STAT303 Sec 508-510
Fall 2008
Exam #3
Form A

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1. **Don't even open this until you are told to do so.**
2. 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.
3. You will have 60 minutes to finish this exam.
4. 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.
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. 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.
7. Good luck!

1. Suppose I wanted to know if there were more purple Skittles® than green ones. One sample of fifty had 13 purples and the other had only 8 greens out of 50. My test statistic was 1.23. What is my p-value and correct conclusion?
   A. Since it's obvious that there are more purple than green, I can make that conclusion without running a hypothesis test.
   B. My p-value is 0.2186, so I would be unable to conclude there are more purple than green.
   C. My p-value is 0.1093, so I would be unable to conclude there are more purple than green.
   D. My p-value is 0.8907, so I would be unable to conclude there are more purple than green.
   E. My p-value is 0.8907, so there are 89.07% more purples than greens.

2. Which of the following is an invalid z-test?
   A. $H_0 : \mu = 50$ vs. $H_A : \mu < 50$ with a non-normal sample of size 50
   B. $H_0 : \pi = 0.5$ vs. $H_A : \pi < 0.5$ with a sample of size 50
   C. $H_0 : \pi = 0.85$ vs. $H_A : \pi < 0.85$ with a sample of size 50
   D. $H_0 : \pi_1 = \pi_2$ vs. $H_A : \pi_1 < \pi_2$ with independent samples of size 50
   E. All of the above are valid z-tests.

3. When can we use the paired t-test?
   A. when we want the most powerful 2-sample test
   B. when we have dependent samples
   C. when we have similar variances and equal samples sizes
   D. when we have equal sample sizes (we don't need the variances to be the same)
   E. Two of the above are correct.

4. 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.

5. After once again losing a football game to the college's archrival, the alumni association conducted a survey to see if alumni were in favor of firing the coach. A simple random sample of 100 alumni from the population of all living alumni was taken. Sixty-five of the alumni in the sample were in favor of firing the coach. Suppose the alumni association wished to see if the majority of alumni are in favor of firing the coach. To do this they test the hypotheses $H_0 : \pi = 0.50$ vs $H_A : \pi > 0.50$. What is the test statistic and p-value for this hypothesis test?
   A. 3 and 0.0013
   B. 3 and 0.0026
   C. 3.14 and 0.0008
   D. 3.14 and 0.0016
   E. 3.14 and 0.9992

6. Researchers have selected a simple random sample of size $n = 12$ from a population for the purpose of testing the null hypothesis $H_0 : \mu = \mu_0$ against the alternative hypothesis $H_A : \mu > \mu_0$. Studies indicate that a substantial degree of skewness can be expected in the population from which the sample was obtained. What might the researchers consider doing in this situation?
   A. There really isn't anything they can do; they simply have to proceed with what the data give them.
   B. They might proceed as usual but alter the p-value later to compensate for the skewness in their data.
   C. They might use a non-parametric (NP) test procedure.
   D. They might try a transform to the data so that it's not skewed.
   E. Each of C and D above are possible approaches they might consider using.

7. A sociologist is studying the effect of having children within the first two years of marriage on the divorce rate. Using hospital birth records, she selects a simple random sample of 200 couples who had children within the first two years of marriage. She checks to see how many couples are divorced within five years. What type of hypothesis test should she run?
   A. a 1-sample test of means to see if the average divorce rate is different from the national average
   B. a 2-sample test of means to see if the average divorce rate is different for childless couples
   C. a paired t-test comparing husbands and wives
   D. a 1-sample test of proportions comparing her proportion of divorces with the national percent after five years of marriage
   E. a 2-sample test of proportions comparing the proportions of divorced couples with the proportion of those still married

8. Suppose we were not sure if our sample of 30 is normal. In which of the following circumstances would we NOT be safe using a t procedure?

   A. The mean and median of the data are not exactly equal.
   B. A histogram of the data is moderately skewed.
   C. The sample standard deviation is large.
   D. A boxplot of the data shows the presence of a large outlier.
   E. Thirty is always large enough for the sample mean to be approximately normal.

9. Using the three confidence intervals below, what is the correct range of the p-value when testing $H_0 : \pi_1 = \pi_2$ vs. $H_A : \pi_1 \neq \pi_2$?

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90% (-0.222, 0.042)
95% (-0.247, 0.067)
99% (-0.230, 0.117)
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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 hypothesized value to determine the p-value

10. Which of the following are always necessary assumptions for any of the 2-sample tests?

   A. The two samples must always have at least 30 observations unless the data is normal.
   B. The two samples must always be independent whether testing means or proportions.
   C. The two samples must always have similar variances when testing means.
   D. All of the above are necessary.
   E. None of the above are always necessary.

11. Suppose we do not believe that students tend to improve their SAT-M score the second time they take the test. Based on a 90% confidence interval, $(-22.56, 72.56)$, we wish to test $H_0 : \mu = 0$ vs $H_A : \mu \neq 0$ at the 5% significance level. Which of the following statements is true?

