Lesson 033 Further Aspects of Hypothesis Testing Friday, November 24

Practical Significance

- Hypothesis testing can tell us whether there is statistical evidence against a null hypothesis.
- It can not tell us whether or not we actually care.
- It is critical to differentiate practical significance from statistical significance.

Make sure to ask yourself: "Even if this were true, would we care?"

Practical Significance

- effect.
 - With small sample sizes, even large effects may have large p-values.
 - With large sample sizes, even small effects may have small p-values.
- We cannot test for practical significance.

The p-value is not a measure of the size of an

A hypothesis test considering the efficacy of a synthetic coating to the durability of a material is run, and the p-value is found to be very small ($p=10^{-6}$). Which of the following is true?

The synthetic coating improves the performance substantially.

The synthetic coating worsens the performance substantially.

The synthetic coating improves the performance, but only mildly.

The synthetic coating worsens the performance, but only mildly.

None of the above are guaranteed to be true.





Suppose a hypothesis test comparing the mean failure time of a particular component compared to a standard. Differences over 1000 hours have a large effect. The observed difference was $\hat{\Delta}=5000$ with p=0.33 for $H_0:\Delta=0.$

These results suggest a large, statistically significant e

These results suggest a small, statistically significant e

These results are statistically significant but not practi

There is likely no meaningful difference in mean failur

effect.	
	0 %
effect.	
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tically significant.	
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re time.	
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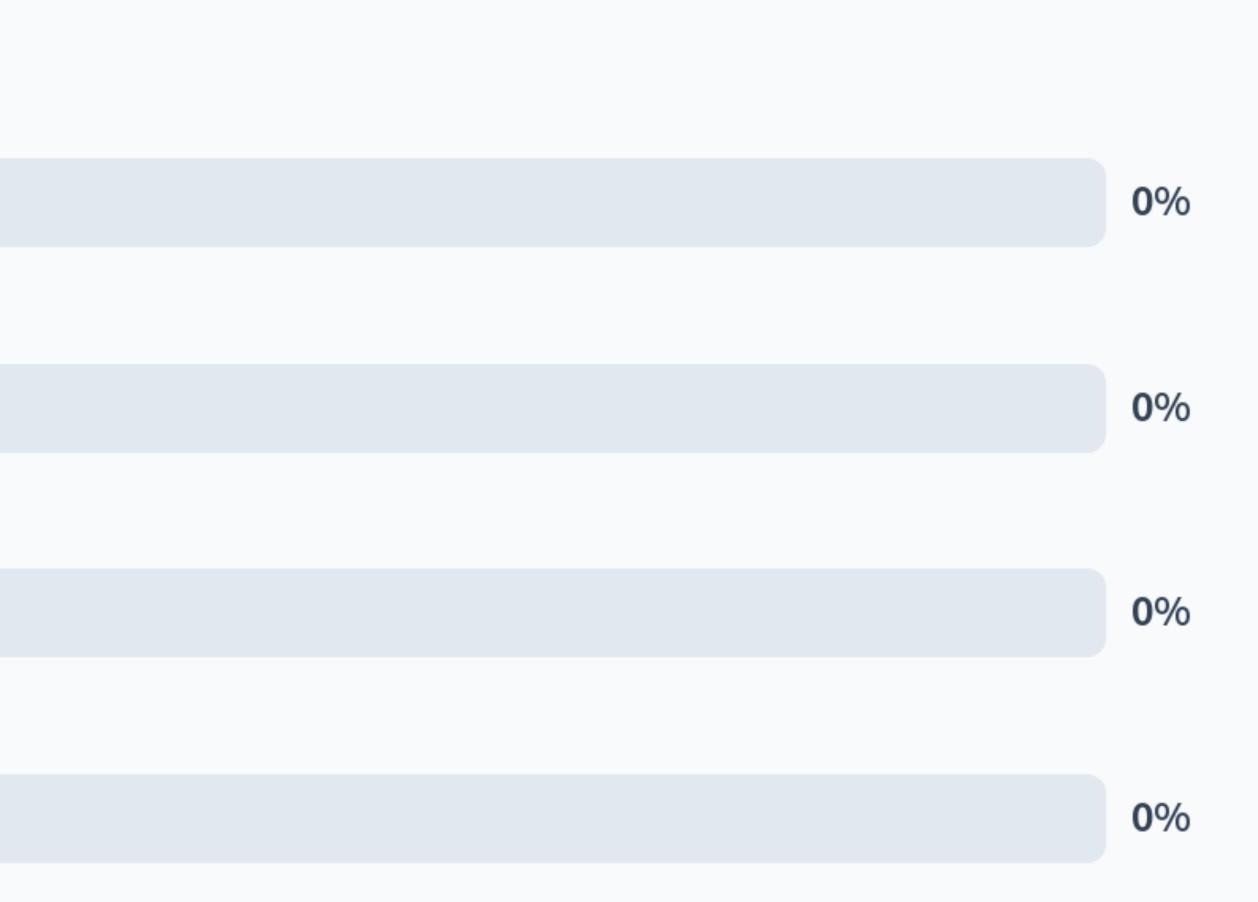
Which of the following would likely suggest the most meaningful effects, if observed from a hypothesis test?

