1. **Don’t even open this until you are told to do so.**

2. Remember to turn your phone off now.

3. Please turn your hats around backwards or take them off.

4. Please put your backpack and other things along the walls or at the front of the room.

5. You need a gray, 81/2 × 11” scantron, pencil, calculator and you may have 5 sheets of notes.

6. There are 20 multiple-choice questions on this exam, each worth 5 points. There is partial credit. Please mark your answers **clearly**. Multiple marks will be counted wrong.

7. You will have 60 minutes to finish this exam.

8. If you have questions, please write out what you are thinking on the back of the page so that we can discuss it after I return it to you.

9. If you are caught cheating or helping someone to cheat on this exam, you both will receive a grade of **zero** on the exam. You must work alone.

10. When you are finished please make sure you have filled in your name and marked your FORM (A, B, C or D) and 20 answers, then turn in JUST your scantron.

11. Good luck!
1. To make inferences in statistics we need
   A. the sampling distribution of the test statistic.
   B. the distribution of the data.
   C. probability.
   D. random chance.
   E. More than one is correct.

2. What would be the ±z_{α/2}'s for a 76.6% confidence interval, i.e., \( P(-z^* < Z < z^*) = 0.32 \) where \( Z \sim N(0, 1^2) \)?
   A. ±0.5478
   B. ±0.725
   C. ±0.7794
   D. ±1.19
   E. ±2.27

3. Suppose we tested \( H_0 : p = 0.5 \) vs. \( H_A : p \neq 0.5 \) and got a \( p \)-value = 0.862. Which of the following are correct?
   A. Since 0.862 is not equal to 0.5, we will reject the null and claim that the true proportion is not 50%.
   B. The \( p \)-value for testing \( H_A : p > 0.5 \) using the same data is 0.431.
   C. Something went wrong since \( p \)-values should never be more than 0.5.
   D. All of the above are true.
   E. None of the above are true.

   90% CI: (0.00396, 0.37604)
   95% CI: (-0.03166, 0.411665)
   99% CI: (-0.10178, 0.481783)

4. What is the correct range of the \( p \)-value for testing \( H_0 : p_1 = p_2 \) vs. \( H_A : p_1 \neq p_2 \) given the three confidence intervals for \( p \) above?
   A. \( p \)-value> 0.10
   B. 0.10 > \( p \)-value> 0.05
   C. 0.05 > \( p \)-value> 0.01
   D. \( p \)-value< 0.01
   E. We can’t use confidence intervals here because we don’t have a hypothesized value to compare.

5. Rejecting at the 5% level of significance means
   A. you will make a Type I error 5% of the time.
   B. you will fail to reject 95% of the time.
   C. you would also reject at the 1% level.
   D. Two of the above are true.
   E. None of the above are true.

6. Humans can tolerate some radiation poisoning but too much is toxic. Before entering places like Chernobyl, you’d want to make sure the level of radiation was not toxic. Which set of hypotheses should you use?
   A. \( H_0: \) level is ok vs. \( H_A: \) level is toxic
   B. \( H_0: \) level is toxic vs. \( H_A: \) level is ok
   C. \( H_0: \) level will cause cancer vs. \( H_A: \) level will not cause cancer
   D. \( H_0: \) radiation poisoning is harmful vs. \( H_A: \) radiation poisoning is not harmful
   E. \( H_0: \) travel is restricted due to toxicity vs. \( H_A: \) travel is not restricted

7. You really want to visit Chernobyl, so you’re going unless you’re not allowed because it’s not safe. \( H_0: \) it’s safe to go to Chernobyl vs. \( H_A: \) it’s not safe to go to Chernobyl. Which of the following is true?
   A. A Type I error would be staying home when you could have safely gone to Chernobyl, so you should use \( \alpha = 0.10 \).
   B. A Type I error would be going to Chernobyl when you shouldn’t have, so you should use \( \alpha = 0.01 \).
   C. A Type II error would be going to Chernobyl when you shouldn’t have, so you should use \( \alpha = 0.01 \).
   D. A Type II error would be staying home when you could have safely gone to Chernobyl, so you should use \( \alpha = 0.10 \).
   E. You’re afraid to fly, so going would be an error.

8. The true proportion of people in favor of Amendment A is 82%. How big of a sample do you need for the distribution of the sample proportion to be approximately normal?
   A. We need a desired margin of error, \( m \).
   B. 18
   C. 19
   D. 84
   E. more than 30

9. Which of the following is true about the sampling distribution of the sample proportion, \( \hat{p} \)?
   A. If the true proportion is 50%, we need a sample of at least 15 to use the normal approximation.
   B. If the true proportion is 90%, the distribution would be skewed to the left so we could never use the normal approximation.
   C. If the true proportion is 25%, the distribution would be skewed to the left unless we had a sample of at least 60.
   D. We can never use the normal approximation if our sample size is less than 30.
   E. More than one of the above is correct.
10. Suppose we tested $H_0 : p = 0.5$ vs. $H_A : p > 0.5$ and got a $p$-value $= 0.43$. Which of the following is the best interpretation of this value?

