Honor pledge: "On my honor, I have neither given nor received unauthorized aid on this examination."

Questions 1-5  The Gainesville Sun reported earlier this month that School Superintendent Owen Roberts said that nurses can't distribute condoms on local public school campuses anymore, citing an aversion to undermining parental responsibility. Although there was never a formal policy about this, nurses at some high schools had given condoms to students who came to their office and asked. The condoms were placed in brown paper bags with instructions for use and information about preventing sexually transmitted diseases and pregnancy. Match each of the five situations below with the parameter of interest from the list. (They should be used only once).

a) one proportion
b) one mean
c) difference of two independent proportions
d) difference of two independent means
e) difference of two dependent means

1. Seventy percent of teenagers have sex before their 19th birthday, according to the Guttmacher Institute, which studies sexual and reproductive health.

2. Opponents of school condom distribution argue that such programs lead students to believe that schools condone their engaging in sexual activity, and thus encourage students to have sex. However, many studies have shown no difference in the average age at which students become sexually active for school districts that distribute condoms and those who don't.

3. The district's School Health Services Handbook states that health education in public schools should teach abstinence, per Florida statutes, but also that: "It is important that students feel comfortable approaching their school nurse for human sexuality education, STD treatment or prevention, teen pregnancy and the prevention of such." The average high school student in the US receives about 6.3 hours of sex education at school.

4. Despite some people's impressions, today's teenagers are not universally having sex at a very young age. In fact, only about 13% of teens have had sex before they turned 15 years old. This is down from about 20% in 1995.

5. Although the risks of teen pregnancy and STDs are real, teenage sex is not associated with delinquency. A large scale study from the University of Virginia examined 534 adolescent same-sex twin pairs over seven years. By examining twins, the researchers were able to control for race and socio-economic factors. The study found that those individuals who engaged in sex at a younger age tended to have, on average, lower levels of delinquency and better social relationships in early adulthood than their peers.

6. Which of the following procedures has a formula that is the most similar to a confidence interval for one mean?
   a) a confidence interval for the mean of matched pairs differences
   b) a significance test for one mean
c) a confidence interval for the difference of two independent means
d) a significance test for one proportion
e) a confidence interval for one proportion

7. When testing $H_0: p_1 - p_2 = 0$ vs $H_a: p_1 - p_2 \neq 0$ a p-value of 0.0003 means that we have:
   a) very little evidence of a difference
   b) a lot of evidence for a difference
c) evidence of a small difference
   d) evidence of a large difference
e) evidence that the difference is 0.0003
Questions 8 – 15 Consumers are selected for a study designed to determine how their impressions of a particular product (favorable or unfavorable) changed after viewing an advertisement. We will conduct McNemar’s Test to determine if the attitudes have changed significantly.

<table>
<thead>
<tr>
<th>Before</th>
<th>Favorable</th>
<th>Favorable</th>
<th>Unfavorable</th>
<th>Unfavorable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Favorable</td>
<td>43</td>
<td>56</td>
<td>99</td>
<td></td>
</tr>
<tr>
<td>Unfavorable</td>
<td>20</td>
<td>91</td>
<td>147</td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>111</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. Percent in the sample who had a favorable impression of the product before watching the ad. a) unknown b) 36% c) 70% d) 47% e) 30%

9. Percent in the population who had a favorable impression of the product before watching the ad. a) unknown b) 36% c) 70% d) 47% e) 30%

10. Percent in the sample who had a favorable impression of the product after watching the ad. a) unknown b) 36% c) 70% d) 47% e) 30%

11. Percent in the population who had a favorable impression of the product after watching the ad. a) unknown b) 36% c) 70% d) 47% e) 30%

12. Percent who changed their mind about the product after watching the ad. a) unknown b) 36% c) 70% d) 47% e) 30%

13. The alternative hypothesis for this test is written as $H_a: p_1 - p_2 \neq 0$. This is a test:
   a) that is two-sided
   b) to determine if there is a difference
   c) for dependent proportions
   d) all of the above
   e) none of the above

14. Compute the Test Statistic for McNemar’s Test.
   a) 6.93 b) 5.90 c) 4.80 d) 4.13 e) 6.00

15. If we reject the null hypothesis at all usual alpha levels, then we can conclude that people’s impressions about this product after watching the ad:
   a) are exactly the same as before.
   b) have changed significantly from before.
   c) have changed from before, but not significantly.
   d) have not changed significantly from before.
   e) are twice as good as before.

