Midterm 2 SUMMER 2024 - Requires Respondus LockDown Browser + We...

Attempt 1 of 1

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Attempt Score **66.14 / 105 - D-**

Overall Grade (Highest Attempt) **66.14 / 105 - D-**

Question 1 **0 / 0.00000001 points**

I attest that I have read and will follow all the instructions above honestly while taking this exam, and that the work I submit will be my own, produced without assistance from others (including other students in this class or AI technologies). Furthermore, I understand that if I share any information about the exam with another student before they have taken it, or if I use AI assistance of any kind, I will face actions including receiving a failing grade in the course and likely being reported to the Office of the Dean of Students for Academic Dishonesty

As a Boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. **Accountable together - We are Purdue.**

- [x] True
- [ ] False

True or False Questions

Question 2 **2 / 2 points**

When the significance level (α) of a statistical test is reduced while holding all other factors constant, the power of the test decreases.

- [x] True
- [ ] False

Question 3 **0 / 2 points**

Let X be a binomial random variable with parameters n and p. If we performed a single experiment from a Binomial distribution, we could estimate p with the unbiased estimator $\hat{p} = \frac{X}{n}$, where X denotes the number of successes in the n-trials.

If we estimated the variance of the binomial distribution using the estimator $\hat{\sigma}^2 = n\hat{p}(1-\hat{p})$, it would be an unbiased estimator of the true variance of the true variance $\sigma^2 = np(1-p)$.

(Hint: Plug in $\hat{p}$ into the formula below for $\hat{\sigma}^2$ and compute $E[\hat{\sigma}^2]$ to see if the statement is True or False.)

- ✗ ◉ True
- ➡ ○ False

Question 4 **2 / 2 points**

A company conducted a study to evaluate the impact of a new employee training program on productivity. They measured the productivity of 30 employees before and after the training program. To analyze the results, the researchers suggested using a two-sample paired t-test.

Considering only the design of the experiment, were the researchers correct in suggesting a two-sample paired t-test for analysis in this study?

- ✓ ◉ True
- ○ False

Question 5 **0 / 2 points**

A study is to be conducted regarding the concentration levels of a chemical in a well-controlled industrial process. "The concentration levels of the chemical are known to be normally distributed due to the precise control of the production environment." If a sample of 3 observations were used to conduct a hypothesis test for testing the mean concentration levels, and the population standard deviation is unknown, it would not be appropriate to use the t-test and interpret the resulting p-value in this scenario due to the small sample size.

- ✗ ◉ True
- ➡ ○ False

Question 6 **0 / 2 points**

When comparing the means of two populations using **two independent samples from normally distributed populations** with **unequal sample sizes** and **equal but unknown population variances,** the **test statistics** calculated using the **Welch estimator** and the **pooled estimator** will be **identical**, but the **degrees of freedom** will be **different**.

Hint: Explore the formulas before answering.

- ✗ ◉ True
- ➡ ○ False

Multiple Choice Questions

Question 7 **3 / 3 points**

A pharmaceutical company plans to evaluate a new drug intended to enhance concentration in individuals with Attention Deficit Hyperactivity Disorder (ADHD).

Which of the following study designs best incorporates experimental design principles of randomization, replication, and control measures?

a) Allow participants to continue their usual medication without any changes and merely observe the additive effects of the new drug, using a blinding method to prevent bias in the assessment of outcomes.

