STAT303 Sec 504
Spring 2013
Exam #2
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 FORM, UIN and 20 answers, then turn in JUST your scantron.
7. Good luck!

1. If you're testing $H_0: \mu_1 = \mu_2$ vs. $H_A: \mu_1 \neq \mu_2$ and $\bar{x}_1 = 3$, $s_1 = 7.8$, $n_1 = 24$ and $\bar{x}_2 = 8.4$, $s_2 = 5.3$, $n_2 = 14$, both from normal populations, what is the correct p-value if the test statistic is -2.5?

   A. $0.02 > p\text{-value} > 0.01$
   B. $0.04 > p\text{-value} > 0.02$
   C. $0.99 > p\text{-value} > 0.98$
   D. $0.01 > p\text{-value} > 0.005$
   E. $0.01 = p\text{-value}$

2. Which of the following would be a Type II error in the previous test?

   A. claiming that 7.8 and 8.4 are the same when obviously they are not
   B. claiming the true means are the same but the sample means are different
   C. failing to prove the true means are different when they are different
   D. failing to prove the true means are the same when they are different
   E. failing to prove the true means are different when the sample means are the same

3. Which of the following is/are true?

   A. The larger the sample size, the more conservative the test, that's why we always round up when calculating sample sizes.
   B. We should always use a paired t-test since it is the most powerful of the 2-sample t-tests.
   C. Pooling the standard deviations in the pooled t-test and one-way ANOVA makes the estimate of σ less biased.
   D. Using excessively large samples could cause non-practical significance.
   E. Two of the above are true.

4. Increasing the sample size, n,

   A. increases the power of a hypothesis test
   B. increases the confidence level of a confidence interval
   C. increases the chance of making a Type I error (because it decreases the chance of a Type II)
   D. All of the above are true.
   E. Only two of the above are true.

5. Suppose we have a 97% confidence interval for $\mu = (6.93, 11.45)$. How do we interpret this?

   A. 97% of the time in repeated sampling, the true mean will be between 6.93 and 11.45.
   B. 97% of the time in repeated sampling, the true mean will be 9.19.
   C. We are 97% confident that the true mean is between 6.93 and 11.45.
   D. We have a 97% chance that the true mean is between 6.93 and 11.45.
   E. Two of the above are correct interpretations.

6. How large of a sample do you need to make the standard deviation of the sample mean, $\overline{X}$, a fifth the size of the population standard deviation?

   A. 5 times the size of the population
   B. 25 times the size of the population
   C. 5
   D. 10
   E. 25

7. If I want to test $H_0: \mu = 10$ vs. $H_A: \mu \neq 10$ and I have a 95% confidence interval of (7.18,10.62), then

   A. I can conclude that the true mean is not 10 at the 10% significance level.
   B. I can't say the true mean is 10 at the 10% level.
   C. I can't say the true mean is 10 at the 5% level.
   D. I can say the true mean is 10 at the 5% level.
   E. I can't say the true mean is NOT 10 at the 5% level.

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            | Summary of Estimated age, from 1st tooth
        Sex|        Mean   Std. Dev.       Freq.
------------+------------------------------------
       male |   5.0333333   1.9158984           6
     female |   2.8571429   1.0195704           7
------------+------------------------------------
      Total |   3.8615385   1.8232473          13

