STAT303 Sec 507-10
Fall 2011
Exam #2
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 above so that it can be returned to you.
3. There are ONLY 17 multiple-choice questions on this exam. There is partial credit. Please mark your answers **clearly**. Multiple marks will be counted wrong.
4. You will have **50 minutes** to finish this exam.
5. If you have questions, please write out what you are thinking by the question so that we can discuss it later.
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 UIN, CORRECT section (Tuesday 11:10 is 507, 12:45 is 508, 2:20 is 509, and 3:55 is 510) and FORM and 17 answers, tuck your sheets in this exam and leave everything on the table. Put the scantron on top, upside down.
9. Good luck!

1. Arsenic occurs naturally in water, and since it is a poison, it must be removed from drinking water. Since it is impossible to remove all of it, there is a maximum allowable amount. Public water systems must be tested regularly. What should the alternative hypothesis be in order to ensure that the water is safe?

   A. The level of arsenic is not at the maximum amount.
   B. The level of arsenic is above the maximum amount.
   C. The level of arsenic is below the maximum amount.
   D. The level of arsenic is at the maximum amount.
   E. The percent of arsenic is unacceptable

1. 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. $H_0 : \bar{r} \leq \bar{o}$ vs. $H_A : \bar{r} > \bar{o}$
   E. $H_0 : \bar{r} = \bar{o}$ vs. $H_A : \bar{r} \neq \bar{o}$

2. The hypotheses $H_0 : \mu = 350$ vs $H_A : \mu < 350$ are examined using a sample of size $n = 20$ with mean = 345 and standard deviation = 13. What is the p-value of this test if we assume that the data is normal?

   A. 0.0427
   B. 0.9573
   C. $0.10 > p\text{-value} > 0.05$
   D. $0.20 > p\text{-value} > 0.10$
   E. We don't have a t-table for negative numbers, so we can't say.

2. Assume that sample data, based on two independent samples of size 25, give us $\overline{x}_1 = 514.5$, $\overline{x}_2 = 505$, $s_1 = 23$, and $s_2 = 28.2$. If we wanted to test if the true means are equal or not, what would be the appropriate conservative range of the p-value if the test statistic value is 1.305?

   A. $0.20 > p\text{-value} > 0.10$
   B. $0.10 > p\text{-value} > 0.05$
   C. $0.15 > p\text{-value} > 0.10$
   D. $0.30 > p\text{-value} > 0.20$
   E. $0.20 > p\text{-value} > 0.15$

3. Using the three confidence intervals below, what is the correct range of the p-value if I wanted to test $H_0 : \mu = 4.5$ vs. $H_A : \mu \neq 4.5$? 7.5 is C.

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90%  (4.456, 7.004)
95%  (4.211, 7.248)
99%  (3.735, 7.725)
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   A. p-value > 0.10
   B. $0.10 > p\text{-value} > 0.05$
   C. $0.05 > p\text{-value} > 0.01$
   D. p-value < 0.01
   E. You need a test statistic value to determine the p-value.

4. We want to test whether directed reading activities in the classroom help elementary school students improve aspects of their reading ability. A treatment class of 23 third-grade students participated in these activities for eight weeks, and a control class of 23 third-graders followed the same curriculum without the activities. After the eight-week period, students in both classes took a Degree of Reading Power (DRP) test which measures the aspects of reading ability that the treatment is designed to improve. Reference: Moore, David S., and George P. McCabe (1989). Introduction to the Practice of Statistics. Original source: Schmitt, Maribeth C., The Effects on an Elaborated Directed Reading Activity on the Metacomprehension Skills of Third Graders, Ph.D. dissertation, Purdue University, 1987. Assuming the data is normal, what type test should we use if we can assume that all of the data is normal? μ_1 is the control group mean and μ_2 is the treatment group mean

   A. a 1-sample t-test testing the treatment mean is greater than the control mean
   B. a 2-sample t-test testing the treatment mean is greater than the control mean
   C. a paired t-test testing if the control mean minus the treatment mean greater than 0
   D. a 2-sample t-test testing the control mean is greater than the treatment mean
   E. a 1-sample t-test testing the control mean is greater than the treatment mean

4. You are thinking of using a t procedure to construct a 95% confidence interval for the mean of a population. You suspect the distribution of the population is not normal and may be skewed. Which of the following statements is correct?