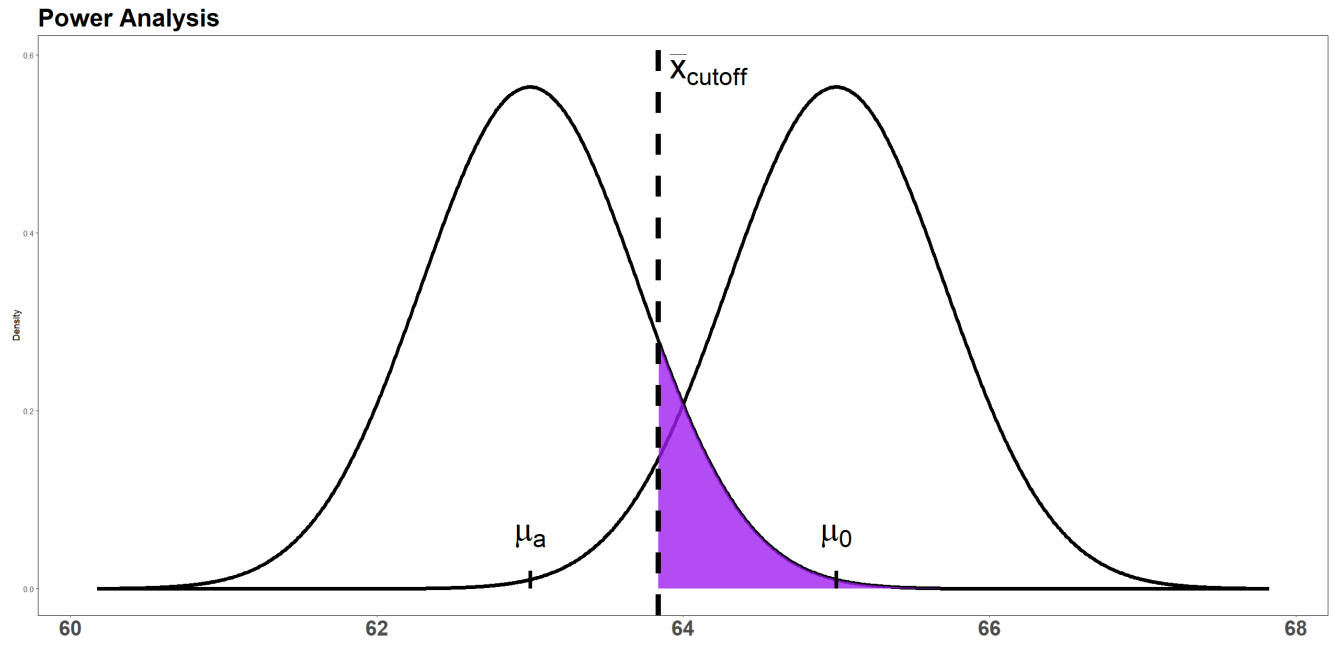
b) Participants are selected based on their availability and preference, with those opting for the drug placed in the treatment group and others in the control group receiving a placebo.

c) Participants currently on various ADHD medications are enrolled and have their existing treatments swapped with the new drug. The effects of the new drug are then monitored over time, comparing outcomes before and after the medication swap within the same individuals.

d) Initiate with a washout period for participants on ADHD medication, then randomly assign them to receive either the new drug or a placebo. Conduct the study as a double-blind trial across multiple locations to ensure consistent and reliable results.

Question 8 **3 / 3 points**

A one-sample hypothesis test procedure is being conducted to determine the unknown mean of a population. The graph below shows the null hypothesis distribution (right) centered at μ_0, the alternative hypothesis distribution (left) centered at μ_a, and the correctly determined cutoff value indicated by $\overline{x}_{\text{cutoff}}$.



What does the purple shaded region in the graph represent?

a) None of the above.

b) The probability of **Type I error**.

c) The **power** of the test in detecting an alternative μ_a.

d) The probability of **Type II error**.

Question 9 **3 / 3 points**

How does the **critical value** used for a **two-sided confidence interval compare** to that used for a **one-sided lower confidence bound** at the **same level of confidence**?

a) The critical value for a two-sided confidence interval is half of the critical value used for a one-sided lower confidence bound.

b) The critical value for a two-sided confidence interval is smaller than the critical value used for a one-sided lower confidence bound.

c) The critical value for a two-sided confidence interval is the same as the critical value used for a one-sided lower confidence bound.

d) The critical value for a two-sided confidence interval is greater than the critical value used for a one-sided lower confidence bound.

e) The critical value for a two-sided confidence interval is twice the size of the critical value used for a one-sided lower confidence bound.

Question 10 **3 / 3 points**

In a **preliminary matched pairs study**, a **90% confidence interval** for the **mean difference** in a population was computed using a **sample of 24 paired observations**. The sample standard deviation of the differences (s_{diff}) was found to be **16**.

