STAT 1350, 4/21 Discussion Questions

1. How can you tell when a hypothesis test or a confidence interval is about a mean (ZTest/ZInterval) or a proportion (1PropZTest/1PropZInt)?

means are averages & need 3 #'s: mean, st. dev, and sample size
proportions need 2 #'s: % or # of people & sample size.

2. What do you have to look for in a problem to know that you are using ZInterval or 1PropZInt (finding a confidence interval), rather than ZTest or 1PropZTest (doing a hypothesis test)?

Confidence interval problems will ask for that directly. hypothesis tests generally ask a question about a sample or population

3. What are the basic rules for stating a hypothesis test?

null, H_0: uses equality ($=$, $\leq$ or $\geq$)
alternative H_a: uses inequality ($\neq$, $>$, or $<$)
value stated in both is the same

4. Which of the following hypothesis tests are set up correctly? If they are set up correctly, are they for a mean or a proportion? And which test in the calculator would you use for them? If they are not set up correctly, what is wrong with them?

a. $H_0{:}\mu = 100, H_a{:}\mu > 100$ good

b. $H_0{:}p = 20, H_a{:}p \leq 20$ not a proportion; equality on Ha

c. $H_0{:}p \neq 0.25, H_a{:}p = 0.25$ switched

d. $H_0{:}\mu = 25, H_a{:}\mu = 100$ equality on Ha; values don't match

e. $H_0{:}p = 0.6, H_a{:}p \neq 0.6$ good

f. $H_0{:}\mu = 120, H_a{:}\mu = 150$ values don't match, equality on Ha

g. $H_0{:}p = 31, H_a{:}p \neq 31$ not a proportion

h. $H_0{:}\mu = 0, H_a{:}\mu < 10$ values don't match

In March 2000, the *New York Times* conducted "a telephone poll of a random sample of 1003 adults in all 50 states, giving all phone numbers, listed and unlisted, a proportionate chance of being included." We can treat this as a simple random sample. One question asked was, "Do you think what is shown on television today is less moral than American society, more moral than American society, or accurately reflects morality in American society?" Of the answers, 46% said "Less," 37% said "Accurate," 9% said "More," and the others had no opinion.

5. We might use these data to answer the question, "Do more than half of all adults think TV is less moral than society?" Is this test about a proportion or a mean?

   proportion

   To set up the hypothesis test, we would take as our null hypothesis to be what?

   $H_0: p = .5$

   What is the alternative hypothesis?

   $H_a: p > .5$

6. The *P*-value for the test in the previous question is about 0.99. What does this mean in the context of the problem? (Your answer should not refer to the level of significance, only the assumption in the null hypothesis.)

   The is not sufficient evidence to reject the null hypothesis

7. The *P*-value of a test of significance is calculated assuming what is true?

   That the null hypothesis is true

8. A scientist is studying the relationship between the depth of a watermelon vines' roots and the weight of the watermelons produced. The scientist collects measurements from a random sample of vines. He then conducts a significance test in which the null hypothesis is that there is no correlation between the two variables (correlation = 0) versus the alternative that the correlation is greater than 0. From this test he found a *P*-value of 0.0032. What does this tell us?

   There is good reason to think the correlation is not zero

9. Why do we say "fail to reject the null hypothesis" instead of "accept the null hypothesis" when the P-value is too high?

"accept the null" is too strong. Saying we don't have good enough reason to reject it is not the same thing as saying the null is definitely true

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A large company that produces allergy medications claims that Americans lose an average of 40 hours of work to problems related to seasonal allergies. A consumer advocacy group believes that this claim is actually just "hype" intended to sell more medication. The advocacy group would like to obtain statistical evidence about this issue and takes a random sample of 100 American workers. They find that these 100 people lost an average of 38 hours with a standard deviation of 9.5 hours.

1. What are the null and alternative hypotheses in this situation? State them in correct notation.

   $H_0: \mu = 40$
   $H_a: \mu < 40$

2. What is the value of the standardized test statistic (the z-score) for this significance test?

   $z = -2.1$

3. What is the *P*-value for this significance test?

   $P = .0176$ (reject Ho)

4. If the *P*-value of a test of significance is 0.999 then do we reject or fail to reject the null hypothesis?

   fail to reject Ho

5. An engineer designs an improved light bulb. The previous design had an average lifetime of 1200 hours. The new bulb had a lifetime of 1200.2 hours, using a sample of 40,000 bulbs. Although the difference is quite small, the effect was statistically significant. The most likely explanation for this result is what?

   very large sample size

6. A television show runs a call-in survey each morning. One January morning the show asked its viewers whether they were optimistic or pessimistic about the economy in the coming year. The majority of those phoning in their responses answered "pessimistic" and the show reported the results as statistically significant. What may we safely conclude about the results?

   the show host does not understand statistics
   the bias of a voluntary response survey is not captured in the P-value

A popular brand of AAA batteries has an effective use time of 12.3 hours, on average. A startup company claims that their AAA batteries last longer. The startup company tested 24,000 of their new batteries and computed a mean effective use time of 12.32 hours. Although the difference is quite small (72 seconds—or just over a minute), the effect was statistically significant (*P*-value < 0.0001).

7. The most likely explanation for a 72-second difference being reported as statistically significant is what?

   large sample size

8. What would be an appropriate conclusion about these results?

   The results are not practically meaningful

9. If I increase the number of subjects in an experiment, what will happen to the confidence interval? What will happen to the P-value of a hypothesis test?

   Shorten ; get smaller

10. Coleman surveys a random sample of city residents and uses a 95% confidence interval to estimate the proportion of all city residents who plan to vote in an upcoming election. Emma isn't satisfied with 95% confidence. She wants to use a 99% confidence interval, but she doesn't want it to be any wider that Coleman's 95% confidence interval. In order to achieve this, Emma must do what differently when taking her sample?

    increase her sample size

11. Which is more informative: confidence intervals or significance tests? Why?

    Significance tests; gives more info w/ P-value, confidence intervals are easier to interpret, however

18. How small must a *P*-value be in order to consider it convincing evidence against the null hypothesis?

    generally less than .05
    though you can set other values in advance of a test

19. What is the difference between a P-value and $\hat{p}$ (a proportion) in a hypothesis test?

    P-value is essentially the probability the null hypothesis is true (that the sample came from same distribution);
    $\hat{p}$ is the proportion of people in a category (being tested) from the sample.