STAT303: Secs 508
Fall 2006
Exam #3
Form A

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Name:____

1. **Don't even open this until you are told to do so.**
2. Be sure to write CARROLL in the space provided on the scantron and your name beneath. Fill in your UIN, section number and form letter.
3. There are 20 multiple-choice questions on this exam, each worth 5 points. There is partial credit. Please mark your answers **clearly** on the scantron. Multiple marks will be counted wrong.
4. You will have 60 minutes to finish this exam.
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. This exam is worth 100 points, and will constitute at least 15% of your final grade.
7. Good luck!

1. We want to test if there is sufficient evidence to say that the percentage of students receiving a passing grade in STAT303 is different for juniors and seniors. How should we gather the data?

   A. Take a sufficiently large random sample of juniors and seniors, make them take STAT 303, and calculate the proportion that passes.
   B. Take a sufficiently large random sample of juniors and seniors who took STAT303 last semester and calculate the proportion that passed.
   C. Take two sufficiently large random samples, one of juniors and one of seniors, make them take STAT 303, and calculate the proportions that pass.
   D. Take two sufficiently large random samples, one of juniors and one of seniors, who took STAT303 last semester and calculate the proportions that passed.
   E. Take two sufficiently large random samples, one of juniors and one of seniors, who took STAT303 within the last ten years, and calculate the proportions that passed.

2. An SRS of 400 parts from supplier 1 finds 20 defective (so $p_1 = 0.05$). A simple random sample of 200 parts from supplier 2 finds 20 defective (so $p_2 = 0.10$). Let π_1 and π_2 be the true proportions of parts which are defective. A test of $H_0 : \pi_1 = \pi_2$ versus $H_A : \pi_1 \neq \pi_2$ is conducted and the resulting p-value is 0.025. Which of the following is the best interpretation of this p-value?

   A. 2.5% more of the parts from supplier 1 are defective than from supplier 2.
   B. 2.5% more of the parts from supplier 2 are defective than from supplier 1.
   C. 2.5% of the time the true proportions are the same even though the sample proportions are different.
   D. 2.5% of the time the sample proportions will be at least as different as 0.05 and 0.10 even though the true proportions are the same.
   E. None of the above are the correct interpretation.

3. Using the same scenario, which of the following is the *best* interpretation of the power of the test above?

   A. Power is the probability that we correctly conclude $\pi_1 \neq \pi_2$.
   B. Power is the probability that we incorrectly conclude $\pi_1 \neq \pi_2$.
   C. Power is the probability that we correctly conclude $\pi_1 = \pi_2$.
   D. Power is the probability that we incorrectly conclude $\pi_1 = \pi_2$.
   E. The power for this test is $1 - 0.025 = 0.975$.

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90% CI:  (0.0176, 0.0580)
95% CI:  (0.0137, 0.0619)
99% CI:  (0.0061, 0.0695)
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4. What is the correct range of the p-value for testing $H_0 : \pi_1 = \pi_2$ vs. $H_A : \pi_1 \neq \pi_2$ given the three confidence intervals for the difference in the true proportions 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. There isn't a hypothesized value, so we can't use the confidence intervals to decide the p-value.

5. What role do assumptions play in a significance test? They guarantee that

   A. the data collected follows the appropriate distribution.
   B. the data collected follows the normal distribution.
   C. the test statistic follows the appropriate distribution.
   D. the test statistic follows the normal distribution.
   E. we get the correct conclusion.

6. When deciding whether or not to pick up a television series, network executives often show the pilot episode to test audiences. Suppose ABC wants to know if women report a grade of "Favorable" for the pilot of a certain show at a higher rate than men. What set of hypotheses should they test?

