STAT303 Sec 508-510
Fall 2007
Exam #3
Form A

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Name:_____

1. **Don't even open this until you are told to do so.**
2. All graphs are on the last page which you may remove.
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. This exam is worth the 15% of your course grade.
8. When you are finished please make sure you have marked your CORRECT section (Tuesday 12:45 is 508, 2:20 is 509, and 3:55 is 510) and FORM and 20 answers, then turn in JUST your scantron to the correct pile for your section.
9. Good luck!

1. Which of the following is true?

   A. We reject the null hypothesis at significance level α if the p-value is larger than α.
   B. If the p-value is smaller than α while H_0 is true, then a Type I error has been made.
   C. If the p-value is larger than α then H_0 is true.
   D. A and B are true.
   E. B and C are true.

2. Researchers are interested in how short-term memory differs for males and females. Suppose it is assumed that two groups of 100 are selected randomly from normal populations with similar variances. Each group is given a memory test and the number of correct answers is recorded. What test should be used if the researcher interested in testing?

   A. A two-sample test of proportions
   B. A one-sample t-test
   C. A two-sample t-test
   D. A pooled t-test
   E. A paired t-test

3. Which of the following would be a Type II error for the hypothesis test above?

   A. failing to prove that men have shorter memories than women even though women can remember much more than men
   B. failing to prove than men and women remember things differently even though we know they do
   C. failing to prove than men and women have different short-term memory abilities when they actually are different
   D. failing to prove than men and women have different short-term memory abilities when they actually are the same
   E. failing to remember whose memory is better

4. Which of the following would be considered an advantage of the pooled t-test versus the two-sample t-test?

   A. If the assumption of equal population variances is valid, then the pooled t-test will have greater power than the two-sample t-test.
   B. If the assumption of equal population variances is valid, the two-sample t-test will always reject the null hypothesis when the pooled test fails to reject.
   C. If the assumption of equal population variances is valid, the two-sample t-test will always fail to reject the null hypothesis when the pooled test rejects.
   D. Two of the above are true.
   E. None of the above are true.

5. Using the information below, what is the correct range of the p-value if I wanted to test $H_0 : \pi = 0.275$ vs. $H_A : \pi \neq 0.275$?

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90% (0.286, 0.514)
95% (0.264, 0.536)
99% (0.222, 0.578)
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   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

6. Researchers were interested in determining whether dietary calcium helps reduce blood pressure or not. In a randomized comparison, 54 white males were divided at random into two groups. One group received calcium, the other a placebo. For each group seated systolic blood pressure was measured. Since this is the first time such a study was done, the researchers were unsure if the variation in each of the two groups would be the same, but it's known that blood pressure follows a normal distribution. What type of hypothesis test should the researchers use?

   A. A two-sample test of proportions
   B. A one-sample t-test
   C. A two-sample t-test
   D. A pooled t-test
   E. A paired t-test

7. Which of the following would be a Type I error for the experiment above?

   A. The researchers claim that calcium reduces systolic blood pressure in men when actually it has no effect.
   B. The researchers claim that calcium increases systolic blood pressure in men when actually it has no effect.
   C. The researchers claim that calcium has no effect when actually it does help reduce the systolic blood pressure in men.
   D. Researchers fail to prove that calcium reduces systolic blood pressure in men when actually it does reduce it.
   E. Researchers fail to prove that calcium has no effect even though no effect exists.

8. A teacher believes that a new method of teaching will improve reading ability for students in elementary school. A third grade class of 21 students learns by way of the new method while a control group of 23 follows curriculum without the new method. After eight weeks, each classroom is then giving a test to measure reading ability. A 95% confidence interval for the difference in the average scores is $(-0.935, 1.654)$. Assuming normality holds so this confidence interval is valid, which of the following conclusions can be made, if any?

   A. At the 5 and 1% levels, we can conclude that the new method is better.
   B. At the 10% level, we can conclude that the old method is better.
   C. Both A and B are correct conclusions.
   D. We cannot conclude that either method is better with a confidence interval.
   E. None of the above are valid conclusions.

9. Suppose we want to test $H_0 : \pi \leq 0.75$ vs. $H_A : \pi > 0.75$. From our sample of 30, we find 20 that fit the criteria, *i.e.*, our sample proportion is 0.67. What is our test statistic?

   A. Our test statistic is -1.01 so our p-value $= 0.1562$.
   B. Our test statistic is 1.01 so our p-value $= 0.8438$.
   C. Our test statistic is -0.93 so our p-value $= 0.1762$.
   D. Our test statistic is 0.93 so our p-value $= 0.8238$.
   E. The assumption of normality is not met, so we can't do a z-test.

10. Again, suppose we want to test $H_0 : \pi \leq 0.75$ vs. $H_A : \pi > 0.75$ and get a valid p-value $= 0.034$. Which of the following is the best conclusion?

    A. At the 5 and 10% levels, we can conclude that the true proportion is more than 0.75.
    B. At the 1% level, we can conclude that the true proportion is less than or equal to 0.75.
    C. At the 5 and 10% levels, we can conclude that the true proportion is more than 0.67.
    D. All of the above are true.
    E. Only two of the above are true.

11. A commonly prescribed drug on the market for relieving nervous tension is believed to be 60% effective. Experimental results with a new drug administered to a random sample of 100 adults who were suffering from nervous tension showed that 72 of them showed improvement. Is there sufficient evidence that the new drug is superior to the one commonly prescribed? Which set of hypotheses is the most appropriate for this situation?