Questions 16 – 19 An experiment was conducted to investigate if it helps to have a "white-sounding" name when looking for a job. Researchers sent 5000 resumes in response to ads that appeared in two major newspapers. The resumes were identical except that 2500 of them had "white-sounding" names such as Brett and Emily, while the other 2500 had "black-sounding" names such as Tamika and Rasheed. Resumes of the first type elicited 250 responses and those of the second type only 167 responses.

16. The pooled proportion used to compute the standard error for the significance test is:
   a) 0.0078 b) 0.0485 c) 0.0668
   d) 0.0834 e) 0.1668

17. The relative risk for this problem shows that resumes from white-sounding applicants:
   a) were 1.5 times more likely to elicit a response from potential employers.
   b) received 83 more responses from potential employers.
   c) had a 3% higher response from potential employers.
   d) all of the above
   e) none of the above

18. The 95% CI for p1-p2 was (0.0179, 0.0485). Then we can predict that a 95% CI for the relative risk will:
   a) not include zero
   b) include zero
   c) not include one
   d) include one
   e) include the parameter

19. Upon further investigation, it was discovered that it was not one resume sent out 5000 times with half using "white-sounding" names and half "black-sounding" names. Instead they had 2500 different resumes with different levels of education, experience, addresses, etc, and each one of these resumes got sent out with a "white-sounding" name and a "black-sounding" name. With this new information we see that:
   a) the data is really about dependent samples.
   b) the problem is really about means.
   c) the alternative hypothesis should be one-sided.
   d) the table we need to use is the Z table.
   e) the assumption of random samples is violated.
Questions 20 – 24 A research study investigated the driving behavior of teenagers by observing their vehicles as they left a high school parking lot. Ten vehicles driven by males and 10 by females were followed for half a mile (past the point where school zone speed limits are in place). Here their speed was compared to the posted speed limit and the amount by which they exceeded it was recorded. Minitab output for this data appears below.

20. The p-value to determine if male teenage drivers exceed the speed limit by more than females, on average, is:
   a) 0.010  
   b) 0.005  
   c) 0.995  
   d) 0.020  
   e) 0.498  
   \[ \mu_m - \mu_f > 0 \]

21. Based on the confidence intervals we can be 95% confident that:
   a) male teenage drivers in the sample exceed the speed limit by 0.231 to 1.409 miles per hour, on average.
   b) male teenage drivers in the population exceed the speed limit by 0.231 to 1.409 miles per hour, on average.
   c) female teenage drivers in the sample exceed the speed limit by 0.231 to 1.409 miles per hour, on average.
   d) female teenage drivers in the population exceed the speed limit by 0.231 to 1.409 miles per hour, on average.
   e) none of the above

22. The degrees of freedom needed to construct a confidence interval for the difference of any two means with the same sample sizes as those in this problem would be:
   a) 14  
   b) between 12 and 16  
   c) between 9 and 18  
   d) 19  
   e) 10

23. A negative value for the amount by which the speed limit was exceeded would imply:
   a) that the vehicle was going under the speed limit  
   b) a mistake in the calculations  
   c) that the original distribution could not be normal  
   d) a violation of the random sample assumption  
   e) that the test statistic will be negative

24. Outside of school zones, most police departments do not ticket people unless they exceed the speed limit by at least 5 miles an hour. Taking this and all the output provided into account we can say about the population of teenage drivers represented by this data that, on average:
   a) they exceed the speed limit regardless of gender.  
   b) the amount by which both genders exceed the speed limit is statistically significant.  
   c) the amount by which they exceed the speed limit is not practically significant in terms of getting a ticket.  
   d) males exceed the speed limit by a significantly higher amount than females.  
   e) all of the above

\[ \text{N} \quad \text{Mean} \quad \text{StDev} \quad \text{SE Mean} \quad 95\% \CI \]
\[
\begin{array}{lllll}
\text{M} & 10 & 1.460 & 0.740 & 0.23 & (0.931, 1.998) \\
\text{F} & 10 & 0.640 & 0.455 & 0.14 & (0.315, 0.965) \\
\end{array}
\]

95% CI for difference \( \mu (M) - \mu (F) \): (0.231, 1.409).

\[ \text{T-Test of difference} = 0 \quad (\text{vs} ≠) \quad \text{T-Value} = 2.99 \quad P-Value = 0.010 \quad DF = 14 \]

Questions 25 – 26 Professor Joel Gelfand of the University of Pennsylvania in Philadelphia, led a study analyzing data collected by the federal Centers for Disease Control and Prevention about a random sample of 207,776 Americans 18 and older and compared the incidence of sunburn in the previous year for those without a high school degree (group 1) and those who had graduated from college (group 2).

