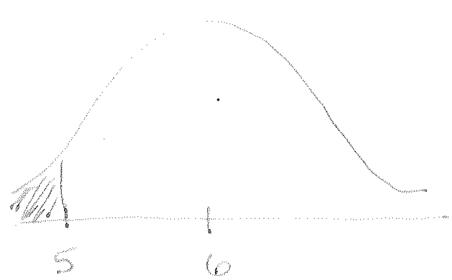
$500 \leq N$

Def. more than 500 MP3 players.

$N(6, .35)$

(c) What is the probability that the sample has a mean weight of less than 5 ounces?

$P(\bar{X} < 5) = P\left(Z < \frac{5-6}{.35}\right) \doteq P(Z < -2.86) = .002$



normalcdf(-1E99, 5, 6, .35) = .002

L.B U.B. μ σ

(d) How would the sampling distribution of $\bar{x}$ change if the sample size, n , were increased from 50 to 100?

Shape: The shape would still stay Approximately Normal

Center: Stays the same. $\mu_{\bar{x}} = 6$

Spread: Standard deviation would decrease

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{2.5}{\sqrt{100}} = .25$

11. 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?

$\mu_{\hat{p}} = .45$

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

10% condition

$10(500) \leq N$

$5000 \leq N$

Def more than 5000 Adults with school age children

$$\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}} = \sqrt{\frac{(.45)(.55)}{500}} = .02$$

$\sigma_{\hat{p}} = .02$

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

LARGE COUNTS

$np \geq 10 \quad n(1-p) \geq 10$

$500(.45) \geq 10 \quad 500(.55) \geq 10$

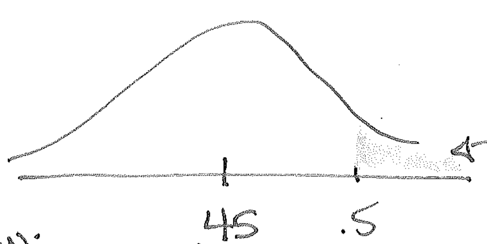
$\checkmark\ 225 \geq 10 \quad 275 \geq 10 \checkmark$

Since both are greater than 10, we can continue w/ Normal Approx.

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

$N(.45, .02)$

$$P(\hat{p} \geq .5) = P\left(z \geq \frac{.5 - .45}{.02}\right) = P(z \geq 2.5)$$



normalcdf(.5, 1E99, .45, .02) = .0062

CONCLUSION:

.62% samples of 500 will have a predicted proportion of .5 or larger.

12. George is a big fan of music from the 1960s, and 22% of the songs on his mp3 player 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). 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?

$\mu_{\hat{p}} = .22$

$\sigma_{\hat{p}} = \sqrt{\dfrac{.22(.78)}{50}} = .059$

Each song is independent
10% condition not needed
since repetition of songs
is permitted.

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

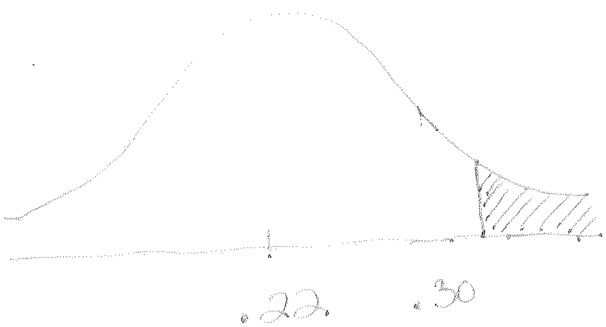
$N(.22, .059)$

$np \geq 10$ $n(1-p) \geq 10$

$50(.22) \geq 10$ $50(.78) \geq 10$

$11 \geq 10$ ✓ $39 \geq 10$ ✓

since both are met,
we can use Normal
Approximation.



$P(\hat{p} > .30) = P\left(z > \dfrac{.30 - .22}{.059}\right) = P(z > 1.36) = .0876$

There is a 8.76% chance that more than 30% of the 50 randomly-selected songs are Beatles songs.