Now, the researcher aims to conduct a **follow-up study** with **improved precision**. They want the **entire width** of the **confidence interval for the mean difference** to be **no more than 6 units** at a **90% confidence level**.

Determine the approximate minimal sample size required to achieve a **90% confidence interval** of **no more than 6 units** in **width**.

a) 77

b) 335

c) 21

d) 308

e) 84

Hide question 10 feedback

Forgot to provide critical value in questions gave full points.

FIB Questions

Question 11 **25.5 / 30 points**

A university department is conducting research to enhance the undergraduate learning environment. The department aims to investigate whether there is a positive impact on learning outcomes when the emphasis of a course is shifted from **traditional lecture-based instruction (T)** to new **AI-enhanced instruction (A)**.

To accomplish this, the department collected data from a course that has run **two sections** for the **past 4 semesters**. One section has an **AI-enhanced instruction emphasis (Group A)**, while the other section has a **traditional lecture emphasis (Group T).** The department collected **historical average final grades** for both **sections** over these **4 semesters**.

The summary statistics of these 4 semesters are provided in the table below.

Course Type	n	$\bar{x}$	s
A	4	79.41944	2.894922
T	4	77.03067	2.625191
A-T	4	2.38877	4.468147

Which analysis method is appropriate for the given situation: **two-sample independent** or **two-sample paired**? Regardless of which method you select you may assume that all of the assumptions necessary for analysis have been checked and are valid.

Select the correct approach and the most appropriate reasoning from the choices below.

Two-Sample Independent Choices

[A] The situation calls for a **two-sample independent analysis**. The department randomly assigned students to either the AI-enhanced instruction section or the lecture-based instruction section each semester. Since the sections were assigned independently and there is no common factor to pair on, a two-sample independent analysis is appropriate.

[B] The situation calls for a **two-sample independent analysis** since the department assigned students to different sections at random, ensuring that each section had a unique group of students. This random assignment of students to sections means there are no shared characteristics between the groups that could be used for pairing, thus eliminating any potential pairing factors.

[C] The situation calls for a **two-sample independent analysis**. The average grades were compared across the two different teaching methods without considering any pairing between sections. This approach treats each group of sections as separate and independent, assuming there are no shared characteristics that would link sections together for a paired analysis.

Two-Sample Paired Choices

[D] The situation calls for a **two-sample paired analysis** because each **AI-enhanced instruction** section is **paired** with a **lecture-based instruction** section based on similar content and difficulty. This matching ensures that each pair of sections is directly comparable in terms of subject matter and instructional level.

[E] The situation calls for a **two-sample paired analysis.** The sections were matched based on

student demographics and prior performance. By pairing sections with similar student populations, the analysis accounts for differences in student backgrounds and abilities.

[F] The situation calls for a **two-sample paired analysis** because the same students took both types of sections, providing a direct comparison. This approach allows for a within-subject comparison, where each student serves as their own control, reducing variability.

___D___ ✓(20 %)

The department will conduct a statistical hypothesis for this investigation at a **0.02 significance level**. Select the most appropriate hypothesis for the given statistical question from the choices below.

Let **A** denote the enhanced AI-based instruction, and **T** denote the traditional lecture-based instructional method and $\boldsymbol{\mu}$ denote the true average grades.

[A] $\mathbf{H_0}$: $\mu_A - \mu_T \geq 0$, $\mathbf{H}_a$: $\mu_A - \mu_T < 0$

[B] $\mathbf{H_0}$: $\mu_A - \mu_T \leq 0$, $\mathbf{H}_a$: $\mu_A - \mu_T > 0$

[C] $\mathbf{H_0}$: $\mu_A - \mu_T = 0$, $\mathbf{H}_a$: $\mu_A - \mu_T \neq 0$

Let the difference **D** be defined as **D = A - T**.

