STAT303 Sec 510
Spring 2006
Exam #3
Form A

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Name:______________________________

1. **Don't even open this until you are told to do so.**
2. Please PRINT your name in the blanks provided.
3. 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.
4. You will have 60 minutes to finish this exam.
5. 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.
6. 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.
7. Good luck!

1. The owner of a construction company knows that the overall average time to build a deck is 2.5 days. Which set of hypotheses should the owner test to determine if his current crew works *faster* than the overall average? Let $\mu_{current}$ be the true average time for his current crew and $\mu_{overall}$ be the true average for all crews.

   A. $H_0 : \mu_{current} = \mu_{overall}$ vs. $H_A : \mu_{current} \neq \mu_{overall}$
   B. $H_0 : \mu_{current} = 2.5$ vs. $H_A : \mu_{current} \neq 2.5$
   C. $H_0 : \mu_{current} = 2.5$ vs. $H_A : \mu_{current} > 2.5$
   D. $H_0 : \mu_{current} = 2.5$ vs. $H_A : \mu_{current} < 2.5$
   E. $H_0 : \mu_{current} = \mu_{overall}$ vs. $H_A : \mu_{current} > \mu_{overall}$

2. Suppose you are testing whether retaking an exam improves a student's understanding, so you run a paired t-test on $H_0 : \mu_{diff} = 0$ vs. $H_A : \mu_{diff} > 0$, where $\mu_{diff} = second - first$, is the true mean difference in exam scores. The resulting p-value is 0.34. Which of the following is the best interpretation of this p-value?

   A. 34% of the students improved their scores (and understanding).
   B. 34% of the time you will claim that students improve when they actually don't.
   C. 34% of the time you will claim students do better the second time when they actually do better on the first.
   D. 34% of the time you will see an improvement such as this, when there actually isn't any.
   E. The students did 34% better on the second exam than the first, on average.

3. In a study of the effectiveness of a weight-loss programs, 50 subjects who were at least 30% overweight took part in a group support program for 10 weeks. Private weighings determined each subject's weight at the beginning of the program and 9 months after the program's end. What type of test do we need to use to test the effectiveness of the weight-loss program?

   A. a pooled t-test
   B. two-sample z-test
   C. one-sample t-test
   D. a matched pairs test
   A. a two-sample t-test

4. A 95% confidence interval for $\mu_1 - \mu_2$ was found to be (1.9, 18.3). What can be concluded from this interval?

   A. At $\alpha = 0.05$, we would fail to reject the null hypothesis that the two means are equal.
   B. Conclude μ_1 and μ_2 are significantly different.
   C. Reject $H_0 : \mu_1 \neq \mu_2$.
   D. There is a 95% probability that μ_1 and μ_2 are significantly different.
   E. Two of the above are true.

5. Suppose you are testing $H_0 : \pi = 0.25$ vs. $H_A : \pi > 0.25$. 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, $\pi > 0.25$.
   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, $\pi > 0.25$.
   C. Since the p-value, 0.25, 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, $\pi > 0.306$.
   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, $\pi > 0.25$.
   E. Since the significance level, α, is not given, we cannot conclude anything.

6. Which of the following is true?

   A. The t distribution takes on only positive values.
   B. The Z distribution is used instead of the t curve to be more conservative.
   C. The p-value associated with a t statistic depends on the sample size used.
   D. All of the above are true.
   E. Exactly two of the above are true.

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90% (10.177573, 11.822427)
95% (10.020018, 11.979982)
99% (9.7120853, 12.287915)
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7. Given the confidence intervals above, what is the correct range of the p-value for testing $H_0 : \mu = 12$ vs. $H_A : \mu \neq 12$?
   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. You need a test statistic value to determine the p-value

8. 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. $H_0 : \pi = 0.05$ $H_A : \pi \neq 0.05$
   B. $H_0 : \pi = 0.92$ $H_A : \pi \neq 0.05$
   C. $H_0 : \pi = 0.1$ $H_A : \pi \neq 0.1$
   D. $H_0 : \pi = 0.92$ $H_A : \pi \neq 0.92$
   E. None of the above are the correct set of hypotheses.

