Stat 2470, 3/12 Discussion Questions Name ____________________

Instructions: Attempt to answer these questions by reading the textbook or with online resources before coming to class on the date above.

1. What is the formula for the test statistic for a test on mean when σ is known?

$$Z = \frac{\bar{X} - \mu_0}{S/\sqrt{n}}$$

2. What is the difference between a one-tailed and a two-tailed test?

critical region determined by z_α and not $z_{\alpha/2}$
also, unlike a two-tailed test, the sign of the test statistic matters

3. How can we conduct the z-test in our calculator?

STAT → TESTS – ZTEST (in TI-84)

4. Describe the sequence of steps to be used when testing a hypothesis around a parameter?

① state the null and alternative hypotheses.
② choose a significance level.
③ calculate the test-statistic & convert to a p-value
④ reject or fail to reject H_0

5. What is the formula for calculating β? How does it differ for one-tailed and two-tailed tests?

one tailed : $\Phi\left(z_\alpha + \frac{\mu_0 - \mu'}{\sigma/\sqrt{n}}\right)$ or $1 - \Phi\left(-z_\alpha + \frac{\mu_0 - \mu'}{\sigma/\sqrt{n}}\right)$
$>$ $<$

two-tailed : $\Phi\left(z_{\alpha/2} + \frac{\mu_0 - \mu'}{\sigma/\sqrt{n}}\right) - \Phi\left(-z_{\alpha/2} + \frac{\mu_0 - \mu'}{\sigma/\sqrt{n}}\right)$

6. What is the formula for calculating a sample size necessary for a specified value of α and a specified value of β?

$$n = \left[\frac{\sigma(z_\alpha + z_\beta)}{\mu_0 - \mu'}\right]^2 \quad \text{or} \quad n = \left[\frac{\sigma(z_{\alpha/2} + z_\beta)}{\mu_0 - \mu'}\right]^2$$

one-tailed two-tailed

7. How do large sample tests with s differ from tests with σ is known?

very little. replace s in formulas for σ

8. Why should we generally use a T-test over a Z-test when σ is not known?

Since s is an estimate, the t-test is a little more conservative in rejecting Ho

9. What is the main difficulty when calculating sample sizes using t-tests rather than z-tests?

Since t depends on the sample size

10. What are the steps for doing hypothesis tests on proportions and the relevant formulas?

(1) Set up Ho & Ha (2) Set significance level.
(3) Calculate test statistic $Z = \frac{\hat{p} - p_0}{\sqrt{p_0(1-p_0)/n}}$
(4) convert to p-value & reject or fail to reject Ho

11. Why do we need $np_0 \geq 10$ and $n(1-p_0) \geq 10$?

Since we need the sampling distribution to be sufficiently normal, and so away from extremely non-normal binomial distributions

12. How is β calculated for tests of proportions?

one: $\Phi\left(\frac{p_0 - p' + z_\alpha\sqrt{p_0(1-p_0)/n}}{\sqrt{p'(1-p')/n}}\right)$ or $1 - \Phi\left(\frac{p_0 - p' - z_\alpha\sqrt{p_0(1-p_0)/n}}{\sqrt{p'(1-p')/n}}\right)$

two: $\Phi\left[\frac{p_0 - p' + z_{\alpha/2}\sqrt{p_0(1-p_0)/n}}{\sqrt{p'(1-p')/n}}\right] - \Phi\left[\frac{p_0 - p' - z_{\alpha/2}\sqrt{p_0(1-p_0)/n}}{\sqrt{p'(1-p')/n}}\right]$

13. What are the formulas for the sample size for a specific β and α?

$$n = \left[\frac{z_\alpha\sqrt{p_0(1-p_0)} + z_\beta\sqrt{p'(1-p')}}{p' - p_0}\right]^2$$ one tailed

or

$$n = \left[\frac{z_{\alpha/2}\sqrt{p_0(1-p_0)} + z_\beta\sqrt{p'(1-p')}}{p' - p_0}\right]^2$$ two-tailed

14. When sample sizes are small, what distribution must we resort to in order to calculate β and hypothesis tests in general?

binomial

15. How do we conduct hypothesis tests on proportions in our calculator?

STAT → TESTS → 1PROPZTEST (in TI-84)

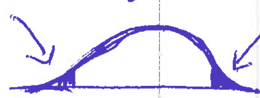
X = whole # p_0 = decimal

16. What is the P-value of a hypothesis test?

it is the probability of obtaining the sample data (or more extreme data) under the assumption of the null hypothesis.

17. When we need to calculate P-values by hand, why do we need to multiply two-tailed tests by 2?

because there is area in the critical region on both ends



18. How do we calculate P-values for Z and T-tests from the test statistic in our calculator?

Z: upper tailed normalcdf(Z, E99); lower tailed normalcdf(−E99, Z)

two tailed 2 × normalcdf(|Z|, E99)

T: Same set up but w/ tcdf(Z, E99, df) (ex. is upper tailed)

19. Why do we set the significance level before we find the P-value and not afterwards?

We may be biased afterwards to choose a value that will make the p-value we found significant. We should set the standard ~~for~~ other reasons prior to the test to avoid increasing our error rate

20. How do we know which test to use? Z-Test? T-Test? Proportion Test?

if a mean: use Z or T; check for σ known and sample size. also consider normality

If a proportion then use that.

21. How do we choose significance levels?

the risk of a Type I error ; if the risk is high of you are wrong choice α to be small. if the risk is low, use the default $\alpha = .05$ or even higher $\alpha = .1$.

22. How do we know which claim should be H_0 and which should be H_a?

Ha is the thing we are trying to gather evidence for.
Ho is the old assumption, the safer fall-back position, or the ~~thing~~ thing we are comparing our data to.

23. What is the difference between statistical significance and practical significance?

Statistical significance just be the result is unlikely to be due to random chance.

Practical significance implies a large (in magnitude) and meaningful difference of outcomes.

1% point on a grade could be statistically significant but it will not change someone's letter grade most of the time; whereas a 10% could be both statistically significant and practically significant since the represents a whole letter grade difference.