Effect size of \$5\$ with a p-value of \$0.01\$.

Effect size of \$10\$ with a p-value of \$0.15\$.

Effect size of \$10\$ with a p-value of \$0.01\$.

Effect size of \$0.01\$ with a p-value of \$0.005\$.





Confidence Intervals and Hypothesis Tests Every confidence interval can be used to generate hypothesis tests based on an α level

- of significance.
- If $H_0: \theta = \theta_0$ then if the $(1 \alpha)100\%$ CI α level.
- Why?

contains the value θ_0 , we fail to reject H_0 at an

A 95% confidence interval for μ is formed as [-2,3]. Suppose that we wish to test $H_0:\mu=-1$. Which of the following conclusions hold?

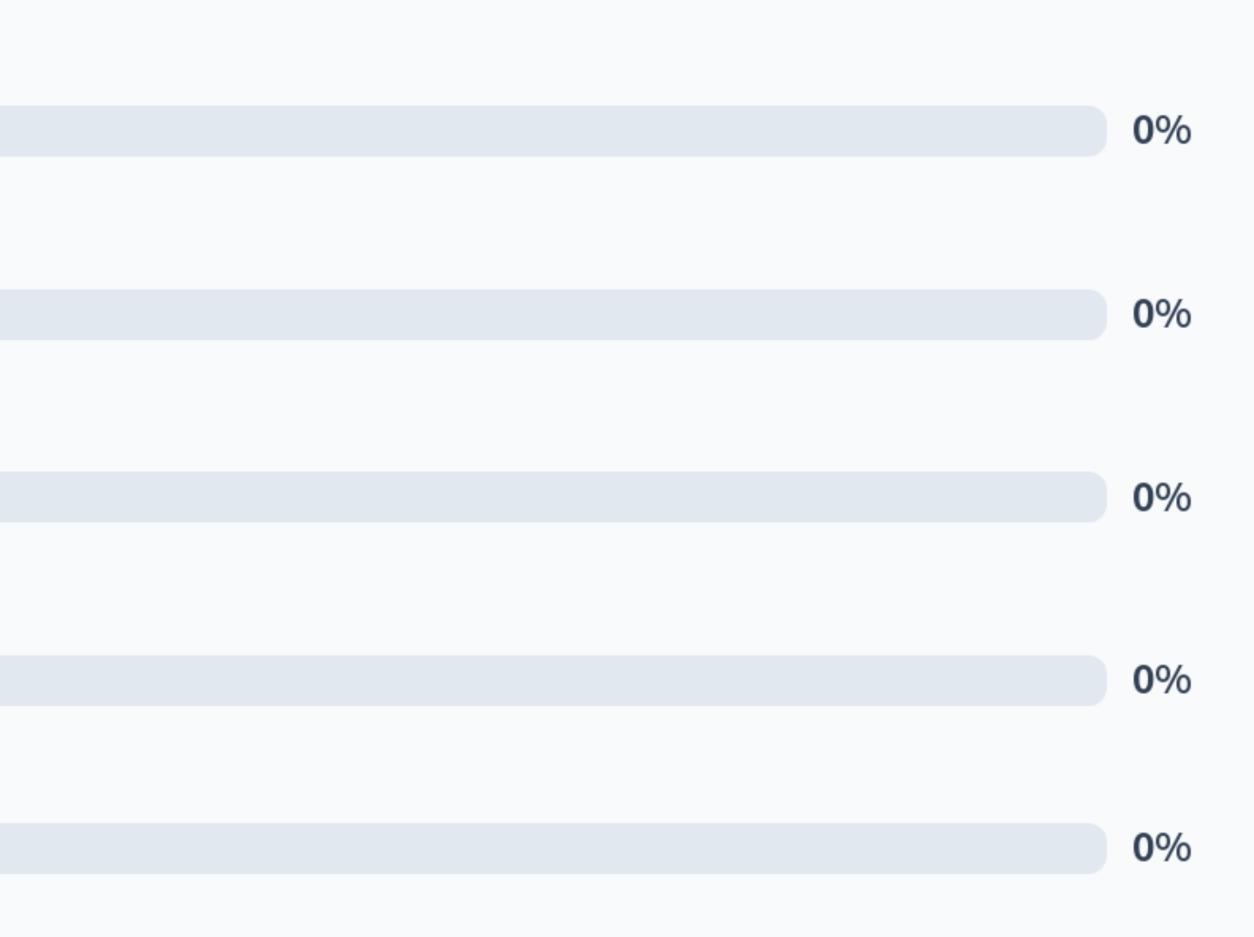
We reject H_0 at a 5% level of significance.