9. A new teacher at a university read an article that discussed a study of the amount of time (in hours) college freshman study each week. The study reported that the mean study time is 7.06 hours. The teacher feels that freshman at her university study more than 7.06 hours per week on average. The null and alternative hypotheses are $H_0 : \mu = 7.06$ vs $H_A : \mu > 7.06$. The teacher selected a simple random sample of 15 freshmen at her university and found the observed sample mean study time to be 8.43 hours and the observed variance to be 18.66. Assume that study time for freshman at her university follow a normal distribution. The observed test statistic and degrees of freedom are
   A. 0.317 with df = 14
   B. 0.019 with df = 28
   C. 1.23 with df = 14
   D. 7.56 with df 28
   E. None of the above are correct.

10. Hospital records show that 30 out of 100 men and 45 out of 110 women suffer from some form depression. A psychiatrist claims that more women suffer from depression than men. What type of test should the psychiatrist run to determine if he/she is correct?
   A. Case 6: 1 sample test of proportions, testing whether the true proportion of women sufferers is 0.5 or more.
   B. Case 9: 2 sample test of means, testing whether the true average is the same for men and women.
   C. Case 11: 2 sample test of proportions, testng whether the true proportion of women sufferers is more than that of men.
   D. Case 3: large sample test of means, since both samples are more than 30.
   E. There's no need to run a test since it's obvious that more women suffer than men (45 vs. only 30).

11. A manufacturer of handheld calculators receives very large shipments of printed circuit boards from their supplier. If the shipment contains more than 5% defectives, it is said to be of inferior quality and returned to the supplier. It is too costly and time-consuming to inspect all incoming circuit boards, so when each shipment arrives, a sample is then used to test $H_0 : \pi = 0.05$ vs. $H_A : \pi > 0.05$, where π is the true proportion of defectives in the shipment. If the null is rejected, the entire shipment is returned, otherwise, it is accepted and used in the calculators. From the calculator manufacturer's point of view, what significance level should be used?
   A. $\alpha = 0.05$ because neither a Type I or Type II error is critical.
   B. $\alpha = 0.01$ because a Type I error is more critical.
   C. $\alpha = 0.01$ because a Type II error is more critical.
   D. $\alpha = 0.10$ because a Type I error is more critical.
   E. $\alpha = 0.10$ because a Type II error is more critical.

12. Suppose we are testing $H_0 : \mu_1 = \mu_2$ vs $H_A : \mu_1 < \mu_2$. Sample 1 has 16 and sample 2 has 12, and we find a test statistic of -2.3. Assuming that both samples came from normal populatins, what is the range p-value for the test?

    A. between 0.025 and 0.02
    B. between 0.05 and 0.04
    C. between 0.02 and 0.01
    D. between 0.04 and 0.02
    E. The t table cannot be used for negative numbers.

13. Suppose you feel certain that for the last 10 years Aggie graduates have higher starting salaries than `t-sips` in their first year out of college. Which of the following would be the best method for testing this hypothesis?

    A. Ask 10 Aggies and 10 `t-sips` how much they make and compare the averages.
    B. Collect random samples of graduating seniors from both schools and compare their average job offers.
    C. Collect random samples of people who graduated in the last 10 years from both schools and compare the proportions of starting salaries over $30,000 for each school.
    D. Collect random samples of people who graduated in the last 10 years from both schools and compare their average starting salaries.
    E. Collect random samples of graduating seniors from both schools and compare the proportions of starting salaries over $30,000 for each school.

14. Still talking about Aggies and `t-sips` and salaries, which type test (case) should you use if you don't know anything about the means or the standard deviations of either school?

    A. Case 1, the 1-sample z-test, because it is the most basic type of test.
    B. Case 3, the large-sample t-test because we don't know that the data is normal nor the standard deviation.
    C. Case 6, the approximate z-test for a proportion, because comparing the proportions would mean we don't have to have the same sample sizes.
    D. Case 9, the 2-sample t-test, because we don't know that the data is normal nor either standard deviation or even if they're equal.
    E. Case 11, the 2-sample approximate z-test for proportions, because we should compare two proportions.