   A. You should not use the t procedure since the population does not have a normal distribution.
   B. You may use the t procedure provided your sample size is large, say at least 50.
   C. You may use the t procedure since it is robust to nonnormality.
   D. You should use a z-test since it has more power.
   E. You should get a different sample that is not skewed.

5. There is a question as to whether the stock market is more or less volatile this year than it was in 2008. The volatility index for 35 randomly sampled stocks is computed for both years and the difference d is recorded for each stock. You should test the hypotheses

   A. $H_0 : \mu_d = 0$ vs. $H_A : \mu_d \neq 0$
   B. $H_0 : \bar{d} = 0$ vs. $H_A : \bar{d} \neq 0$.
   C. $H_0 : \mu_d = 0$ vs. $H_A : \mu_d > 0$.
   D. $H_0 : \bar{d}_{2008} \neq \bar{d}_{2011}$ vs. $H_a : \bar{d}_{2008} = \bar{d}_{2011}$.
   E. $H_0 : \mu_{2008} \neq \mu_{2011}$ vs. $H_A : \mu_{2008} = \mu_{2011}$.

5. A researcher wants to know if tougher sentencing laws have had a positive effect in terms of deterring crime. He plans to select a sample of states which have enacted a "3 strikes" law and compare violent crime rates before the law was enacted and two years later. Let $\bar{d}$ be the average difference by state, μ_d is the true difference in crime rates by state, before and after, μ_1 is the true mean crime rates before the law was enacted and μ_2 is the true mean crime rate two years later. The correct set of hypotheses to test are:

   A. $H_0 : \mu_d = 0$ vs. $H_A : \mu_d \neq 0$
   B. $H_0 : \bar{d} = 0$ vs. $H_A : \bar{d} \neq 0$.
   C. $H_0 : \mu_d = 0$ vs. $H_A : \mu_d > 0$.
   D. $H_0 : \mu_1 \neq \mu_2$ vs. $H_A : \mu_1 > \mu_2$
   E. $H_0 : \mu_1 \neq \mu_2$ vs. $H_A : \mu_1 = \mu_2$.

6. When stating your conclusion for the hypothesis test, you should report include

   A. the p-value of the test.
   B. the confidence level you used.
   C. the significance level you used.
   D. all of the above.
   E. only A and C.

6. Why is it a good idea to report a confidence interval with your conclusion based on the p-value?

   A. A confidence interval is not useful and shouldn't be include with the conclusion.
   B. Reporting just the confidence interval would be better since it gives plausible values for the true mean.
   C. Really large or small p-values are questionable and confidence intervals give the size of the effect.
   D. Confidence intervals are not affected by the sample size, so they give us more information.
   E. None of the above.

7. In a recent study, a random sample of 20 nonobese adults, aged 25 to 36, were fed 1000 calories in excess of the calories needed to maintain a stable body weight for a period of 8 weeks. Their weights before and after the 8-week period was recorded. There were no outliers in the distribution of the differences. The researchers wished to determine whether the mean weight gain differed from 16 pounds (the theoretical weight gain calculated from the number of excess calories consumed). This is an example of a(n)

   A. one-sample experiment.
   B. matched-pairs experiment.
   C. independent random sample.
   D. a two-sample experiment.
   E. two one-sample experiments.

7. Suppose that the experiments used a random sample of 32 nonobese adults, aged 25 to 36, in the above experiment. They randomly assigned 16 subjects to a control group fed a diet with the calories needed to maintain stable body weight. The remaining 16 subjects were fed 1000 calories in excess of the calories needed to maintain a stable body weight for a period of 8 weeks. The weights of the 32 subjects at the end of 8-week period were recorded. The researchers wished to determine whether the difference in mean weights for the two groups differed from 16 pounds. This is an example of a(n)

   A. one-sample experiment.
   B. matched-pairs experiment.
   C. independent random sample.
   D. a two-sample experiment.
   E. two one-sample experiments.

