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

2. 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.

3. You will have 50 minutes to finish this exam.

4. 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.

5. 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.

6. When you are finished please make sure you have marked your CORRECT section (Tuesday 11:10 is 507, 12:45 is 508, 2:20 is 509, and 3:55 is 510) and FORM (A, B, C or D) and 20 answers, then turn in JUST your scantron.

7. Good luck!
1. Suppose that a very skillful weight specialist physician claims that under his regimen 92% of his patients lost 5% of their excess of weight in 3 months. We want to test his claim about the proportion of patients that lost 5% of their extra pounds using a 10% significance level. Which null and alternative hypotheses are appropriate?

A. \( H_0 : p = 0.05 \) \( H_A : p \neq 0.05 \)
B. \( H_0 : p = 0.92 \) \( H_A : p \neq 0.05 \)
C. \( H_0 : p = 0.1 \) \( H_A : p \neq 0.1 \)
D. \( H_0 : p = 0.92 \) \( H_A : p \neq 0.92 \)
E. None of the above are the correct set of hypotheses.

2. What is a sampling distribution of a sample proportion?

A. The values of all possible sample proportions that could be calculated from different samples of the same size, along with their probabilities.
B. The values of all possible samples that could be calculated from different samples of the same size, along with the proportions of times each sample occurs.
C. The values of all possible populations of the same size that sample proportions could be taken from, along with the probabilities of each sample proportion.
D. All possible values of a random variable, along with the proportion of times each of those values occurs.
E. All possible values of a single sample, along with the proportion of times each of those values occurs.

3. When testing whether \( H_0 : p = 0.5 \) or not, our sample proportion, \( \hat{p} = 0.4 \), so our test statistic is be 1.41. What is the \( p \)-value for this test?

A. 0.9207
B. 0.0793
C. 0.1586
D. 0.8414
E. 0.7621

4. Which of the following is FALSE?

A. A \( p \)-value is how often we would get data as contradictory as we got even though \( H_0 \) is true.
B. A \( p \)-value is a measure of the strength of the evidence against the null hypothesis.
C. A \( p \)-value is the probability that the null hypothesis is rejected even though \( H_0 \) is true.
D. A \( p \)-value can be used to perform a test of hypotheses at any significance level.
E. None of the above are false; all of the above are true.

5. What is \( P(-1.36 < Z < 3.42) \) if \( Z \sim N(0, 1^2) \)?

A. 0.0866
B. 0.9325
C. 0.9131
D. 0.9803
E. 0.9128

6. In a General Social survey, a random sample of all Americans, participants were asked whether they had little or much confidence in Congress. 1900 participants responded that they had little confidence in Congress, while 601 said they had much confidence in Congress. Among those who had little confidence in Congress, there were 1020 women, and 281 of those with much confidence were women. Suppose that the confidence interval calculated from this data did NOT contain 0. What conclusion could you make?

A. We cannot be sure that the proportion of all those who had little faith in Congress that were women is different from the proportion of all those who had much faith in Congress that were women.
B. We cannot be sure that the proportion of women in our sample who had little faith in Congress is different from the proportion of women in our sample who had much faith in Congress.
C. We are 95% sure that the proportion of women in our sample who had little faith in Congress is different from the proportion of women in the sample who had much faith in Congress.
D. We are 95% sure that the proportion of all women who had little faith in Congress is different from the proportion of women who had much faith in Congress.
E. We are 95% sure that the proportion of all those who had little faith in Congress that were women is different from the proportion of all those who had much faith in Congress that were women.

7. If a distribution is bell-shaped with a mean of 25 and standard deviation of 6, how much of the curve is between 13 and 43?

A. 99.7%
B. 2.35%
C. 97.35%
D. 97%
E. 11.85%
8. Using the three confidence intervals below, what is the correct range of the p-value when testing \( H_0 : p_1 = p_2 \) vs. \( H_A : p_1 \neq p_2 \)?

<table>
<thead>
<tr>
<th>Confidence Level</th>
<th>Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>92%</td>
<td>(0.1412, 0.3588)</td>
</tr>
<tr>
<td>95%</td>
<td>(0.1204, 0.3796)</td>
</tr>
<tr>
<td>99%</td>
<td>(0.0796, 0.4204)</td>
</tr>
</tbody>
</table>

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. There’s not a hypothesized value to determine the p-value.

9. A manufacturer receives parts from two suppliers. A SRS of 400 parts from supplier 1 finds 20 defective, and a SRS of 100 parts from supplier 2 finds only 10 defective. Rather than running a hypothesis test, we calculated a 90, 95 and 99% confidence for the difference in the true proportion of defectives for the two suppliers, \( p_1 - p_2 \):

\(-0.103, 0.003\), \(-0.113, 0.013\), \(-0.133, 0.033\). What conclusion could we make?

A. Since 0 is in all three confidence intervals, it is plausible that the true proportion of defectives is the same for the two suppliers.
B. Since 0 is in all three confidence intervals, it is plausible that the true proportion of defectives is different for the two suppliers.
C. Since 0.05 isn’t in any of the confidence intervals, we would conclude that the true proportion of defectives is different for the two suppliers.
D. Since 0.01 is in the 95 and 99% confidence interval, it is plausible at the 1% level that the true proportion of defectives is the same for the two suppliers.
E. Since we don’t have a p-value, we can’t come up with a conclusion.

10. In the previous problem, the sample proportions were \( 20/400 = 0.05 \) and \( 10/100 = 0.10 \) for supplier 1 and 2 respectively. If supplier 2 had 20 defectives instead of only 10, what would have been the difference?

