STAT302: Secs 102 & 103
Summer I 1997
Exam #3
Form A

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1. **Don't even open this until you are told to do so.**
2. Be sure to mark your section number (102 or 103) and your test form (A or B) on the scantron!
3. Sign your name where indicated on your scantron and write your Wednesday section number and computer number beside it. Also, you must place your scantron in the correct section stack (for next Wednesday).
4. 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.
5. You will have 60 minutes to finish this exam.
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 100 points, and will constitute 20% of your final grade.
8. Good luck!

1. Suppose that a random sample of 50 bottles of a particular brand of cough medicine is selected and the alcohol content of each bottle is determined. Let μ denote the true average alcohol content for the population of all bottles of the brand under study. If the sample of 50 results in a 95% confidence interval for μ of $(7.8, 9.4)$, which of the following statements is correct?

   A. There is a 95% chance that the true mean alcohol content, μ, of this brand falls between 7.8 and 9.4.
   B. The estimate, $\overline{x}$, is within 95% of the true mean, μ.
   C. If the process of selecting a sample of size 50 and then computing the corresponding 95% confidence interval is repeated many times, approximately 95% of the resulting intervals will include μ.
   D. If the process of selecting a sample of size 50 and then computing the corresponding 95% confidence interval is repeated many times, approximately 95% of the resulting intervals will fall within $(7.8, 9.4)$.
   E. Both C. and D. are correct.

2. If we tested $H_0 : \mu = 10$ vs. $H_A : \mu \neq 10$ using the 95% confidence interval above, $(7.8, 9.4)$, what would be the appropriate conclusion?

   A. Reject H_0 only at the 10% level of significance and conclude that the true mean alcohol content is not 10.
   B. Reject H_0 only at the 5 and 10% levels of significance and conclude that the true mean alcohol content is not 10.
   C. Reject H_0 at the 1, 5 and 10% levels of significance and conclude that the true mean alcohol content is not 10.
   D. Reject H_0 only at the 5% level of significance and conclude that the true mean alcohol content is not 10.
   E. Reject H_0 only at the 1 and 5% levels of significance and conclude that the true mean alcohol content is not 10.

3. What would be the consequence of a Type II error when testing the hypotheses above?

   A. You claim the true mean alcohol content is not 10 when it really is 10.
   B. You claim the true mean alcohol content is not 10 when it really is not 10.
   C. You don't claim the true mean alcohol content is not 10 when it really is 10.
   D. You don't claim the true mean alcohol content is not 10 when it really is not 10.
   E. You love the taste of grape Dimetapp, so we drink all 50 bottles.

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4. Which of the following does NOT affect the width of a small-sample confidence interval for the mean of a normal population when σ is known?

   A. the population standard deviation
   B. the sample standard deviation
   C. the sample size
   D. the confidence level
   E. exactly two of the above

5. The p-value of a hypothesis test is

   A. the probability that H_0 is true, given the data.
   B. the probability that H_0 is not true, given the data.
   C. the probability of committing a Type I error, given the data.
   D. the probability of committing a Type II error, given the data.
   E. the significance level.

6. The article "What Kinds of People Do Not Use Seat Belts?" (*Amer. J. of Public Health*(1977)) reported on a survey with the objective of studying characteristics of drivers and seat belt usage. Let π denote the proportion of all drivers of cars with seat belts who use them. Suppose that at the outset of the study, the investigators wished to estimate π to within 2% with 95% confidence. What is the required sample size?

   A. 183
   B. 98
   C. 9604
   D. 2401
   E. 1537

7. Which of the following is NOT true?

   A. The standard test procedures do allow the user to control α, but they provide no *direct* control over β.
   B. Choosing a small value for α implies that the user wants to employ a procedure for which the risk of a Type I error is quite small.
   C. With collecting more data, both α and β can be reduced simultaneously.
   D. For fixed sample size, β can be reduced by reducing the value of α.
   E. All of the above are true.

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8. Family incomes are known to follow a Weibull distribution (strongly right-skewed). The mayor of College Station wants to know whether or not the average family income in College Station is higher than that of Bryan. A sample of five families are randomly selected from each city and their average incomes is recorded. What is the appropriate test procedure?

   A. a small-sample t-test for a normal population mean
   B. a small-sample t-test for the difference of two normal population means
   C. a large-sample z-test for the difference of two normal population means
   D. a non-parametric test procedure
   E. There is no appropriate test procedure; you must gather more data.

9. The mayors of Bryan and College Station have a bet going. Whoever's city has the higher average family income wins $10. Since the mayor of College Station is doing the test, what significance level should he use? Remember H_0 is always that the two are equal.

   A. 0.10
   B. 0.05
   C. 0.01
   D. It depends on which city is sample 1 and which is sample 2.
   E. It doesn't matter since a hypothesis can't conclude one is higher than the other.

The paper "Undergraduate Marijuana Use and Anger" (*J. of Psychol.*(1988)) reported for a sample of 47 frequent marijuana users a mean and standard deviation on an anger expression scale of 42.72 and 6.05, respectively. Suppose that the population mean score for nonusers is 41.5. Does the data indicate that frequent users have a mean anger expression score that is higher than that for nonusers?