25. The 95% CI for the difference of the two proportions was (-0.27, -0.09). Which of the following is a correct interpretation? We are 95% confident that:
   a) college grads are 9% to 27% more likely to get sunburned than adults without a high school degree  
   b) college grads are 9% to 27% less likely to get sunburned than adults without a high school degree  
   c) college grads are 9% less likely to 27% more likely to get sunburned than adults without a high school degree  
   d) college grads are 27% less likely to 9% more likely to get sunburned than adults without a high school degree  
   e) none of the above

26. A newspaper article reported this with a headline that read “Smartest People Often Dumbest About Sunburns”. Assuming “smartest people” refers to college grads, the alternative hypothesis to test this statement is:
   a) \( p_1 - p_2 < 0 \)  
   b) \( p_1 - p_2 > 0 \)  
   c) \( \hat{p}_1 - \hat{p}_2 < 0 \)  
   d) \( \hat{p}_1 - \hat{p}_2 > 0 \)  
   e) \( \hat{p}_1 - \hat{p}_2 ≠ 0 \)
Questions 27 – 31 A research paper published in the journal Medicine and Science in Sports and Exercise compared chocolate milk to carbohydrate replacement drinks as a recovery aid after strenuous exercise. Nine male cyclists performed an intense workout, followed by a drink and a rest period. At the end of the rest period, each cyclist performed an endurance trial in which he exercised until exhausted and time to exhaustion was measured. Each cyclist completed the entire regimen on two different days - one day drinking chocolate milk (treatment 1), and on the other day drinking a carbohydrate replacement drink (treatment 2). All nine cyclists were able to exercise for a longer period of time before exhaustion the day they drank chocolate milk. A test was conducted to determine if there is a difference in average time to exhaustion using these drinks - the p-value was 0.002.

27. Based on the p-value, we:
   a) Reject the null hypothesis and conclude there is a significant difference between the two drinks.
   b) Reject the null hypothesis and conclude there is no significant difference between the two drinks.
   c) Fail to reject the alternative hypothesis and conclude there is a significant difference between the two drinks.
   d) Fail to reject the null hypothesis and conclude there is no significant difference between the two drinks.
   e) Reject the alternative hypothesis and conclude there is a significant difference between the two drinks.

28. The p-value for the researchers original hypothesis that chocolate milk is more effective would be:
   a) exactly the same as before, because we are using the same data
   b) half as big, making it easier to reject the null hypothesis
   c) half as big, making it easier to reject the alternative hypothesis
   d) twice as big, making it harder to reject the null hypothesis
   e) twice as big, making it easier to reject the alternative hypothesis

29. The degrees of freedom needed to construct a confidence interval for the mean of matched pairs for any data with the same sample size as in this problem would be:
   a) 8
   b) between 9 and 18
   c) between 8 and 16
   d) 17
   e) 9

30. Based on all the information provided on this page, which of the following could be the 95% confidence interval for the mean difference?
   a) (6.83, 21.48)
   b) (-21.48, 6.83)
   c) (-21.48, -6.83)
   d) (-6.83, 21.48)
   e) (6.83, -21.48)

31. What would be considered a type I error in this problem?
   a) deciding chocolate milk works better when in fact there is no difference.
   b) deciding there is no difference when in fact chocolate milk works better
   c) a cyclist who performed better with chocolate milk than carbohydrate replacement drink
   d) a cyclist who performed worse with chocolate milk than carbohydrate replacement drink
   e) none of the above

32. In general, the conclusions can be extended to the population of interest only if:
   a) we make a confidence interval, but not if we conduct a significance test
   b) the results of the confidence interval and the significance test agree
   c) the significance test is two sided, but not if it is one sided
   d) we find significant differences at least at the 0.10 significance level
   e) the assumption of random samples is satisfied

33. In general, we make statistical inferences about:
   a) unknown statistics
   b) unknown parameters
   c) known statistics
   d) known parameters
   e) all of the above