    A. $H_0 : p \leq 0.72$ vs. $H_A : p > 0.72$
    B. $H_0 : p = 0.72$ vs. $H_A : p \neq 0.72$
    C. $H_0 : \pi = 0.72$ vs. $H_A : \pi \neq 0.72$
    D. $H_0 : \pi = 0.6$ vs. $H_A : \pi \neq 0.6$
    E. $H_0 : \pi \leq 0.6$ vs. $H_A : \pi > 0.6$

12. When testing $H_0 : \mu_1 \leq \mu_2$ vs. $H_A : \mu_1 > \mu_2$, we get the following statistics: $\bar{x}_1 = 20$, $s_1 = 5.43$, $n_1 = 18$, $\bar{x}_2 = 14$, $s_2 = 4.96$, and $n_2 = 12$. Assuming both populations are normal, what is the range of the p-value if the test statistic is 3.06?

    A. $0.005 > p$-value > 0.002
    B. $0.0025 > p$-value > 0.001
    C. $0.01 > p$-value > 0.005
    D. $0.02 > p$-value > 0.01
    E. p-value $= 0.0011$

13. If our p-value in the last problem was 0.182 (it's not a choice), how would we interpret this?

    A. There's an 18.2% chance that the alternative is true.
    B. 18.2% of the time, we would find the true mean from the first population at least this much larger than the true mean from the second population if the sample means were this different.
    C. 18.2% of the time, we would get a sample mean from the first population at least this much larger than the sample mean from the second population if the true means were the same.
    D. 18.2% of the time, we would get a sample mean from the first population at least this much larger than the sample mean from the second population if the true means were this much different.
    E. 18.2% of the time, we would get a sample mean from the second population at least this much larger than the sample mean from the first population if the true means were the same.

14. Using the information below, what is the correct range of the p-value if I wanted to test $H_0 : \pi_1 = \pi_2$ vs. $H_A : \pi_1 \neq \pi_2$?

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90% (-0.015, 0.215)
95% (-0.037, 0.237)
99% (-0.080, 0.280)
```

    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

15. Suppose we want to test $H_0 : \pi = 0.5$ vs. $H_A : \pi \neq 0.5$ and get a p-value $= 0.026$. Which of the following are correct statements?

    A. 0 would be in a 99% confidence interval for π but not in a 90 or 95%.
    B. We could conclude that the true proportion is not 0.026 at the 5 and 10% levels.
    C. We would fail to prove that the true proportion is 0.5 at the 1% level.
    D. All of the above are true.
    E. None of the above are true.

16. We want to test whether sleep deprivation impairs manual dexterity. Suppose we observe a sample of 39 individuals performing an activity to test their dexterity after they all were allowed to sleep until fully rested. A week later we give them a similar activity without letting them sleep the night before. On both occasions the performance of individuals in the sample were evaluated and given a score by a sleep science expert. Which of the following testing procedures would be most appropriate?

    A. A one sample t-test since we don't know the true standard deviation.
    B. A one sample test of proportions using the success rate as the sample proportion.
    C. A two sample test of proportions comparing the success rates.
    D. A two sample t-test comparing the score averages.
    E. A paired t-test, pairing the exam scores by individual.

17. Power plants are commonly located either near rivers or near oceans so that the available water can used for cooling the condensers. Suppose that as part of an environmental impact study, a power company wants to determine if there is a difference in average water temperature between the discharges of the two types of plants. What are the appropriate hypotheses?

    A. $H_0 : \mu_r \leq \mu_o$ vs. $H_A : \mu_r > \mu_o$
    B. $H_0 : \mu_r = \mu_o$ vs. $H_A : \mu_r \neq \mu_o$
    C. $H_0 : \mu_r \geq \mu_o$ vs. $H_A : \mu_r < \mu_o$
    D. $H_0 : \pi_r \leq \pi_o$ vs. $H_A : \pi_r > \pi_o$
    E. $H_0 : \pi_r = \pi_o$ vs. $H_A : \pi_r \neq \pi_o$

18. Which of the following situations for a hypothesis test would be the LEAST likely to make a Type I error?

    A. $n = 100, \alpha = 0.01$
    B. $n = 10, \alpha = 0.05$
    C. $n = 100, \alpha = 0.05$
    D. $n = 1000, \alpha = 0.05$
    E. $n = 10, \alpha = 0.10$

19. Suppose we want to test the hypotheses $H_0 : \mu \leq 7$ vs. $H_A : \mu > 7$ given $n = 38$, $\bar{x} = 8.05$, and $s = 7.46$. Which of the following statements would be most appropriate regarding the p-value for this test?

    A. 0.868
    B. p-value $= 0.1922$
    C. $0.20 > p$-value > 0.15
    D. $0.40 > p$-value > 0.30
    E. $0.85 > p$-value > 0.80

20. Suppose the p-value is the previous problem was 0.089 (don't worry that's not even a choice). Which of the following is the best interpretation of this value?

    A. 8.9% of the time we will get a sample mean of 8.05 or more if we sample the same population.
    B. There's an 8.9% chance that we'll get a sample mean of 8.05 or more in continued sampling if the population sampled has a true mean of 7 or less.
    C. 8.9% of the time we'll get the sample mean to be 8.05.
    D. 8.9% of the sample means in this population are 8.05 or more.
    E. 8.05 is 8.9% more than the true mean of 7.

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