

STAT303: Secs 508-510

Fall 2004

Exam #3

**Form A**

Instructor: Julie Hagen Carroll

November 29, 2004

1. **Don't even open this until you are told to do so.**
2. Be sure to write your instructor's name in the space provided on the scantron and your name beneath.
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 20 of your final grade.
7. Good luck!

1. Which of the following would give us the most power in a test of hypotheses?
  - A.  $n = 100$  with an  $\alpha$ -level of 0.05.
  - B.  $n = 100$  with an  $\alpha$ -level of 0.01.
  - C.  $n = 50$  with an  $\alpha$ -level of 0.05.
  - D.  $n = 50$  with an  $\alpha$ -level of 0.01.
  - E. We would have to run the test of determine the power.
2. Suppose you tested  $H_0 : \mu_1 = \mu_2$  vs.  $H_A : \mu_1 \neq \mu_2$  and got a  $p$ -value of 0.04. Which of the following statements would be correct?
  - A. 0 would not be in the 95% confidence interval for the difference  $\mu_1 - \mu_2$ .
  - B. Conclude at the 5% level that  $\mu_1$  differs from  $\mu_2$ .
  - C. 4% of the time we would see at least this much difference in sample means even though the true means are equal.
  - D. All of the above statements are correct.
  - E. Only two of the above are correct.
3. Twelve people who suffer from chronic fatigue syndrome volunteer to take part in an experiment to see if shark fin extract will increase one's energy level. Eight of the volunteers are men and four are women. Half of the volunteers are to be given shark fin extract twice a day and the other half a placebo twice a day. What type of test should we run?
  - A. A paired  $t$ -test of the difference between the shark fin and placebo groups energy levels, assuming these differences are normally distributed.
  - B. A 2 sample  $t$ -test comparing the men's and women's energy levels, assuming the data is normally distributed.
  - C. A 2 sample  $t$ -test comparing the shark fin and placebo groups' energy levels, assuming the data is normally distributed.
  - D. A 2 sample  $z$ -test for proportions comparing the percent improvement for the shark fin and placebo groups energy levels, assuming the data is normally distributed.
  - E. We would need to get four more women for any test to be valid for both men and women.
4. If we are the manufacturer of shark fin supplements, what  $\alpha$  level would we want to use if we were testing  $H_0 : \mu_{shark} \leq \mu_{placebo}$  vs.  $H_A : \mu_{shark} > \mu_{placebo}$ , where  $\mu$  is the true average energy level of shark fin or placebo takers?
  - A. 0.001
  - B. 0.01
  - C. 0.05
  - D. 0.10
  - E. It doesn't matter since shark fin is useless for increasing one's energy level. You should drink Red Bull.
5. In reference to a One-Way ANOVA table, if the  $F$ -test statistic is significant, then
  - A. the associated means are all equal.
  - B. the associated effect exists.
  - C. the associated  $p$ -value is small.
  - D. Exactly two of the above are correct.
  - E. All of the above are correct (excluding D.).
6. An experiment was done with 15 students to see if manual dexterity was better for the dominant hand compared to the non-dominant hand. The experiment consisted of tossing beans into a paper cup and counting how many beans made it in 15 seconds. The order in which the two hand were measured was randomized to compensate for 'learning'. How should the data be analyzed?
  - A. Assuming that the data is normal, we can use Case 2, the small sample  $t$  test.
  - B. Assuming that the data is normal, we can use Case 8, the 2 sample  $t$  test since it's probable the variances are equal.
  - C. Assuming that the data is normal, we can use Case 9, the 2 sample  $t$  test.
  - D. Assuming that the data is normal, we can use Case 10, the paired  $t$  test.
  - E. Assuming that the true proportion is around 0.5, we can use Case 11, the 2 sample  $z$  test.
7. Why are the assumptions so important in statistical inference, *i.e.*, hypothesis testing?
  - A. They are the only rules we have to go by.
  - B. They are what make the assumed distributions valid.
  - C. They are what minimize the Type I and II errors.
  - D. They are what help us decide our conclusions.
  - E. They are what help us decide which procedure to use.

90% CI: (4.01057, 7.58943)  
 95% CI: (3.61245, 7.98754)  
 99% CI: (2.73322, 8.86678)

8. What is the correct range of the  $p$  - value for testing  $H_0 : \mu = 5$  vs.  $H_A : \mu \neq 5$  given the three confidence intervals for  $\mu$  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. You need a test statistic value to determine the  $p$ -value

9. Which of the following tests could you use to test whether *two* proportions are equal or not?

A. One-Way Analysis of Variance  
 B. 2-sample  $t$ -test  
 C.  $\chi^2$  test  
 D. 2-sample  $z$ -test  
 E. Two of the above

10. What is the relationship between two-sided tests of hypotheses for a population mean,  $\mu$ , at a significance level  $\alpha$  and a  $(1 - \alpha) * 100\%$  confidence interval for the same  $\mu$ ?