[D] $\mathbf{H_0}$: $\mu_D \geq 0$, $\mathbf{H}_a$: $\mu_D < 0$

[E] $\mathbf{H_0}$: $\mu_D \leq 0$, $\mathbf{H}_a$: $\mu_D > 0$

[F] $\mathbf{H_0}$: $\mu_D = 0$, $\mathbf{H}_a$: $\mu_D \neq 0$

___E___ ✓(10 %)

Calculate the appropriate test statistic. **(Use 4 decimal places in your answer)**

___1.0692___ ✓(15 %)

Indicate which of the options below is **most likely** to be the correct R code for directly computing the appropriate p-value for the hypothesis test?

Let **TS** denote the assumed correctly computed test statistic value you computed above.

[A] pnorm(**TS**, lower.tail= TRUE)

[B] 2*pnorm(|**TS**|, lower.tail=FALSE)

[C] pnorm(**TS**, lower.tail=FALSE)

[D] pt(**TS**, df= 3, lower.tail=TRUE)

[E] 2 * pt(|**TS**|, df= 3, lower.tail=FALSE)

[F] pt(**TS**, df= 3, lower.tail=FALSE)

[G] pt(**TS**, df= 5.909852, lower.tail=TRUE)

[H] 2 * pt(|**TS**|, df= 5.909852, lower.tail=FALSE)

[I] pt(**TS**, df= 5.909852, lower.tail=FALSE)

___F___ ✓(15 %)

Assume that the following interval and bounds are computed correctly using the data and at a **confidence level** of **0.98**.

Choose the appropriate confidence bound/interval for this situation.

[A] 98 percent confidence interval: **-12.533034 7.755494**

[B] 98 percent confidence interval: **-10.16761 Inf**

[C] 98 percent confidence interval: **-Inf 5.39007**

___B___ ✓(10 %)

Select an appropriate interpretation of your confidence interval or bound.

[A] I am **98% confident** that the **true mean difference** between **AI-enhanced instruction** and **traditional lecture-based instruction** is **captured** by the interval **(-12.533034, 7.755494)**.

[B] There is a **98% probability** that the **true mean difference** between **AI-enhanced instruction** and **traditional lecture-based instruction** is **within** the interval **(-12.533034, 7.755494)**.

[C] I am **98% confident** that the **true mean difference** between **AI-enhanced instruction** and **traditional lecture-based instruction** is **less than -10.16761**.

[D] I am **98% confident** that the **true mean difference** between **AI-enhanced instruction** and **traditional lecture-based instruction** is **greater than -10.16761**.

[E] I am **98% confident** that the **true mean difference** between **AI-enhanced instruction** and **traditional lecture-based instruction** is **less than 5.39007**.

[F] I am **98% confident** that the **true mean difference** between **AI-enhanced instruction** and **traditional lecture-based instruction** is **greater than 5.39007**.

___D___ ✓(15 %)

Based **solely** on the **appropriate confidence interval/bound** that you selected above, what is the **most appropriate conclusion** for the **hypothesis test** from the choices below.

[A] Do not reject the null hypothesis. The data **does not provide** sufficient **evidence** to **reject** the **null hypothesis** at the **significance level (α)**, indicating **no significant difference** between the instructional methods.

[B] Reject the null hypothesis. The data **does provide** sufficient **evidence** to **reject** the **null hypothesis** at the **significance level (α)**, indicating a **significant difference** between the instructional methods.

[C] Do not reject the null hypothesis. Since the constructed **98% confidence interval** or **bound** is complementary to the hypothesis test **(with α + C = 1)**, is in the **direction** of the **alternative hypothesis**, and **contains 0**, we would **not reject** the **null hypothesis** and therefore we **do not have sufficient evidence** to suggest that the AI-enhanced instruction has a positive impact on learning outcomes in comparison to traditional based instruction.

[D] Reject the null hypothesis. Since the constructed **98% confidence interval** or **bound** is complementary to the hypothesis test **(with α + C = 1),** is in the **direction** of the **alternative hypothesis**, and **contains 0**, we would **reject** the **null hypothesis** and therefore we **have sufficient evidence** to suggest that the AI-enhanced instruction has a positive impact on learning outcomes in comparison to traditional based instruction.