   A. $H_0 : \pi_W = \pi_M$ vs. $H_A : \pi_W \neq \pi_M$
   B. $H_0 : \pi_W \geq \pi_M$ vs. $H_A : \pi_W < \pi_M$
   C. $H_0 : \pi_W \leq \pi_M$ vs. $H_A : \pi_W > \pi_M$
   D. $H_0 : \mu_W \leq \mu_M$ vs. $H_A : \mu_W > \mu_M$
   E. $H_0 : \mu_W \geq \mu_M$ vs. $H_A : \mu_W < \mu_M$

7. A car manufacturing company requires that its cars be tested for quality. If the quality is good, the cars are distributed to various distributors. If the quality is poor, the cars are held back. Suppose the engineer in charge uses a null hypothesis which means the quality is good. Which of the following statements correctly describes a Type I and Type II error?

   A. A Type I error would be distributing poor cars, and a Type II error would be holding back good cars.
   B. A Type I error would be distributing good cars, and a Type II error would be holding back poor cars.
   C. A Type I error would be holding back good cars, and a Type II error would be distributing poor cars.
   D. A Type I error would be holding back poor cars, and a Type II error would be distributing good cars.
   E. A Type I error would be retesting the good cars, and a Type II error would be not testing the poor cars.

8. If you ran a greater than test, *i.e.*, $H_A : \mu > \mu_0$ instead of a less than test, which of following would be true? Assume that everything else is the same: the data, α, etc.

   A. The $<$ p-value would be $1-$ the $>$ p-value.
   B. The $<$ α-level would be $1-$ the $>$ α-level.
   C. The $<$ test statistic would be the negative of the $>$ test statistic.
   D. All of the above would be true.
   E. Only two of the above would be true.

9. Suppose the US Department of Education is interested in knowing if the proportion of high school seniors planning on attending college is more than 60%. They conduct a hypothesis test with $\alpha = 0.05$ and get a p-value of 0.039. What conclusion should they make?

   A. They should reject H_0, and believe that proportion of high school seniors planning to attend college is less than 0.6.
   B. They should not reject H_0, and believe that the proportion of high school seniors planning to attend college is 0.60.
   C. They should reject H_0, and believe that the proportion of high school seniors planning to attend college is different than 0.60.
   D. They should reject H_0, and believe that the proportion of high school seniors planning to attend college is greater than 0.60.
   E. They should not reject H_0, and believe that the proportion of high school seniors planning to attend college is different than 0.60.

10. Grades in an extremely difficult chemistry course are known to follow a distribution that is extremely right skewed. Is the average grade in the course at TAMU higher than that at tu (that school in Austin)? A sample of 10 students in the course is randomly selected at each school and the average grade is recorded. What is the appropriate test procedure?

    A. a non-parametric test procedure
    B. a one sample t-test for a single mean
    C. a two sample t-test for the difference between two means
    D. a pooled t-test for the difference between two means
    E. a paired t-test

11. An agricultural economist wants to know if the average number of bolls on a cotton plant differs for two different fertilizers, F1 and F2. He samples 45 plants from a field sprayed with F1 and 45 plants from a field sprayed with F2. The sample standard deviations are 4 and 1 respectively. What type of test statistic should the economist use?

    A. a paired t-test with 44 df
    B. a two sample t-test with 44 df
    C. a two sample t-test with 88 df
    D. a pooled t-test with 44 df
    E. a pooled t-test with 88 df

12. Which of the following is NOT an example of a matched pairs design?

    A. A scientist compares the cholesterol level of males and females.
    B. A teacher compares the pre-test and post-test scores of students.
    C. A pediatrician compares the birth weights of identical twins.
    D. An ophthalmologist compares the reading speeds of subjects based on which eye was covered while reading.
    E. All of the above should use the paired t-test.

13. Suppose the pediatrician did a 5% siginificance test of $H_0 : \mu_1 = \mu_2$ vs. $H_A : \mu_1 > \mu_2$ where μ_1 is the average birth weight of the first born twin and μ_2 is the average birth weight of the second born and got a p-value = 0.086. This means she should conclude

    A. the first born weighs 8.6% more than the second born.
    B. the first born weighs more than the second born 8.6% of the time.
    C. there is a 8.6% chance that the first born weighs more than the second born.
    D. there is sufficient evidence to conclude the first born weighs more than the second born.
    E. there is insufficient evidence to conclude the first born weighs more than the second born.