A. The only thing they have in common is that they can use the same sample data.  
 B. If the hypothesized value for  $\mu$  is in the confidence interval, we would reject the null hypothesis.  
 C. If 0 is in the confidence interval, we would reject the null hypothesis.  
 D. If the hypothesized value for  $\mu$  is in the confidence interval, we would fail to reject the null hypothesis.  
 E. If 0 is in the confidence interval, we would fail to reject the null hypothesis.

		GENDER		Total
		male	female	
HOMETOWN	metro	37	57	94
	large	12	21	33
	city	24	38	62
	town or rural	36	48	84
Total		109	164	273

#### Chi-Square Test

	Value	df	Sig.(2-sided)
Chi-Square	0.526	3	0.913

0 cells have expected count less than 5.  
 The minimum expected count is 13.18.

11. What is the **Expected Count** for *female city* dwellers?

A. 38  
 B.  $38 * 62 * 164 / 273$   
 C.  $62 * 164 / 273$   
 D.  $164 / 273 * 62 / 273$   
 E.  $164 * 62$

12. What is the correct conclusion for the  $\chi^2$  test in the previous question?

A. There is sufficient evidence to conclude that there is a relationship between GENDER and HOMETOWN.  
 B. There is insufficient evidence to conclude that there is a relationship between GENDER and HOMETOWN.  
 C. There is insufficient evidence to conclude that there is a relationship between males and females by HOMETOWN.  
 D. There is insufficient evidence to conclude that GENDER and HOMETOWN are independent.  
 E. There is sufficient evidence to conclude that GENDER and HOMETOWN are independent.

13. Which of the following is an example of a Type I error for the previous  $\chi^2$  test above?

A. We claim that GENDER and HOMETOWN are related when they are actually independent.  
 B. We claim that males and females are related by their HOMETOWN.  
 C. We fail to prove that GENDER and HOMETOWN are independent even though they actually are.  
 D. We fail to prove that GENDER and HOMETOWN are related even though they actually are.  
 E. We claim that females are more likely to live in a metroplex when actually all of the types of HOMETOWN are about equally likely.

14. Suppose we ask a large (so the necessary assumptions are met) random sample of people whether they would return the money if they found a wallet on the street. To find out if age makes any difference, we separated the sample into 5 age groups. What test procedure should we use to analyze the data?
- One way ANOVA on the multiple means.
  - Case 9 since the sample is large and there are no other assumptions.
  - Case 6 since the data is categorical and the sample is large.
  - Case 11 since the data is categorical and the sample is large.
  - Chi-squared test since the data is categorical, and we have more than 2 proportions.
15. In tests of significance about an unknown parameter, the hypothesized value
- is the value of the unknown parameter under the null hypothesis.
  - is the value of the sample statistic.
  - is the value of the test statistic.
  - measures the compatibility between the null hypothesis and the data.
  - None of the above.
16. What is a  $p$ -value anyway?
- A  $p$ -value is probability from the hypothesized curve.
  - A  $p$ -value is used to help us decide whether to reject a null hypothesis or not.
  - A  $p$ -value is dependent on the sample data, the sign of the alternative hypothesis and the hypothesized value.
  - All of the above are true statements about a  $p$ -value.
  - Only two of the above are true statements about a  $p$ -value.

	SS	df	MS	F	Sig.
Between	23397.42		23397.42	8.09	0.005
Within	783777.38		2892.17		
Total	807174.80	272			

17. The ANOVA table above is testing whether *gender* has an effect on *how much* money one carries, using the data from the class survey. What is the correct alternative hypothesis?
- $H_A : \mu_{male} \neq \mu_{female}$
  - $H_0 : \mu_{male} = \mu_{female}$
  - $H_A : \pi_{male} \neq \pi_{female}$
  - Two of the above are correct.
  - None of the above are correct.
18. Assuming all assumptions are met, what are the degrees of freedom for the  $F$  statistic above? Yes, they are missing from the table?
- We can't determine them; we need to look at the data.
  - 1 and 271
  - 2 and 270
  - 2 and 272
  - 1 and 272
19. Which of the following is the *best* interpretation of the  $p$ -value for the previous ANOVA  $F$ -test?
- 5% of the time we would see at least this big of a difference in means even though the true means are equal.
  - 5% of the time we would see at least this big of a difference in effects even though there isn't one.
  - 0.5% of the time we would see at least this big of a difference in means even though the true means are equal.
  - Two of the above are correct.
  - None of the above are correct.
20. A. Yes, I will be there to take the early final, and if I don't show thereby wasting a copy (since the regularly scheduled final will be different), I will **lose a letter grade** on the exam.
- B. I think I will be there, but I will email [julie@stat.tamu.edu](mailto:julie@stat.tamu.edu) by Tuesday, Dec. 7th so that there will be a copy waiting for me. Otherwise, I will have to wait until more can be xeroxed.
- C. No, I will be taking the regularly scheduled final, Dec. 15th from 1 to 3 in COLS 267 even though there may be volleyball going on upstairs!

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