[E] Do not reject the null hypothesis. The **p-value** was found to be **greater** than the **significance level (α)**, indicating that we **do not have sufficient evidence** to **reject** the **null hypothesis** and suggest a **significant difference** between the instructional methods.

[F] Reject the null hypothesis. The **p-value** was found to be **less** than the **significance level (α)**, indicating that we **do have sufficient evidence** to **reject** the **null hypothesis** and suggest a **significant difference** between the instructional methods.

___D___ ✖ **([C], C, c, [c])**

Question 12 **14.64 / 32 points**

The Federal Aviation Administration (FAA) requires that environmental documents address noise impact around airports using an impact threshold of Day Night Average Sound Level (DNL) 65(dBa). A **sample of 112 residential homes** in the vicinity of a major airport were selected and the average DNL noise level of these residents were measured with the owner's permission over a 1-month period. The data is used to assess if there is evidence at an **0.06 significance level** that the DNL **exceeds 65(dBa)**. The **sample mean and sample standard deviation** for these **112 observations** for the average DNL noise level was found to be **66.00179(dBa) and 6.717169(dBa) respectively**.

Select the letter corresponding to the correct choice for the first step of the four-step hypothesis test process.

[A] The parameter of interest is the sample Day Night Average Sound

Level (DNL) "$\overline{X}_{\text{DNL}}$" of the 112 residential homes sampled from around this major airport; in units of dBA.

[B] The parameter of interest is the sample Day Night Average Sound Level (DNL) "$\overline{X}_{\text{DNL}}$" of the neighborhood of residential homes around this major airport; in units of dBA.

[C] The parameter of interest is the true Day Night Average Sound Level (DNL) "$\overline{X}_{\text{DNL}}$" of the neighborhood of residential homes around this major airport; in units of dBA.

[D] The parameter of interest is the sample Day Night Average Sound Level (DNL) "$\boldsymbol{\mu_{\text{DNL}}}$" of the 112 residential homes sampled from around this major airport; in units of dBA.

[E] The parameter of interest is the true Day Night Average Sound Level (DNL) "$\boldsymbol{\mu_{\text{DNL}}}$" of the neighborhood of residential homes around this major airport; in units of dBA.

[F] The parameter of interest is the sample Day Night Average Sound Level (DNL) "$\boldsymbol{\mu_{\text{DNL}}}$" of the neighborhood of residential homes around this major airport; in units of dBA.

___E___ ✓(6.25 %)

Select the letter corresponding to the most appropriate choice for the second step **(State the Hypothesis)** of the four-step hypothesis test process.

[A] $\mathbf{H_0}$: $\boldsymbol{\mu_{\text{DNL}} \leq 65\ (\text{dBa})}$, $\mathbf{H_a}$: $\boldsymbol{\mu_{\text{DNL}} > 65\ (\text{dBa})}$

[B] $\mathbf{H_0}$: $\boldsymbol{\mu_{\text{DNL}} \geq 65\ (\text{dBa})}$, $\mathbf{H_a}$: $\boldsymbol{\mu_{\text{DNL}} < 65\ (\text{dBa})}$

[C] $\mathbf{H_0}$: $\boldsymbol{\mu_{\text{DNL}} = 65\ (\text{dBa})}$, $\mathbf{H_a}$: $\boldsymbol{\mu_{\text{DNL}} \neq 65\ (\text{dBa})}$

[D] $\mathbf{H_0}$: $\boldsymbol{\mu_{\text{DNL}} \neq 65\ (\text{dBa})}$, $\mathbf{H_a}$: $\boldsymbol{\mu_{\text{DNL}} = 65\ (\text{dBa})}$

[E] $\mathbf{H_0}$: $\boldsymbol{\mu_{\text{DNL}} = 65\ (\text{dBa})}$, $\mathbf{H_a}$: $\boldsymbol{\mu_{\text{DNL}} < 65\ (\text{dBa})}$

[F] $\mathbf{H_0}$: $\boldsymbol{\mu_{\text{DNL}} = 65\ (\text{dBa})}$, $\mathbf{H_a}$: $\boldsymbol{\mu_{\text{DNL}} > 65\ (\text{dBa})}$

___A___ ✓(6.25 %)

Which of the following would provide a result consistent with the hypothesis you selected above:

[A] Confidence Interval

[B] Lower Confidence Bound

[C] Upper Confidence Bound

___B___ ✓(6.25 %)

What is the appropriate **confidence level** for the **interval or bound** that you selected above?