14. Still talking about the pediatrician's test above, $H_0 : \mu_1 = \mu_2$ vs. $H_A : \mu_1 > \mu_2$, which of the following would be a Type I error?

    A. if she concluded that the first born weighs more when actually he doesn't
    B. if she concluded that the second born weighs more when actually he doesn't
    C. if she concluded that the twins weigh the same when actually they have different weights
    D. if she failed to prove the first born weighs more even though he does
    E. if she failed to prove the twins weigh the same even though they do

15. The shift manager at a credit card company's customer service center will be reprimanded if more than 30% of customer calls during his shift last longer than 5 minutes. A sample of 50 calls is taken and the hypothesis $H_0 : \pi \leq 0.3$ vs. $H_A : \pi > 0.3$ is tested. The test statistic is found to be 1.68. Which is the MOST SPECIFIC information we can get about the p-value?

    A. p-value $= 0.9535$
    B. $0.05 < p$-value < 0.10
    C. $0.025 < p$-value < 0.05
    D. p-value $= 0.0465$
    E. p-value $= 0.0930$

16. Given $H_0 : \mu = 10$ vs. $H_A : \mu \neq 10$, with a sample size of 25, where X is normally distributed with unknown standard deviation, and a p-value of 0.03, which is true of the test statistic?

    A. z is either -2.17 or 2.17
    B. z is either -1.88 or 1.88
    C. t is between 1.708 and 2.060
    D. t is between 1.711 and 2.064
    E. t is between 2.172 and 2.492

17. Which of the following would be true for the test in the last problem, $H_0 : \mu = 10$ vs. $H_A : \mu \neq 10$, with a p-value of 0.03?

    A. The hypothesized value, 10, would be in a 99% confidence interval for the true mean created from the same data, but not in a 90 or 95% interval.
    B. The hypothesized value, 10, would be in a 90 and 95% confidence interval for the true mean created from the same data, but not in a 99% interval.
    C. The test statistic would be in a 99% confidence interval for the true mean created from the same data, but not in a 90 or 95% interval.
    D. The p-value would be in a 99% confidence interval for the true mean created from the same data, but not in a 90 or 95% interval.
    E. More than one of the above is true.

18. The American Medical Association wants to investigate the proportion of Americans who are allergic to aspirin. They get a 95% confidence interval of (0.087, 0.145). Which of the following are true?

    A. At $\alpha = 0.10$, they would reject $H_0 : \pi = 0.05$.
    B. They are 95% confident that the true proportion of Americans with an aspirin allergy is between 0.087 and 0.145.
    C. At $\alpha = 0.05$, they would not reject $H_0 : \pi = 0.09$.
    D. B and C are true, we can't be sure about A.
    E. A, B, and C are all true.

19. A SRS of 400 Milky Way bars yields a mean weight of $\overline{x}_M = 2.15$ oz. A SRS of 200 Snickers bars yields a mean weight of $\overline{x}_S = 2.5$ oz. Let μ_M and μ_S be the true average weights of the candy bars. A test of $H_0 : \mu_M = \mu_S$ versus $H_A : \mu_M \neq \mu_S$ is conducted and the p-value is 0.437.

    A. 43.7% of the time Snickers bars will weigh more than Milky Way bars.
    B. 43.7% of the time Snickers and Milky Way bars will weigh the same even though they should be different.
    C. 43.7% of the time the true means will be at least as different as 2.15 and 2.5 even though the sample means are the same.
    D. 43.7% of the time the true means are the same even though the sample means are different.
    E. 43.7% of the time the sample means will be at least as different as 2.15 and 2.5 even though the true means are the same.

20. If the sample sizes above, 400 and 200, were reduced to 40 for Milky Way bars and 20 for Snickers bars but the means remained the same, which of the following would be true?

    A. The p-value would be larger.
    B. The p-value would be smaller.
    C. We would have to run a non-parametric test unless we knew the data was normal.
    D. A and C are true.
    E. B and C are true.

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