

Multiple Choice [10 pts] – choose the ONE BEST answer for each question by writing the corresponding letter in the blank to the left of the question.

- _____ 1. Which of the following statistics is biased?
A. \bar{x} **B.** s **C.** IQR **D.** All are biased **E.** None is biased
- _____ 2. Which descriptors best describe the situation where multiple samples produce very similar results but those results do not average out to the true value of the parameter?
A. Accurate, Precise **B.** Accurate, Imprecise **C.** Inaccurate, Precise **D.** Inaccurate, Imprecise
- _____ 3. What decision should be made if the p-value $< \alpha$?
A. DNR H_0 **B.** Reject H_0 **C.** DNR H_A **D.** Reject H_A **E.** None of these
- _____ 4. Which of the following is **not** a possible H_A ?
A. $\bar{x} < 17$ **B.** $\bar{x} \neq -17$ **C.** $\mu = 17$ **D.** All of them **E.** None of them
- _____ 5. Which of the following is **not** a possible p-value?
A. -0.0345 **B.** 0.9345 **C.** $1.34e-6$ **D.** All of them **E.** None of them
- _____ 6. What type of error occurs when a true H_0 is rejected?
A. Type I **B.** Type II **C.** Type III **D.** Rejection **E.** No error
- _____ 7. Which symbol or word represents the probability of rejecting a false H_0 ?
A. α **B.** β **C.** σ **D.** Inference **E.** Power
- _____ 8. What happens to the probability of a Type II error if α is increased?
A. decreases **B.** stays the same **C.** increases **D.** becomes zero **E.** rejects H_0
- _____ 9. What level of confidence should be used if $\alpha=0.1$ and $H_A: \mu > \mu_0$?
A. 0.10 **B.** 0.50 **C.** 0.90 **D.** 0.95 **E.** 0.99
- _____ 10. What type of confidence region is constructed if $\alpha=0.1$ and $H_A: \mu > \mu_0$?
A. Interval **B.** Point estimate **C.** Upper bound **D.** Lower bound **E.** Rejection region

Short (Paragraph) Answers – Answer THREE of the following questions with complete sentences on a separate sheet of paper. Circle the questions below that you have chosen to answer and make sure to clearly label your answers on the separate sheet. Each question is worth 3 points.

11. Completely describe all differences between a population and a sampling distribution.
12. What are the two major methods or techniques for performing statistical inference? Completely describe the differences between the objectives for the two methods?
13. Describe choices that you, as a researcher, can make to reduce β . Which is the best choice to make and why?
14. What is the difference between “statistical significance” and “practical significance”? Explain why is it important to make a distinction between these two forms of significance?
15. Completely describe the similarities and differences between a Z- and a t- distribution.

R – Answer the following questions with complete sentences in a typed document. Your answers should refer to properly labeled figures and tables, as appropriate, generated in R, and pasted into your document. You should also include an appendix of R commands that you used to answer each question. Make sure that you start with a blank RStudio (except for your script for loading the data in 19) and MS-Word document and that you save your documents regularly.

16. [13 pts] The Wisconsin Department of Natural Resources is examining the amount of domestic corn consumed by raccoons per week. For the questions below, assume that the amount eaten is slightly right-skewed with a mean of 8 kg and a standard deviation of 2 kg.
- What is the probability that a raccoon consumes more than 13 kg?
 - What is the probability that a sample of 25 raccoons will have a mean corn consumption of more than 10 kg?
 - What is the probability that a sample of 60 raccoons will have a mean corn consumption between 8.5 and 10 kg?
 - What is the probability that a sample of 60 raccoons will consume a TOTAL of more than 510 kg?
 - What is the mean consumption for the top 25% of samples of 10 raccoons?
17. [8 pts] Use the following information to answer the following questions: $H_A: \mu > 90$, $\sigma = 10$, $\alpha = 0.01$, $n = 50$, and $\bar{x} = 94$.
- Compute the p-value and make a decision.
 - Compute and interpret the confidence region.
18. [3 pts] Biologists often visually estimate the number of geese in a flock to determine relative abundance. Some researchers believe, however, that biologists tend to over-estimate the true size of the flock with their visual estimates. To test this hypothesis, researchers will show a slide with a certain number of geese on it to a random sample of biologists and ask each biologist to estimate the number of geese on the slide. Assume that the standard deviation for the estimates is 40, the researchers want the estimate to be within 5 birds, and that they will use a 10% significance level. Compute what sample size they should use.
19. [15/17 pts] The golden rectangle is a rectangle with a width-to-length ratio of 0.618 (i.e., if the width is divided by the length of the golden rectangle then the resultant value is 0.618). Evidence for the golden rectangle can be found in several works by ancient Greeks and Egyptians. Recently, anthropologists measured the width-to-length ratios of beaded rectangles used by the Shoshoni Indians of America to decorate their leather goods. The collected data is in **Shoshoni.txt**. Use these data to determine, at the 5% level, if the golden rectangle is evident (or not) in the beadwork of the Shoshoni Indians.

11 Steps for any Significance Test

- [1] state the rejection criterion (α),
- [2] state the null and alternative hypotheses to be tested and define the parameter(s),
- [1] determine which hypothesis test to use – thoroughly explain why,
- [1] collect the data (address type of study and randomization),
- [2] check all necessary assumptions (explain how you tested the validity),
- [1] calculate the appropriate statistic(s),
- [2] calculate the appropriate test statistic,
- [2] calculate the p-value,
- [1] state the rejection decision,
- [2] summarize your findings in terms of the problem, and
- [2] if reject H_0 , compute a **100(1- α)% confidence region** for the parameter.