We fail to reject H_0 at a 5% level of significance.

We reject H_0 at a 1% level of significance.

We fail to reject H_0 at a 1% level of significance.

More than one of the above.





A 95% confidence interval for μ is formed as [-2,3]. Suppose that we wish to test $H_0:\mu=4$. Which of the following conclusions hold?

We reject H_0 at a 5% level of significance.

We fail to reject H_0 at a 5% level of significance.

We reject H_0 at a 10% level of significance.

We fail to reject H_0 at a 10% level of significance.

More than one of the above.





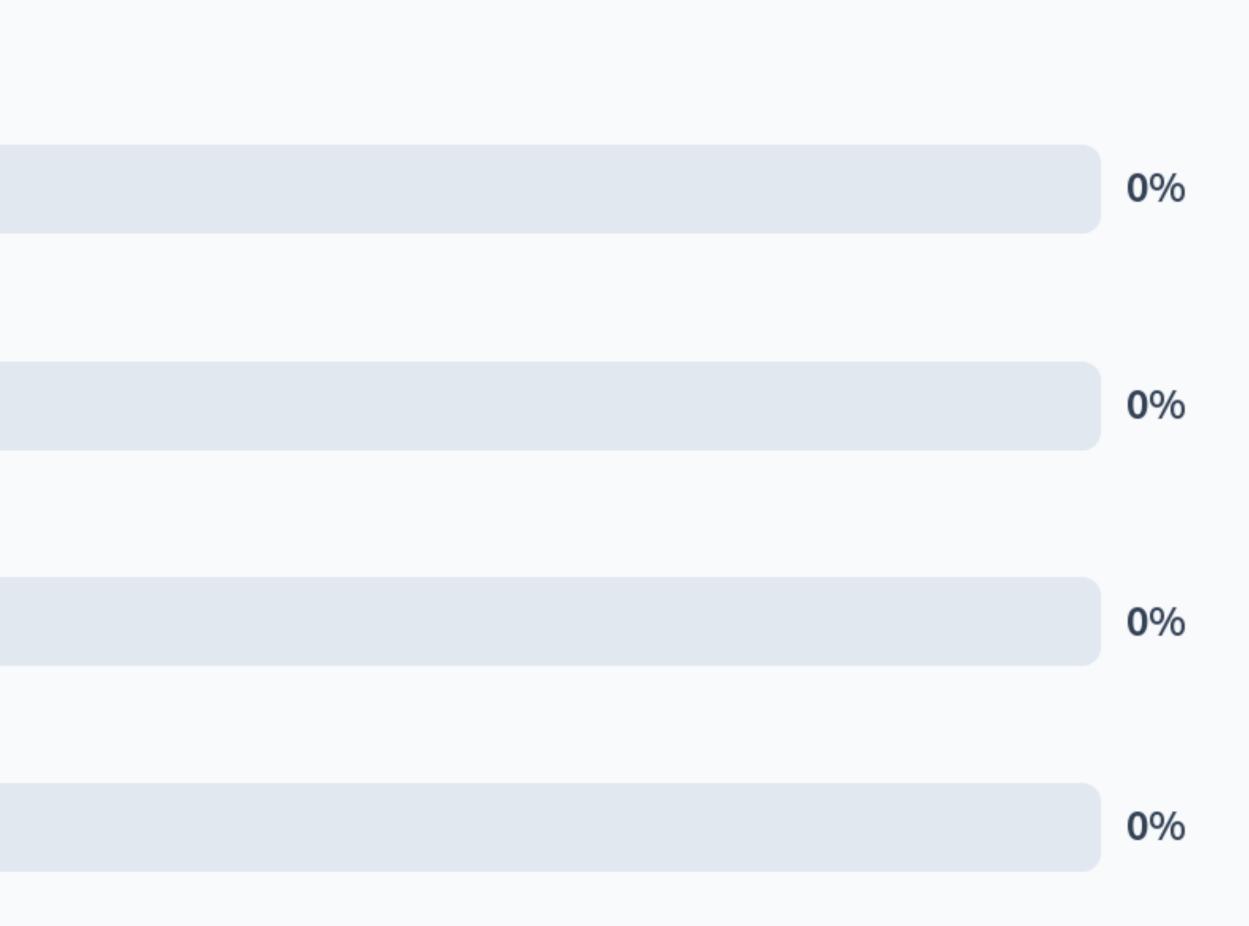
Suppose that the hypothesis test of $H_0: \mu = 0$ has a compute p-value of 0.03. Which of the following confidence intervals are plausible?

A 95% confidence interval of [-1,1].

A 90% confidence interval of [-1,1].

A 99% confidence interval of [-1,1].

More than one of the above.





Critiques of Hypothesis Testing Some statisticians deeply dislike hypothesis testing as a framework.

- - P-values are prioritized above all else.
 - The null hypothesis is often inadequate.
 - The framework itself is easily abused.