Please write your answer using **4 decimal places** and write it as **decimal value not** as a **percentage**.

For example, if it was a **95.55% confidence level**, you would enter **0.9555**. You may drop any trailing zeros if you do not need the full 4 decimal places.

___0.9400___ ✓(6.25 %)

An FAA researcher has determined from prior studies that the average DNL noise level in neighborhoods around airports is **known** to have a **standard deviation of 4(dBa)**.

Select the **correct critical value** from the **table below** for the **confidence interval** or **bound** that is **consistent** with your **stated hypothesis** and **confidence level**.

Note that more information is provided in the table than is needed to answer the question.

> qt(0.06, df = 111, lower.tail = FALSE) **[1] 1.566834**	**> qt(0.06/2, df = 111, lower.tail = FALSE)** **[1] 1.90021**
> qnorm(0.06, lower.tail = FALSE) **[1] 1.554774**	**> qnorm(0.06/2, lower.tail = FALSE)** **[1] 1.880794**

Your answer should be given using the full value of the critical value. Do not round and make sure you use the full value in subsequent questions.

___1.566834___ ✗ **(1.554774, 1.55477, 1.5548, 1.555, 1.56, 1.6)**

Use the **critical value** you just obtained and the **population standard deviation** of **4 dBa** to **calculate** the **confidence interval** or **bound** that is consistent with your stated hypothesis.

Your answer must be given in **interval notation** and any **numbers** should be **correctly rounded** to **four decimal places**.

If you have a **confidence interval** provide your answer as: **(number1, number2)**.

If you have a **confidence lower bound** provide your answer as: **(number, INF)**.

If you have a **confidence upper bound** provide your answer as: **(-INF, number)**.

(Note INF is notation to indicate infinity and must be in all caps if used.)

___(65.4134, INF)___ ✖ **((65.4141, INF), (65.4141,INF), 65.4141, (65.4141, INF), (65.4141, ∞), (65.4141,∞), (65.4141, ∞))**

Using the confidence interval or bound that you computed above determine the conclusion of the hypothesis test.

Would you reject the null hypothesis? Select the most appropriate option from the choices below.

Confidence Upper Bound Choices

[A] The **confidence upper bound** value is **greater than** the **null value of 65 (dBa)**. Therefore, we **would reject** the **null hypothesis** that the **true DNL** is **at least 65 (dBa)** and conclude that there **is evidence** at the **0.06 significance level** that the **true DNL** is **less than 65 (dBa)**.

[B] The **confidence upper bound** value is **greater than** the **null value of 65 (dBa)**. Therefore, we **would reject** the **null hypothesis** that the **true DNL** is **at least 65 (dBa)** and conclude that there is **no evidence** at the **0.06 significance level** that the **true DNL** is **less than 65 (dBa)**.

[C] The **confidence upper bound** value is **greater than** the **null value of 65 (dBa)**. Therefore, we **would not reject** the **null hypothesis** that the **true DNL** is **at least 65 (dBa)** and conclude that there **is evidence** at the **0.06 significance level** that the **true DNL** is **less than 65 (dBa)**.

[D] The **confidence upper bound** value is **greater than** the **null value of 65 (dBa)**. Therefore, we **would not reject** the **null hypothesis** that the **true DNL** is **at least 65 (dBa)** and conclude that there is **no evidence** at the **0.06 significance level** that the **true DNL** is **less than 65 (dBa)**.

Confidence Interval Choices

[E] The **null value** of **65 (dBa)** is **not within** the **confidence interval**. Therefore, we would **reject** the **null hypothesis** that the **true DNL** is **65 (dBa)** and conclude that there **is evidence** at the **0.06 significance level** that the **true DNL** is **not equal** to **65 (dBa)**.