A. If the null is true, we would get a $p$-value of 0.43 50% of the time.
B. If the null is true, we would reject 43% of the time.
C. In repeated sampling from this same population, we would reject 57% of the time.
D. If the true proportion is 50%, we would get a sample proportion at least as big as the one here, 43% of the time.
E. If the true proportion is 43%, we would get a sample proportion at least as big as the one here, 50% of the time.

11. Say our sample proportion in the previous problem was 81% (it wasn’t, but don’t worry about it). If we sampled from the same population and got a $\hat{p} = 0.72$ instead, what would be true?

A. Don’t know, we would need to rerun the test.
B. The $p$-value would be larger because the null would be more believable.
C. The $p$-value would be larger because the null would be less believable.
D. The $p$-value would be smaller because the null would be more believable.
E. The $p$-value would be smaller because the null would be less believable.

12. To determine whether a test of hypotheses has practical significance, we need

A. to compare the hypothesized proportion to our sample proportion.
B. create a confidence interval.
C. Either A or B would help.
D. As long as we rejected, we can say the test is significant.
E. We can never determine practical significance, only statistical significance.

13. A 95% confidence interval for the true proportion, $p$, is $(0.23, 0.53)$. Which of the following are correct statements based on this interval?

A. We could conclude that the true mean is 50% at the 5 and 1% significance levels.
B. We could not determine whether the true mean is 50% or not at the 10% level.
C. We would conclude that the true mean is not 60% at the 5 and 1% significance levels.
D. All of the above are correct statements.
E. Only two of the above are correct statements.

14. What is the best interpretation of the previous confidence interval, $(0.23, 0.53)$?

A. We are 95% confident that the true proportion is 38%.
B. 95% of the time, the true proportion will fall between 23 and 53%.
C. In repeated sampling from this same population and calculating 95% confidence intervals, about 95% of these intervals will contain 38%.
D. In repeated sampling from this same population and calculating 95% confidence intervals, about 95% of these intervals will contain the true proportion.
E. More than one of the above are correct.

15. Comparing the hypothesized proportion, $p_0$, to the sample proportion, $\hat{p}$ is like comparing

A. 0 to the test statistic value.
B. $p$-value to $\alpha$
C. $H_0$ to $H_A$
D. All of the above
E. Only two of the above.

16. If the sample proportion based on a sample of 50 is normal with a mean of 70%, i.e., $\hat{p}_{50} \sim N(0.7, 0.0648^2)$, what proportion is the upper 25th percentile?

A. $0.7 + 0.25 \times 0.7 = 0.875$
B. $0.75 \times 0.7 = 0.525$
C. $0.7 + 0.675 \times 0.7 = 1.1725$
D. $0.7 + 0.675 \times 0.0648 = 0.744$
E. $0.7 + 0.75 \times 0.0648 = 0.749$
17. Why is it better to report a $p$-value than just reject ($p$-value < $\alpha$) or fail to reject ($p$-value > $\alpha$)?

A. The actual $p$-value is more informative because the strength of the evidence varies from sample to sample.
B. The actual $p$-value is more informative because the probability of making a Type I or Type II error depends on $\alpha$.
C. The actual $p$-value is more informative because proportion of tests that would be rejected depends on the significance level.
D. The actual $p$-value is more informative because it will vary depending on whether the null is true or not.
E. It isn’t any better. We can still make a decision.

18. Are Aggies more likely to wear maroon on Friday’s (or not)? What should we test?

A. $H_0 : p_{maroon} = p_{not}$ vs. $H_A : p_{maroon} \neq p_{not}$
B. $H_0 : p_{maroon} = p_{not}$ vs. $H_A : p_{maroon} > p_{not}$
C. $H_0 : p_{maroon} = 0.5$ vs. $H_A : p_{maroon} > 0.5$
D. $H_0 : p_{maroon} = 0.5$ vs. $H_A : p_{maroon} \neq 0.5$
E. We need to be given a value to test.

19. The proportion of students who reported drinking to get drunk was 35.7% in 1994. In 2001, this proportion was down to 32%. Suppose a 95% confidence interval for the difference in true proportions, $p_{2001} - p_{1994}$ did not include 0. Would you then be able to say that the campaign against drinking, which began in 2000, caused students to drink less (be more cautious)?

A. Yes, we would reject the hypothesis that the proportion stayed the same.
B. Yes, the campaign worked.
C. No, 0 in the interval doesn’t tell us anything.
D. No, the data is biased because students were afraid to say yes.
E. No, this is an observational study, not an experiment.

20. As the value of the $Z$-test statistic gets farther from 0 (larger in absolute value)

A. the null hypothesis becomes more false.
B. the $p$-value gets smaller.
C. the difference in the sample proportion and the hypothesized proportion gets more significant.
D. All of the above are correct.
E. Only two of the above are correct.