

PART 1: Answer True or False (each question times 2 = 20 Points)

1. A hypothesis test for a population mean is to be performed at 5% level of significance. The population standard deviation is known. The hypotheses are
$$H_0 : \mu = 80$$
$$H_a : \mu \neq 80$$
A 95% confidence interval is also constructed for μ . True or false, if 80 lies in the 95% confidence interval, then the null hypothesis will be rejected.
2. A one-sample z-test for a population is performed. The smaller the P-value, the stronger the evidence against the null hypothesis.
3. The probability of making a type I error is called the significance level of the hypothesis test.
4. Rejecting the null hypothesis when it is in fact true is called a type II error.
5. The Chi-square curve is right skewed and has area exactly 1 underneath it.
6. Voter registration records show that 68% of all voters in Indianapolis are registered as Republicans. To test a random digit dialing device, you use the device to call 150 randomly chosen residential telephones in Indianapolis. Of the registered voters contacted, 73% are registered Republicans. The statistic is 73% and the parameter is 68%.
7. For a t-curve with $df = 13$, $t_{0.10} = 1.350$.
8. For a z- curve $z_{0.01} = 3.15$.
9. A hypothesis test for a population is performed. The probability of a Type I error does not depend on the true mean.
10. The expression for the confidence level is $100(1 - \alpha)$

Part 2: Circle the Right Answer (each question times 2 = 20 Points)

11. When estimating a population mean by a sample mean, which of the following does the margin of error not depend on?

- A. The confidence level
- B. The sample size
- C. The population standard deviation
- D. The sample mean

12. Traditionally in hypothesis testing the null hypothesis represents the “status quo” which will be overturned only if there is evidence against it. Which of the statements below might represent a null hypothesis?

- A. The defendant is guilty.
- B. The teaching method raises SAT scores.
- C. The treatment has no effect.

13. Draw an SRS of size n from a population that is **not normal** with mean μ and finite standard deviation σ . When n is large, the sampling distribution of the sample mean \bar{x} is

- A. approximately normal $N(\mu, \sigma)$.
- B. approximately normal $N(\mu, \frac{\sigma}{n})$.
- C. approximately normal $N(\mu, \frac{\sigma}{\sqrt{n}})$.
- D. None of the above

14. The sample mean \bar{x} is an unbiased estimator of the unknown population mean μ . This means

- A. the mean \bar{x} is the same as the standard deviation of the population.
- B. the mean \bar{x} could be improved by using the continuity correction.
- C. the mean \bar{x} is the same as the mean of the population.
- D. the mean \bar{x} is within the 95% confidence interval.

15. An example of a set of data for which statistical inference is valid is

- A. an SRS.
- B. Not an SRS
- C. data with lurking variables.
- D. none of the above.

16. The P - value for a two- sided test of the null hypothesis $H_0 : \mu = 10$ is 0.06.
- A. The 95% confidence interval does not include the value 10.
 - B. The 90% confidence interval does include the value 10.
 - C. The 95% confidence interval does include the value 10 and the 90% confidence interval does not include the value 10.
 - D. None of the above
17. Suppose we are going to test if there is a preference for Coke over Pepsi. We present 25 subjects with a cup of each cola (in a random order) and ask which they prefer. If a sufficient number prefer Coke over Pepsi, then we will conclude that the population in general prefers Coke over Pepsi. In this setting, the number in our sample who prefer Coke over Pepsi is:
- A. The null Hypothesis .
 - B. α
 - C. the test statistic.
 - D. None of the above
18. Which of the following is true concerning significance levels?
- A. When rejecting H_0 would lead to a major change, you should use a smaller level of significance.
 - B. If H_0 is widely believed, you should use a smaller level of significance.
 - C. A significance level of 0.05 is commonly used.
 - D. All of the above.
19. Based on a sample of 34 randomly selected years, a 90% confidence interval for the mean annual precipitation in one city is from 47.5 inches to 50.5 inches. Find the margin of error.
- A) 3 inches
 - B) 1.5 inches
 - C) 0.42
 - D) There is not enough information to find the margin of error.
20. A population is normal with a variance of 51. Suppose you wish to estimate the population mean μ . Find the sample size needed to assure with 68.26 percent confidence that the sample mean will not differ from the population mean by more than 4 units.
- A) 163
 - B) 4
 - C) 13
 - D) 2

PART 3: Show all steps in each problem to earn full credit (each question times 6 = 60 Points)

21. You want to rent an unfurnished one-bedroom apartment for next semester. You take a random sample of 10 apartments advertised in the local newspaper and record the rental rates. Here are the rents (in dollars per month):

500, 650, 600, 505, 450, 550, 515, 495, 650, 395

Minitab reports the following descriptive statistics for a variable (assume a 95% confidence level).

T Confidence Intervals

Variable	N	Mean	StDev	SE Mean	95.0 % CI
C1	10	531.0	82.8	26.2	(471.8, 590.2)

Give the degrees of freedom for this statistic and use the concept of confidence interval and the Minitab output to decide whether a mean of 500 is consistent with the given data.

22. Another Minitab output reports the following using the same data in number (21)

T-Test of the Mean

Test of $\mu = 500.0$ vs $\mu > 500.0$

Variable	N	Mean	StDev	SE Mea	T	p
C1	10	531.0	82.8	26.2	1.18	0.13

State the Hypotheses and use the p-value reported to state your conclusion whether these data give good reason to believe that the mean rent of all advertised apartments is greater than \$500 per month.

23. Restate the hypotheses in number (22) with a two-sided alternative give the corresponding p-value using the Minitab output and use the p-value to state your conclusion whether these data give good reason to believe that the mean rent of all advertised apartments is different from \$500 per month.

24. A *Gallup Survey* on the drinking habits of Americans estimated the percentage of adults across the country who drink beer, wine, or hard liquor, at least occasionally. Of the 1516 adults interviewed, 985 said that they drank. Determine a 95% confidence interval for the proportion, p , of all Americans who drink beer, wine, or hard liquor, at least occasionally. Show work.

25. Data on salaries in the public school system are published annually in *National Survey of Salaries and Wages in Public Schools*. The mean annual salary for classroom teachers is \$43,658. Assume a standard deviation of \$8,000. Determine the percentage of all samples of 256 school teachers that have mean salaries within \$1,000 of the population mean salary of \$43,658. Show work.

26. The scores of students on the ACT college entrance examination in 2001 had mean $\mu = 21.0$ and standard deviation $\sigma = 4.7$. The distribution of scores is only roughly normal. Now take an SRS of 50 students who took the test. What is the approximate probability that the mean score \bar{x} of these students is 23 or higher?

27. A test for the level of potassium in the blood is not perfectly precise. Moreover, the actual level of potassium in a person's blood varies slightly from day to day. Suppose that repeated measurements for the same person on different days vary normally with $\sigma = 0.2$. How large a sample of Julie's potassium levels would be needed to estimate her mean μ within ± 0.06 (margin of error) with 95% confidence?

28 (a). A test of the null hypothesis $H_0 : \mu = \mu_0$ gives test statistic $z = 3.35$
What is the P – value if the alternative is $H_a : \mu \neq \mu_0$?

(b) Is the value $z = 3.35$ significant at the 5% level?

29 a. Referring to number (28a) what is the P – value if the alternative is $H_a : \mu > \mu_0$?

b. Do you reject the null hypothesis at the 1% level?