15. Suppose that we are in 2006 and we are reviewing old news papers. We read that the outcome of Kobe Bryant's trial in 2004 was found not guilty of all the charges. New witnesses have appeared since then and according to them he was guilty, but he couldn't be charged again because of double jeopardy. If we consider the trial as a statistical hypothesis test, what can we say about the trial?

    A. Celebrities are always innocent.
    B. The jury made a type I error.
    C. A jury trial is considered the most powerful test.
    D. The jury made a type II error.
    E. The jury made a correct decision.

16. Suppose the state claims that the average teacher's salary is $27,500/year. You want to prove that they are wrong, *i.e.*, the true average teacher's salary is not $27,500/year, but the only information you have is a 90% confidence interval for the true average: ($26,865,$29,345). What would you conclude?

    A. Since $27,500 is not the center of the interval, it is not the mean.
    B. Since $27,500 is in the interval, we can conclude that the state is wrong.
    C. Since $27,500 is in the interval, we cannot refute the claim (show the state is wrong) at the 1, 5, or 10% level.
    D. Since $27,500 is in the interval, we cannot refute the claim at the 10% level, but we cannot make any statement at the 1 and 5% levels..
    E. You cannot use confidence intervals to make conclusions for hypothesis tests.

17. The owner of a fruit and vegetable market is unhappy because he has lately been receiving a high proportion of spoiled oranges from his supplier. The owner decides to look for a new supplier if, based on a random sample of 100 oranges from his next shipment, he finds sufficient evidence at the 5% level that the true proportion of spoiled oranges exceeds 10%. His sample produced a p-value of 0.07. What should the owner do?

   A. Since the p-value, 0.07, is less than $\alpha = 0.10$, he rejects and looks for another supplier.
   B. Since the p-value, 0.07, is less than $\alpha = 0.05$, he rejects and looks for another supplier.
   C. Since the p-value, 0.07, is NOT less than $\alpha = 0.05$, he rejects and looks for another supplier.
   D. Since the p-value, 0.07, is NOT less than $\alpha = 0.05$, he fails to reject and stays with the same supplier.
   E. Since the p-value, 0.07, is NOT less than $\alpha = 0.10$, he fails to reject and stays with the same supplier.

18. Suppose we are interested in testing whether the proportion of business majors who are male is different from the proportion of engineering majors who are male. We do a hypothesis test and get a p-value of 0.025. Which of the following is TRUE?

   A. We would conclude that the proportions are different at the 0.05 significance level.
   B. We could use either a Z test or a t test as long as we know the data is normal or the sample sizes is large enough.
   C. At an $\alpha = 0.01$ level, we could make a Type I error.
   D. If we made a 95% confidence interval for $\pi_{BUS} - \pi_{ENG}$ it would include 0.
   E. More than one of the above is true.

19. The insecticide lead arsenate is commonly used in the vineyards of the wine producing regions of northern California. According to the U.S.D.A. regulations, for wine to be 'safe', the mean amount of lead per liter of wine must be less than 0.3 mg/l. A winery wants to demonstrate that their wines are in compliance, *i.e.*, they want to statistically prove that their wine has less than 0.3 mg/l of lead. Which type of test should they run?

   A. Case 3: large sample test of means, testing if their average mg/l is less than 0.3.
   B. Case 6: 1 sample test of proportions, testing if their proportion of bottles in compliance is less than 0.3.
   C. Case 6: 1 sample test of proportions, testing if their proportion of bottles in compliance is more than 0.3.
   D. Case 11: 2 sample test of proportions, testing if their proportion of bottles in compliance is less than the other wineries.
   E. Case 9: 2 sample test of means, testing if their average mg/l is less than 30% of the other wineries.

20. Which of the following would be a Type II error for the scenario above?

   A. The winery concludes that they are in compliance, but they actually have way too much lead in their wine.
   B. The winery concludes that they are in compliance, and they actually have 'safe' wine.
   C. The winery fails to prove that they are in compliance, and they actually have way too much lead in their wine.
   D. The winery fails to prove that they are in compliance, and they actually have 'safe' wine.
   E. They use killer bugs instead of an insecticide.

1D,2D,3D,4B,5B,6C,7C,8D,9C,10C,11E
12A,13D,14D,15D,16C,17D,18A,19A,20D