   A. We cannot make a decision since the confidence level we used to calculate the confidence interval is 90%, and we would need a 95% confidence interval.
   B. We reject H_0 at the 10% level, since the value 0 falls in the 90% confidence interval, but we fail to reject at the 5% level.
   C. We reject H_0 at the 5 and 10% levels, since the value 0 falls in the 90% confidence interval.
   D. We fail to reject H_0 at the 5 and 10% levels, since the value 0 falls in the 90% confidence interval and would therefore also fall in the 95% confidence interval.
   E. We reject H_0 at the 5% level, but we fail to reject at the 10% level.

12. A simple random sample of 60 households in the city of Greenville is taken. In the sample, there are 45 households that decorate their houses with lights for the holidays. A simple random sample of 50 households is also taken from the neighboring town of Brownsboro. In the sample, there are 40 households that decorate their houses. We want to know if there is a difference in proportions of households that decorate their houses with lights for the holidays. Given a 95% confidence interval, $(-0.206, 0.106)$, what conclusions can be made?

   A. At the 5 and 10% levels we can conclude there is a difference in the true proportions of decorated houses for the two cities.
   B. At the 1% we can conclude that the true proportions of decorated houses for the two cities is the same.
   C. Brownsboro has a higher percentage of decorated houses than Greenville.
   D. All of the above are true.
   E. None of the above are true.

13. What are be an example of a Type II error in the problem above?

   A. concluding that Brownsboro has a higher percentage of decorated houses than Greenville when actually they are the same
   B. failing to conclude that Brownsboro has a higher percentage of decorated houses than Greenville when it does
   C. failing to prove there is a difference in the percent of decorated houses in the two cities when one exists
   D. failing to prove the percent of decorated houses in the two cities is the same when they are the same
   E. failing to prove the percent of decorated houses in the two cities is the same when they are the different

14. A study was to be undertaken to determine if a particular training program would improve physical fitness. An SRS of 31 university students was selected to be enrolled in the fitness program. One important measure of fitness is maximum oxygen uptake. Measurements of oxygen uptake in untrained individuals are known to follow a normal distribution with a mean of 45 ml/kg/min. The researchers wished to determine if there was evidence that their sample of students differed from the general population of untrained subjects. The measurements made on the subjects coming into this study produced a mean of 47.4 with a standard deviation of 5.3. If the 98% confidence interval were determined to be $(45.2, 49.6)$, an interval which may or not be correct, what would the researchers conclude?

    A. The sample is not statistically significant at the 0.02 level. We cannot say the true mean is not 45.
    B. The sample mean is significantly different from $\mu = 45$ at the 0.04 level since this is a two-sided test.
    C. There would be no reason to believe the selected students come from a different population.
    D. This suggests, at the 0.02 level, that there is evidence to conclude that the sample comes from a population with a mean different from $\mu = 45$.
    E. This suggests, at the 0.01 level, that there is evidence to conclude that the sample comes from a population with a mean different from $\mu = 45$.

15. Referring to the previous question, if we had used a 95% confidence interval instead of a 98%, what would happen to the confidence interval and the resulting p-value?

    A. The confidence interval would be longer and the p-value would decrease.
    B. The confidence interval would be shorter and the p-value would increase.
    C. The confidence interval would not change and the p-value also would not change.
    D. The confidence interval would be shorter and the p-value would decrease.
    E. The confidence interval would be shorter but the p-value would not change.

16. When is increasing the sample size NOT a good idea?

    A. when it leads to non-practical significance
    B. when its greater than the sample size necessary for a given margin of error
    C. when it's cost prohibitive
    D. All of the above are correct.
    E. more is always better

17. 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 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. $0.20 > p\text{-value} > 0.15$

18. Which of the following is false for the data above? Note: all possible choices for the p-value are greater than 5%.

    A. At the 5% significance level, we would fail to prove that there is a difference between the two population means, μ_2 and μ_1.
    B. The margin of error for the difference between the two sample means would be smaller if we were to take larger samples.
    C. If a 99% confidence interval were calculated instead of the 95% interval, it would include more values for the difference between the two population means.
    D. The difference in the true means would be in the 95% confidence interval.
    E. All of the above are true statements about the data.

19. What would be a Type I error for the previous test?

    A. concluding that the true means were the same when they were actually different
    B. concluding that the true means were different when they were actually the same
    C. failing to conclude that the true means were the same when they were actually different
    D. failing to conclude that the true means were different when they were actually the same
    E. failing to conclude that the true means were different when they were actually were different

20. A public health worker suspects that pipes in one of the older A&M dorms is causing students living there to have excess lead in their blood, *i.e.*, over 100ppb (parts per billion). What set of hypotheses should they test to insure the health of the students in the dorm?

    A. $H_0 : \mu \leq 100$ vs. $H_A : \mu > 100$
    B. $H_0 : \mu \geq 100$ vs. $H_A : \mu < 100$
    C. $H_0 : \mu = 100$ vs. $H_A : \mu \neq 100$
    D. $H_0 : \mu < 100$ vs. $H_A : \mu \geq 100$
    E. $H_0 : \mu > 100$ vs. $H_A : \mu \leq 100$

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