[F] The **null value** of **65 (dBa)** is **not within** the **confidence interval**. Therefore, we would **not reject** the **null hypothesis** that the **true DNL** is **65 (dBa)** and conclude that there **is no evidence** at the **0.06 significance level** that the **true DNL** is **not equal** to **65 (dBa)**.

[G] The **null value** of **65 (dBa)** is **within** the **confidence interval**. Therefore, we would **not reject** the **null hypothesis** that the **true DNL** is **65 (dBa)** and conclude that there **is evidence** at the **0.06 significance level** that the **true DNL** is **not equal** to **65 (dBa)**.

[H] The **null value** of **65 (dBa)** is **within** the **confidence interval**. Therefore, we would **reject** the **null hypothesis** that the **true DNL** is **65 (dBa)** and conclude that there **is**

no evidence at the **0.06 significance level** that the **true DNL** is **not equal** to **65 (dBa)**.

Confidence Lower Bound Choices

[I] The **confidence lower bound** value is **greater than** the **null value of 65 (dBa)**. Therefore, we would **not reject** the **null hypothesis** that the **true DNL** is **at most 65 (dBa)** and conclude that there **is evidence** at the **0.06 significance level** that the **true DNL** is **greater than 65 (dBa)**.

[J] The **confidence lower bound** value is **greater than** the **null value of 65 (dBa)**. Therefore, we would **not reject** the **null hypothesis** that the **true DNL** is **at most 65 (dBa)** and conclude that there is **no evidence** at the **0.06 significance level** that the **true DNL** is **greater than 65 (dBa**

[K] The **confidence lower bound** value is **greater than** the **null value of 65 (dBa)**. Therefore, we would **reject** the **null hypothesis** that the **true DNL** is **at most 65 (dBa)** and conclude that there is **evidence** at the **0.06 significance level** that the **true DNL** is **greater than 65 (dBa)**.

[L] The **confidence lower bound** value is **greater than** the **null value of 65 (dBa)**. Therefore, we would **reject** the **null hypothesis** that the **true DNL** is **at most 65 (dBa)** and conclude that there is **no evidence** at the **0.06 significance level** that the **true DNL** is **greater than 65 (dBa)**.

___I___ ✖ **([K], K, k, [k])**

Another researcher has identified that the design of the neighborhoods around this airport differs from those around typical airports and it would **not be appropriate** to **assume** that the **standard deviation is 4(dBa)**. Would the **critical value** of the **confidence interval** or **bound change**?

Select the letter of the most appropriate answer from the choices below.

[A] Yes, the **critical value would change**; in fact, it would be **larger** than what we found previously. The need for a new critical value is **due to the characteristics of the neighborhood** forcing the **selection** of a **new larger critical value**.

[B] Yes, the **critical value would change**; in fact, it would be **smaller** than what we found previously. The need for a new critical value is **due to the characteristics of the neighborhood** forcing the selection of a **new smaller critical value**.

[C] Yes, the **critical value would change**; in fact, it would be **larger** than what we found previously. The need for a **new critical value** is **due** to the **added uncertainty** of having to **estimate** the **standard deviation** from the data.

[D] Yes, the **critical value would change**; in fact, it would be **smaller** than what we found previously. The need for a **new critical value** is **due** to the **added uncertainty** of having to **estimate** the **standard deviation** from the data.

[E] No, the **critical value would not change**. The choice of the critical value is **not dependent** on the **knowledge** of the **population standard deviation**.

[F] No, the **critical value would not change**. The **only thing** that **would change** is the **standard deviation** as we now need to **estimate** it from the data.

[G] No, the **critical value would not change**. The **critical value** is solely **determined** by the **sample size** and **significance level**, not by whether the **standard deviation** is **known** or **estimated**.

[H] No, the **critical value would not change**. The **critical value** is a **constant** for a **given significance level** and **degrees of freedom**, not by whether the **standard deviation** is **known** or **estimated**.