10. If μ is the true mean anger expression score for frequent marijuana users, what are the appropriate hypotheses to be tested?

    A. $H_0 : \mu = 41.5$ vs. $H_A : \mu = 42.72$
    B. $H_0 : \mu = 41.5$ vs. $H_A : \mu > 42.72$
    C. $H_0 : \mu = 42.72$ vs. $H_A : \mu > 42.72$
    D. $H_0 : \mu = 41.5$ vs. $H_A : \mu > 41.5$
    E. $H_0 : \mu > 42.72$ vs. $H_A : \mu = 42.72$

11. Which test procedure should be used?

    A. a small-sample t-test for a normal population mean
    B. a large-sample z-test for a population mean
    C. a large-sample z-test for a population proportion
    D. a large-sample z-test for the difference of two normal population means
    E. a non-parametric test procedure

12. Suppose the associated p-value for the test above is 0.0838. At the 5% significance level, what is the appropriate conclusion?

    A. Fail to reject H_0 and conclude that there is not sufficient evidence to say the true mean anger expression score for frequent marijuana users is higher than that of nonusers.
    B. Fail to reject H_0 and conclude that there is evidence to say the true mean anger expression score for frequent marijuana users is higher than that of nonusers.
    C. Reject H_0 and conclude that there is not sufficient evidence to say the true mean anger expression score for frequent marijuana users is higher than that of nonusers.
    D. Reject H_0 and conclude that there is evidence to say the true mean anger expression score for frequent marijuana users is higher than that of nonusers.
    E. Reject H_0 and conclude that there is evidence to say the true mean anger expression score for frequent marijuana users is not that of nonusers.

13. Suppose the true mean and standard deviation of Duracell Alkaline AA battery lifetime are 4.1 hr and 1.8 hr, respectively. Those of Eveready batteries are 4.5 hr and 2.0 hr, respectively. If $\overline{X}_D$ is the sample mean of 100 Duracells and $\overline{X}_E$ is the sample mean of 100 Evereadys, what is the approximate sampling distribution of $\overline{X}_D - \overline{X}_E$?

    A. $N(-0.4, 0.269^2)$
    B. $N(-0.4, 0.2^2)$
    C. $N(-0.4, -0.2^2)$
    D. $N(-0.4, 0.0724^2)$
    E. $N(-0.4, 0.02^2)$

14. Which of the following will *increase* the power of a hypothesis test?

    A. increasing the significance level.
    B. increasing the sample size.
    C. increasing the sample standard deviation.
    D. All of the above
    E. Exactly two of the above (excluding D.)

15. Suppose a 90% confidence interval for the true proporion of A&M students who watch *Walker: Texas Ranger* is (0.22, 0.53), and a 90% confidence interval for the true proportion of `t.u.` students who watch is (0.29, 0.42). From this we can conclude

    A. more Aggies watch than `t.u.` students.
    B. less Aggies watch than `t.u.` students.
    C. it's plausible that the same proportion from either school watch.
    D. we have more confidence that the A&M interval contains the true proportion since it is wider than the other.
    E. `t.u.` students are not as patriotic as Aggies.

16. Which of the following statements about hypothesis tests in NOT true?

    A. The level of significance is taken to be a small number.
    B. Type II errors are considered to be more serious that Type I errors.
    C. For any of the 3 possible forms of the alternative, H_A, we reject H_0 if the p-value is less than α.
    D. We require strong evidence before rejecting the null, H_0.
    E. No hypothesis test can prove the null, H_0, true.

17. Given the following confidence intervals for μ: (55.6, 60.4), (55.2, 60.8), (54.2, 61.8), what is the appropriate range for the p-value for testing $H_0 : \mu = 60.5$ vs. $H_A : \mu \neq 60.5$?

    A. p-value > 0.10
    B. 0.10 > p-value > 0.05
    C. 0.05 > p-value > 0.01
    D. 0.01 > p-value
    E. The test statistic is needed in order to determine the p-value.

18. In the lab we each generated 20 random samples from a population of $N(4, 10^2)$. From these samples, we created 20 90% confidence intervals. If we looked at all of our confidence intervals collectively (there were about 400), then

    A. no more than 90% of them actually contained the true mean of 4.
    B. exactly 90% of them actually contained the true mean of 4.
    C. approximately 90% of them actually contained the true mean of 4.
    D. all of them actually contained the true mean of 4 since we all did the same thing and we KNOW the true mean is 4.
    E. at least 90% of them actually contained the true mean of 4.

19. $H_0 : \mu = 4$ vs. $H_A : \mu > 3$ is NOT a valid set of hypotheses because

    A. we rarely know μ is practice.
    B. the population standard deviation is not given/known.
    C. 4 is not a plausible value for μ.
    D. there is not a *practical* significant difference between 3 and 4.
    E. both hypotheses could be true simultaneously.

20. The degrees of freedom for a t curve determine

    A. the mean of the t curve.
    B. the spread of the t curve.
    C. the skewness of the t curve.
    D. how big of a sample you need.
    E. Exactly two of the above are correct.

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