                        Analysis of Variance
 Source      SS       df    MS       F     Prob > F
----------------------------------------------------
Between    15.30     1    15.30    6.84   0.0240
 Within     24.59    11     2.24
---------------------------------------------------
    Total    39.89   12     3.32
```

8. What is the correct alternative hypothesis for the output above?

   A. $H_A: \mu_1 \neq \mu_2$
   B. $H_A: \mu_1 - \mu_2 \neq 0$
   C. H_A: all of the means are not the same
   D. All of the above say the same thing, so they're all correct.
   E. Only A and B are correct.

9. What is the correct interpretation of the previous p-value?

   A. We would get at least this big of a difference in sample means 2.4% of the time if the true means were equal.
   B. We would get a difference in sample means of at least 2.4% even though the true means were the same.
   C. 2.4% of the time we would conclude the true means were different when they were actually the same.
   D. A difference in sample means would happen only 2.4% of the time if the true means were the same.
   E. A difference in sample means would happen only 2.4% of the time if the true means were the different.

10. Suppose $X \sim N(14, 5^2)$. How likely are you to get a sample mean more than 12 from a sample of size 4?

    A. 0.8
    B. 0.4681
    C. 0.5319
    D. 0.7881
    E. 0.6554

11. We suppose we test $H_0 : \mu_1 = \mu_2$ vs. $H_A : \mu_1 \neq \mu_2$ and get a p-value = 0.046. Which of the following is true?

    A. 0 would be in a 95% confidence interval for the true difference in means but not in 99%.
    B. 0 would be in a 99% confidence interval for the true difference in means but not in 95%.
    C. 0.046 is NOT less than 0, so we would fail to reject and say we couldn't prove the true means were different.
    D. At the 1% level we could conclude the true means are the different.
    E. Two of the above are true.

12. Which of the following *best* describes the Central Limit Theorem?

    A. As long as we take a large enough random sample from a population with a finite mean and standard deviation, the distribution of the sample will be approximately normally distributed.
    B. As long as we take a large enough random sample from a population with a finite mean and standard deviation, the distribution of the sample mean will be approximately normally distributed.
    C. As long as we take a large enough random sample from a population with a finite mean and standard deviation, the distribution of the population mean will be approximately normally distributed.
    D. As long as we take a large enough random sample from a population with a finite mean and standard deviation, the distribution of the population will be approximately normally distributed.
    E. As long as we take a large enough random sample from a population with a finite mean and standard deviation, the mean of the sample means will be the mean of the population.

13. Suppose I need to know whether the true average test score is under 70, so I want to test $H_0 : \mu = 70$ vs. $H_A : \mu < 70$. If I sample the population 20 times and reject (conclude the true mean is under 70) twice (2 out of 20 times), what does this tell me?

    A. The true mean really is under 70 since I rejected twice.
    B. The true mean is under 70. The 2 out 20 rejections, 10%, is just my sample estimate of α, the chance of making a Type I error.
    C. The true mean is under 70. The 2 out 20 rejections, 10%, is just my sample estimate of β, the chance of making a Type II error.
    D. The true mean is probably not under 70. The 2 out 20 rejections, 10%, is just my sample estimate of α, the chance of making a Type I error.
    E. The true mean is probably not under 70. The 2 out 20 rejections, 10%, is just my sample estimate of β, the chance of making a Type II error.

14. Which of the following is true?

    A. You should use a larger α, say 0.10, if you want to reduce the chance of a Type II error.
    B. The smaller α-level you use, the more evidence you need to reject the null.
    C. When using a confidence interval to decide whether to reject or not in a 2-sample test, the 'hypothesized value' is always 0.
    D. All of the above are true.
    E. Only two of the above are true.

15. Suppose a test of $H_0 : \mu = 0$ vs. $H_A : \mu \neq 0$ is run with $\alpha = 0.05$. The p-value of the test is 0.069. If you were to calculate a 90% confidence interval for μ, would the resulting interval contain 0?

    A. No, because based on the p-value for the hypothesis test we would FTR the null, which means that 0 is not a plausible value for μ.
    B. No, because based on the p-value for the hypothesis test we would reject the null, which means that 0 is not a plausible value for μ.
    C. Yes, because based on the p-value for the hypothesis test we would FTR the null, which means that 0 is a plausible value for μ.
    D. Yes, because based on the p-value for the hypothesis test we would reject the null, which means that 0 is a plausible value for μ.
    E. There is not enough information to answer this question.

16. Which of the following is FALSE?

    A. If I reject at the 5% level, I will always reject at the 10% level.
    B. Increasing the sample size, n, gives us more information, so we have a more powerful test.
    C. The simple random sample assumption is always necessary.
    D. The confidence level for a 95% confidence interval for μ tells us that the probability a particular interval contains μ is 0.95.
    E. More than one of the above is false.

17. Using the three confidence intervals below, what is the correct range of the p-value when testing $H_0 : \mu = 5$ vs. $H_A : \mu \neq 5$?

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90%  (5.456, 8.004)
95%  (5.211, 8.248)
99%  (4.735, 8.725)
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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

18. Let $X \sim N(18, 7^2)$ and $\overline{X}_4$ is the sample mean from a sample of size 4. Which of the following is true?

    A. $P(X > 18) > P(\overline{X}_4 > 18)$
    B. $P(X > 20) > P(\overline{X}_4 > 20)$
    C. $P(X < 20) > P(\overline{X}_4 < 20)$
    D. $P(X < 11) = 2 * P(\overline{X}_4 < 11)$
    E. None of the above are true statements.

19. A marketing researcher wanted to know whether people actually liked Chips Ahoy cookies better than the store brand, so 37 participants were asked to rate both a Chips Ahoy cookie and a store brand cookie on a scale of 1-10. The order in which participants tried the cookies was randomized. Which of the following methods should be used to test the researcher's hypotheses?

    A. 2 (independent) samples t-test on the two groups, Chips Ahoy and store brand
    B. matched pairs t-test on the differences in scores between the two groups
    C. ANOVA on the 10 possible ratings of the cookies
    D. two one-sample confidence intervals on the two groups, Chips Ahoy and store brand; see if they overlap
    E. 1 sample t-test comparing the true mean rating for the store brand with the sample mean from Chips Ahoy

20. Which of the following is true?

    A. We can only prove the null hypothesis is false. We can never prove the null true.
    B. If we want to be very sure we don't make an error, we should use a very small α level.
    C. Confidence intervals are more powerful than hypothesis tests because we can tell whether the statistical significance is actually practical.
    D. To make sure our test is not biased, we should use a large sample size.
    E. Two of the above are true.

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