___G___ ✖ **([C], C, c, [c])**

What **practical answer** would you give to the FAA about the noise level around this particular major airport? **Differences greater than 1.5(dBa) higher** than the **impact threshold DNL** of **65(dBa)** are **considered problematic** and **require significant investment** to reduce the noise level. Use the **confidence interval or bound** found previously to provide a **practicality assessment** for the FAA. You may continue to assume the **population standard deviation** is **known**, regardless of your conclusion in the previous part.

You must report your **conclusion, difference,** and **effect size**.

Write your answer as follows: conclusion (yes or no), difference, effect size. Round your number to 2 decimal places for simplicity.

For **example**, if you concluded **yes** there is **practical significance (investment is required to reduce the noise level)**, and found a difference of **3.2 dBa**, with an **effect size** of **0.81** you would write your answer as: --> **yes,3.2,0.81**

___no, 0.59, 0.15___ ✖ **(no,0.41,0.1, no, 0.41, 0.1, no, .41, .1, no,.41,.1)**

Hide question 12 feedback

Part i,f partial credit

Written Response Question

Question 13 — 10 / 21 points

Suppose the **wingspan** of **adult eagles** in a national park follow a **slightly positively skewed distribution** with an **average wingspan** of **7 feet** and a **standard deviation** of **3.5 feet**. A researcher randomly selects a **sample** of **49 adult eagles** from this population.

a. What is the **distribution** of the **mean wingspans** of a **random sample** of **49 adult eagles**? Clearly specify the **name** of the **distribution** and its **parameter(s)**.

a. Given that the **mean wingspan** of the **49 adult eagles** is known to be **at least 6.625 feet**, what is the probability that the **mean wingspan** is **more than 7.75 feet**?

Clearly set up the probability to be calculated and show the mathematical steps required to obtain the probability.

You may use the following R output in your calculations.

pnorm(-0.75, lower.tail = TRUE) 0.2266274	pnorm(-0.75, lower.tail = FALSE) 0.7733726
pnorm(-0.11, lower.tail = FALSE) 0.4562047	pnorm(-0.11, lower.tail = FALSE) 0.5437953
pnorm(0.21, lower.tail = TRUE) 0.5831662	pnorm(0.21, lower.tail = FALSE) 0.4168338
pnorm(1.5, lower.tail = TRUE) 0.9331928	pnorm(1.5, lower.tail = FALSE) 0.0668072

b. What is the **mean wingspan value** that separates the **top 5%** of the **mean wingspans** of a **sample** of **49 adult eagles**? Show your work.

You may use the following R output in your calculations.

qnorm(0.01/2, lower.tail = FALSE) 2.575829	qnorm(0.01, lower.tail = FALSE) 2.326348
qnorm(0.05/2, lower.tail = FALSE) 1.959964	qnorm(0.05, lower.tail = FALSE) 1.644854

a. The distribution is normal and takes parameters μ (mean) and σ (standard deviation)

b. We are asked to provide a probability of some event A (μ>7.75) given some other event B (μ>6.625). We can use Bayes' rule to compute this, which states that

$$(*) \qquad P(A \mid B) = \frac{P(B \mid A)P(A)}{P(B)}$$

First, note that

$$P(B \mid A) = 1,$$

since this is the probability that the mean wingspan is greater than 6.625 given it is greater than 7.75, which is trivially true. Thus, we can rewrite (*) as

$$P(A \mid B) = \frac{P(A)}{P(B)} = \frac{P(\mu > 7.75)}{P(\mu > 6.625)}.$$

Now, we can simply compute the individual probabilities. First, we find the z-scores for each outcome as follows:

$$z_A = \frac{x - \bar{x}}{s} = \frac{7.75 - 7}{3.5} \approx 0.2142$$

$$z_B = \frac{\mu_B - \mu}{\sigma} = \frac{6.625 - 7}{3.5} \approx -0.1071$$

With these, (*) becomes

$$P(A \mid B) = \frac{P(Z > 0.2142)}{P(Z > -0.1071)}$$

Using a z-table, we can compute these probabilities and find the solution.

The correct answer is not displayed for Written Response type questions.

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a) sigma/sqrt(n)

b) my is not a random variable. Need to use sigma/sqrt(n) not sigma. The probabilities can be obtained above. Use the pnorm code.

c)?

Done