Chapter 9 REVIEW

Name TEACHER ________________________________

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
A (a) Statistic
(b) Sample
(c) Parameter
(d) Population
(e) None of the above. The answer is ________________________.

2. 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. The mean of the sampling distribution of the sample proportion is
(a) 46
b (b) 0.46
(c) about 0.46, but not exactly 0.46
(d) 0.00248
(e) 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
(a) σ
(b) 100 σ
C (c) $\sigma/10$
(d) $\sigma/100$
(e) 0.1

4. The distribution of values taken by a statistic in all possible samples of the same size from the same population is
(a) the probability that the statistic is obtained.
(b) the population parameter.
D (c) the variance of the values.
(d) the sampling distribution of the statistic.
(e) none of the above. The answer is ________________________.

5. If a statistic used to estimate a parameter is such that the mean of its sampling distribution is equal to the true value of the parameter being estimated, the statistic is said to be
(a) random
(b) biased
(c) a proportion
D (d) unbiased
(e) none of the above. The answer is ________________________.

6. A simple random sample of 1000 Americans found that 61% were satisfied with the service provided by the dealer from which they bought their car. A simple random sample of 1000 Canadians found that 58% were satisfied with the service provided by the dealer from which they bought their car. The sampling variability associated with these statistics is
(a) exactly the same.
(b) smaller for the sample of Canadians because the population of Canada is smaller than that of the United States, hence the sample is a larger proportion of the population.
(c) smaller for the sample of Canadians because the percent satisfied was smaller than that for the Americans.
(d) larger for the Canadians because Canadian citizens are more widely dispersed throughout the country than in the United States, hence they have more variable views.
E (e) about the same.

7. The central limit theorem is important in statistics because it allows us to use the Normal distribution to make inferences concerning the population mean:
A (a) provided that the sample size is reasonably large (for any population).
(b) provided that the population is Normally distributed and the sample size is reasonably large.
(c) provided that the population is Normally distributed (for any sample size).
(d) provided that the population is Normally distributed and the population variance is known (for any sample size).
(e) provided that the population size is reasonably large (whether the population distribution is known or not).

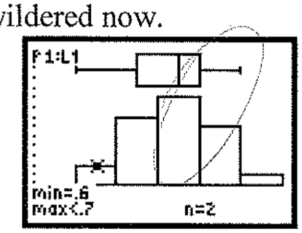
Communicate your thinking clearly and completely. $p=.5$ $\hat{p}=.8$

8. Suppose that you and your lab partner flip a coin 20 times and you calculate the proportion of tails to be 0.8. Your partner seems surprised at these results and suspects that the coin is not fair. Write a brief statement that describes why you either agree or disagree with him. Your response should relate what you have learned about sampling and sampling distributions.

The population proportion of getting tails should be $p=.5$ But the proportion of tails in a sample group can vary. $n=20$ is a small sample so variation will increase

cannot judge the coin based on a small sample

9. This problem extends the previous problem. You flip the coin 20 more times and calculate the proportion of heads. You repeat the process again and again until you have calculated 25 proportions $\hat{p}$. Your lab partner then plots a histogram of the results on his calculator and overlays a boxplot for the same data as shown. Your lab partner appears totally bewildered now. Interpret these results for him.



According to the graph it appears that the coin may be biased toward heads

The mean + median of the distribution $\hat{p}$ apears to be much more than .5 ($\mu_{\hat{p}}=.5$). Since the mean proportion $\hat{p}$ does not come close to matching the population $p=.5$ the distribution may be biased

If not the coin, how experiment was conducted in some way

10. A survey asks a random sample of 1500 adults in Ohio if they support an increase in the state sales tax from 5% to 6%, with the additional revenue going to education. Let $\hat{p}$ denote the proportion in the sample who say they support the increase. Suppose that 40% of all adults in Ohio support the increase.

(a) If $\hat{p}$ is the proportion of the sample who support the increase, what is the mean of the sampling distribution of $\hat{p}$? $\mu_{\hat{p}} = .40$

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

$$\sigma_{\hat{p}} = \sqrt{\frac{(.4)(.6)}{1500}} = \boxed{.0126}$$

(c) Explain why you can use the formula for the standard deviation of $\hat{p}$ in this setting.

it is safe to assume the 10% rule is followed as 1500 = 10% ohio population

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

$.4(1500) = 600 > 10$ ✓

$.6(1500) = 900 > 10$ ✓

normal can be used

(e) Find the probability that $\hat{p}$ takes a value between 0.37 and 0.43.

$P(.37 < \hat{p} < .43)$ = normalcdf(.37, .43, .40, .0126)

$= \boxed{.9827}$

The probability that $\hat{p}$ takes a value between .37 & .43 is .9827

(f) How large a sample would be needed to guarantee that the standard deviation of $\hat{p}$ is no more than 0.01? Explain.

$\sigma_{\hat{p}} = \sqrt{\frac{pq}{n}}$ solve for n

$.01^2 = \sqrt{\frac{(.4)(.6)}{n}}^{\,2}$

$.0001 = \frac{(.4)(.6)}{n}$

$n = \frac{(.4)(.6)}{.0001}$

n = 2400

For $\sigma_{\hat{p}}$ to be .01, sample should contain 2400 adults

11. The number of lightning strikes on a square kilometer of open ground in a year has a mean of 6 and standard deviation of 2.4. (These values are typical for much of the US). The National Lightening Detection Network uses automatic sensors to watch for lightening in random sample of 10 one- squre kilometer plots of land

(a) Explain why you cannot safely calculate the probability that $\bar{x}$ <5 based on a sample of 10?

sample = 10 ⇒ cant apply normal unless
I am told distrib. is normal

(b) What are the mean and standard deviation of $\bar{x}$, the sample mean number of strikes per square km.

$\mu_{\bar{x}} = 6 \quad \sigma_{\bar{x}} = \frac{2.4}{\sqrt{10}} = \boxed{.7589}$

(c) Suppose the NLDN takes a random sample of n=50 sq. km instead. Explain how the central limit theorem allows us to find the probability that the mean number of lightning strikes per sq. km is less than 5. Then calculate the probability. Show work.

$\mu_{\bar{x}} = 6 \quad \sigma_{\bar{x}} = \frac{2.4}{\sqrt{50}} = .6514$

$P(\bar{x} < 5) = \text{normalcdf}(-\infty, 5, 6, .6514) = \boxed{.0624}$