8. For the study above, the researchers had hypothesized that the excess calories should result in a weight gain of 16 pounds or 7.27 kg. From the data, a 95% confidence interval for the mean weight gain was (3.80kg,5.66kg). The appropriate conclusion is that

   A. the mean weight gain differs at level 0.05 from that hypothesized since 7.27 kg is outside the confidence interval.
   B. the mean weight gain differs at level 0.05 from that hypothesized since 7.27 kg is inside the confidence interval.
   C. the mean weight gain does not differ at level 0.05 from that hypothesized since 7.27 kg is outside the confidence interval.
   D. the mean weight gain does not differ at level 0.05 from that hypothesized since 7.27 kg is inside the confidence interval.
   E. we cannot come to a conclusion because the sample size is too small.

8. For the study above, the researchers had hypothesized that the excess calories should result in a difference in mean weight of 16 pounds or 7.27 kg. From the data, a 95% confidence interval for the difference in mean weights for the two groups was (-2.52kg,11.98kg). The appropriate conclusion is that

   A. the mean weight gain differs at level 0.05 from that hypothesized since 7.27 kg is outside the confidence interval.
   B. the mean weight gain does not differ at level 0.05 from that hypothesized since 0 is inside the confidence interval.
   C. the mean weight gain differs at level 0.05 from that hypothesized since 7.27 kg is inside the confidence interval.
   D. the mean weight gain does not differ at level 0.05 from that hypothesized since 7.27 kg is inside the confidence interval.
   E. we cannot come to a conclusion because the hypothesis is in pounds and the measurements are in kilograms.

9. A local farmer is interested in comparing the yields of two varieties of tomatoes. In an experimental field, she selects 40 locations and randomly assigns 20 plants from both varieties to the locations. She determines the average per plant (in pounds). She computes a 95% confidence interval for the difference in mean yields between the two varieties using the two-sample t procedures with the resulting interval (2.13, 6.41). Which of the following are valid conclusions?

   A. At the 5% level, the sample means are not the same.
   B. At the 5% level, the population means are not the same.
   C. At the 1% level, the population means are not the same.
   D. At the 10% level, the sample means are not the same.
   E. Two of the above are valid conclusions.

10. A 95% confidence interval for the mean, μ, of a population is (13, 20). Based on this interval:

    A. there is a 95% chance μ is in the interval.
    B. the method gives correct results 95% of the time.
    C. 95% of the observations lie in the interval.
    D. 95% of the sample means will fall in this interval.
    E. None of the above are correct.

10. Suppose we have a 95% confidence interval for the true test average, μ, of (73.6, 85.8). Then we can say

    A. 95% of the test takers made a B (in the 80's) or C (in the 70's).
    B. 95% of all exams of this type will have an average in this same range.
    C. 95% of the possible samples from this same population of test grades will have an average in this range.
    D. 95% of the possible samples from this same population of test grades will produce intervals containing this range.
    E. None of the above are correct.

11. I want to know if the lottery is truly random or not so my alternative hypothesis is the lottery is random (don't worry about how we would represent this using means). Which of the following is a correct statement?

    A. A Type I error would be claiming the lottery is random when it's not, so I should use $\alpha = 0.10$.
    B. A Type II error would be failing to prove the lottery is not random when it's actually not random, so I should use $\alpha = 0.10$.
    C. A Type I error would be claiming the lottery is not random when it is, so I should use $\alpha = 0.01$.
    D. A Type II error would be claiming the lottery is random when it's not, so I should use $\alpha = 0.01$.
    E. A Type II error would be failing to prove the lottery is random when it is, so I should use $\alpha = 0.10$.

11. Many people say that dentists make them nervous. One way to determine whether someone is stressed, *e.g.*, from having to go to the dentist, is to measure their blood pressure. So, we want to know if visiting the dentist causes the mean blood pressure to increase. What would be the consequence of a Type I error?

    A. concluding that people's blood pressure increases when they visit the dentist when it actually doesn't
    B. concluding that people's blood pressure increases when they visit the dentist when it actually does
    C. concluding that people's blood pressure decreases when they visit the dentist when it actually doesn't
    D. concluding that people's blood pressure decreases when they visit the dentist when it actually does
    E. concluding that people's blood pressure doesn't increase when they visit the dentist when it actually does

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90% (2.3265, 16.4735)
95% (0.972, 17.828)
99% (-1.694, 20.494)
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12. The three confidence intervals above are for the true mean difference in two populations. What is the correct range of the p-value if I wanted to test if the means were the same or not, $H_0 : \mu_1 = \mu_2$ vs. $H_A : \mu_1 \neq \mu_2$?