A. It would have been less likely that the two true proportion of defectives were the same.
B. It would have been more likely that the two true proportion of defectives were the same.
C. It would not have made any difference since we’re testing the true proportions and not the sample proportions.
D. We would have to run another test, or calculate new intervals to tell.
E. None of the above are correct.

11. Let \( X \sim N(4, 2^2) \). What is \( P(2 < X < 5) \)?

A. 0.0228
B. 0.5
C. 0.5328
D. 0.6915
E. 0.8502

12. Americans were asked, “Is your financial situation better or worse than it was four years ago?” In a test of \( H_0 : p = 0.5 \) vs. \( H_A : p \neq 0.5 \), where \( p \) = proportion of Americans who say their financial situation is better, the p-value was found to be 0.3698. What conclusion can be made from this study?

A. We have evidence that a majority of Americans believe their financial situation is better.
B. We don’t have evidence that a majority of Americans believe their financial situation has changed (for the better or worse).
C. We have evidence that a majority of Americans believe their financial situation has changed (for the better or worse).
D. We have evidence that the proportion of Americans that believe their financial situation is better is 0.5.
E. We don’t have evidence that the proportion of Americans that believe their financial situation is better is 0.5.

13. In a recent random sample of 1,000 Americans, 40% reported that they have confidence that elections are conducted honestly, for a 95% confidence interval of (0.37, 0.43). How should we interpret this confidence interval?

A. We are 95% confident that between 37% and 43% of the 1,000 study participants are confident that elections are conducted honestly.
B. We are 95% confident that between 37% and 43% of all Americans are confident that elections are conducted honestly.
C. 95% of Americans are between 37% and 43% confident that elections are conducted honestly.
D. In repeated sampling, 95% of all confidence intervals conducted in this manner would contain the value 0.4.
E. In repeated sampling, 95% of all confidence intervals conducted in this manner would contain the proportion of the 1,000 study participants that are confident that elections are conducted honestly.

14. What value of \( ±z* \) contains the middle 62% of the distribution?

A. ±0.5753
B. ±0.7324
C. ±0.88
D. ±0.31
E. ±0.5
15. Suppose you are testing $H_0 : p = 0.25$ vs. $H_A : p > 0.25$. The resulting $p$-value is 0.306. What is your conclusion?

A. Since the $p$-value, 0.306, is NOT less than 0.25, we fail to reject at the 25% level and conclude that there is insufficient evidence to say that the true proportion, $p > 0.25$.
B. Since the $p$-value, 0.306, is NOT less than even 0.10, we fail to reject at the 10% level and conclude that there is insufficient evidence to say that the true proportion, $p > 0.25$.
C. Since the $p$-value, 0.25, is NOT less than even 0.10, we cannot conclude anything.
D. Since the $p$-value, 0.306, is greater than 0.25, we reject and conclude that there is sufficient evidence to say that the true proportion, $p > 0.25$.
E. Since the significance level, $\alpha$, is not given, we cannot conclude anything.

16. Turning on your lights when driving in the rain is good defensive driving (people can see you better!). The table below is from our class survey. Are males better (more defensive) drivers than females based on this data?

<table>
<thead>
<tr>
<th></th>
<th>No</th>
<th>Yes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>female</td>
<td>62</td>
<td>41</td>
<td>103</td>
</tr>
<tr>
<td>male</td>
<td>38</td>
<td>27</td>
<td>65</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>68</td>
<td>168</td>
</tr>
</tbody>
</table>

Chi-Square test:

<table>
<thead>
<tr>
<th>Statistic</th>
<th>DF</th>
<th>Value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-square</td>
<td>0.049</td>
<td>0.8237</td>
<td></td>
</tr>
</tbody>
</table>

A. Of course, females are most likely texting in the rain.
B. Yes, 27/65 > 41/103, so the percentage of males who turn on their lights is greater than the percentage of females.
C. The chi$^2$-test says gender and lights are independent, so we can’t prove males are better.
D. We should have used a z-test since the chi$^2$-test is equivalent to the $\neq$ alternative and we want to prove greater than which would make the $p$-value 0.4 which is less than 0.5 so we could have rejected and said yes.
E. The chi$^2$-test is inconclusive; we can’t prove there is a relationship.

17. If $\hat{p}$ ~ $N(0.3, 0.046^2)$, what value of $\hat{p}$ has 75% of the distribution above it?

A. 0.6750
B. 0.2690
C. 0.7734
D. 0.2644
E. 0.2725

19. Suppose we tested $H_0 : p \leq 0.2$ vs. $H_A : p > 0.2$ and got a $p$-value = 0.003. Which of the following would be the best conclusion?

A. Reject $H_0$ since 0.3% is greater than 0.2.
B. Reject $H_0$ at the 0.3% level and conclude that the true proportion is greater than 0.2.
C. Reject $H_0$ at the 5% level and conclude that the true proportion is not 0.2.
D. Reject $H_0$ at the 5% level and conclude that the true proportion is greater than 0.2.
E. Reject $H_0$ at the 5% level and conclude that the true proportion is greater than 0.3%.

20. Suppose we generated 50 80% confidence intervals from the same distribution, as we did in lab, which of the following is true?

A. It’s impossible that all 50 will contain the true proportion, $p$, of the population since 80% is so far (different) from 100%.
B. It’s possible that exactly 80% of these intervals contain the true proportion, $p$, of the population.
C. If we looked at all 2500 (50 intervals created by 50 students in lab), then exactly 80% would contain the true proportion, $p$, of the population since 2500 is close to all possible samples.
D. All of the above are true.
E. None of the above are true.