 - Even when it works, it can lead to concerns.

Suppose that the p-value for a (symmetric) test of $H_0: \mu = \mu_0$ versus $H_1: \mu \neq \mu_0$ is 0.04. What would the p-value be for the same procedure of $H_0: \mu \leq \mu_0$ versus $H_1: \mu > \mu_0$.





What would the p-value be for the same procedure of $H_0:\mu\leq \mu_0$ versus $H_1:\mu>\mu_0.$ Suppose $\widehat{\mu} > \mu_0$.



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Suppose that the p-value for a (symmetric) test of $H_0: \mu=\mu_0$ versus $H_1: \mu eq\mu_0$ is 0.04.



What would the p-value be for the same procedure of $H_0:\mu\leq \mu_0$ versus $H_1:\mu>\mu_0.$ Suppose $\widehat{\mu} < \mu_0$.



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Suppose that the p-value for a (symmetric) test of $H_0: \mu=\mu_0$ versus $H_1: \mu eq\mu_0$ is 0.04.



Suppose that $H_0:\mu\geq\mu_0$ is tested against $H_1:\mu<\mu_0$, where $\hat\mu<\mu_0$. The p-value is computed as 0.03. What would be the conclusion of testing $H_0:\mu=\mu_0$ at lpha=0.05?

We fail to reject H_0 .

We reject H_0 .

We cannot test this from the given information.