    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 is no hypothesized value, so we can't determine the p-value from the intervals.

13. Suppose I tested $H_0 : \mu \leq 5$ vs. $H_A : \mu > 5$ with a sample mean, $\bar{x} = 7$, sample size, $n = 20$ and standard deviation, $s = 2$ from a normal population. In which of the following situations would I be more likely to reject? Holding all other variables constant.

    A. a larger sample size
    B. a larger sample mean
    C. a larger hypothesized value μ_0
    D. All of the above would have a smaller p-value, so I would be more likely to reject.
    E. Only two of the above would have a smaller p-value, so I would be more likely to reject.

13. A random sample of size n is collected from a population with standard deviation s. With the data collected, a 95% confidence interval is computed for the mean of the population. Which of the following would produce a new confidence interval with smaller width (smaller margin of error) based on these same data?

    A. a larger sample size
    B. a larger sample mean
    C. a larger standard deviation
    D. All of the above would have a smaller width.
    E. Only two of the above would have a smaller width.

14. Suppose the p-value in the problem above was 0.23. How should be interpret this value?

    A. 23% of the time, the sample mean will be 7 when the true mean is 5 or less.
    B. 23% of the sample means from this population with mean 5 will be 7 or less.
    C. 23% of the sample means from this population with mean 5 will be greater than 5.
    D. 23% of the time we get sample means of 7 or more when the true mean is 5 or less.
    E. Our sample mean is 23% greater than the population mean.

15. It has been claimed that women live longer than men; however, men tend to be older than their wives. Ages of 50 husbands and wives from England were obtained. The null hypothesis of equality of means is rejected. What conclusion can be made from this study?

    A. English husbands are older than their wives.
    B. English husbands don't live as long as their wives.
    C. English husbands and their wives are the same age.
    D. English husbands' and their wives' ages are different.
    E. Since we don't know if the data is normal, we can't make any valid conclusions.

15. I want to test $H_0 : \mu_1 = \mu_2$ vs. $H_A : \mu_1 \neq \mu_2$, but all I have is a 95% confidence interval for the true difference in the population means.

    A. If 0 is the center of the interval, then $\mu_1 = \mu_2$.
    B. If 0 is in the interval, then $\mu_1 = \mu_2$.
    C. If 0 is in the interval, then $\bar{x}_1 = \bar{x}_2$.
    D. Two of the above are true.
    E. None of the above are true.

16. Given the output below, which of the following is/are true?

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Summary statistics:
Column    n  Mean     Std. Dev. Std. Err.
Control   23 41.52174 17.148733 3.575758
Treatment 21 51.47619 11.007357 2.402002

Hypothesis test results:
mu1 : mean of Control, mu2 : mean of Treatment
mu1 - mu2 : mean difference
H0 : mu1 - mu2 = 0 vs. HA : mu1 - mu2 not = 0

Difference Sample Mean Std. Err. DF   T-Stat P-value
mu1 - mu2    -9.954     4.392    42  -2.266  0.0286
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    A. At the 5 and 10% levels, we could claim that the treatment (activities) worked (improved reading skills).
    B. The true difference of the populations means would be in a 99% confidence interval, but not in the 95 nor 90%.
    C. 0 would be in the 90 and 95% confidence intervals but not in the 99%.
    D. Two of the above are true.
    E. None of the above are true.
    C. 0 would not be in the 90 and 95% confidence intervals but it would be in the 99%.

17. Comparing the p-value to α is the same as comparing

    A. the critical (table) value to the test statistic.
    B. the sample mean to the hypothesized mean.
    C. the hypothesized mean to a con
    dence interval.
    D. Two of the above are correct.
    E. None of the above are correct.

17. Which of the following statements is correct?

    A. An extremely small p-value indicates that the actual data differs markedly from that expected if the null hypothesis were true.
    B. The p-value measures the probability that the null hypothesis is true.
    C. The p-value measures the probability of making a Type II error.
    D. The larger the p-value, the stronger the evidence against the null hypothesis.
    E. None of the above statements are true.

7/10,8/9: 1C1B,2C2D,3A3C,4B4B,5A5C,6E6C,7B7D,8A8D,9B9B,
10B10E,11E11A,12C,13E13A,14D,15D15E,16E16C,17A17A