# STAT303 Sec 508-510 Spring 2010 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 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!

STAT303 SEC 508-510

### Exam #2, Form A

- 1. Which of the following is NOT affected by the sample size, n?
  - A. the power of a test of hypotheses
  - B. the *p*-value of a test of hypotheses
  - C. the type of test statistic for a test of hypotheses
  - D. the biasness of the sample statistic
  - E. All of the above are affected by the sample size.
- 2. Why is the test for multiple means being equal called an Analysis of Variance?
  - A. Actually, it should be called an Analysis of Means since that's what is being tested.
  - B. It uses the variance within the groups to check if the sample means are too spread out to believe the true means are the same.
  - C. It divides the total variance of the data into the variance of the sample means and the variance of the observations of a group.
  - D. It looks at the ratio of the the variance of the sample means and the variance of the observations of a group.
  - E. Only A is wrong.
- 3. A hypothesis test,  $H_0: \mu = \mu_0$  vs.  $H_A: \mu \neq \mu_0$  failed to be rejected at  $\alpha = 0.05$ . We can also say
  - A. the same test would be rejected at the 10% level.
  - B. the same test would not be rejected at the 1% level.
  - C. the true mean,  $\mu = \mu_0$ .
  - D. All of the above are correct.
  - E. Only two of the above are correct.
- 4. I want to test  $H_0: \mu = 10$  vs.  $H_A: \mu \neq 10$  but I'm given a 99% confidence interval for  $\mu = (5.43, 9.86)$ . What's my conclusion?
  - A. Since 10 is not in the 99% confidence interval, I should reject the null at the 1, 5 and 10% levels and conclude that the true mean is not 10.
  - B. Since 10 is not in the 99% confidence interval, I should reject the null at the 1% level and conclude that the true mean is not 10, but I would fail to reject at the 5 and 10% levels.
  - C. Since 10 is not in the 99% confidence interval, I should reject the null at the 10 and 5% levels and conclude that the true mean is not 10, but I would fail to reject at the 1% level.
  - D. Since 10 is not in the 99% confidence interval, I should fail to reject the null at the 1, 5 and 10% levels.
  - E. I can't use the confidence interval to make conclusions.

- 5. How should we interpret the 99% confidence interval above, (5.43, 9.86)?
  - A. 99% of the time, the true mean will be between 5.43 and 9.86.
  - B. The probability of this interval containing the true mean is 0.99.
  - C. The probability of getting an interval such as this (calculated with the same method) that contains the true mean is 0.99.
  - D. The probability of getting an interval such as this (calculated with the same method) that contains the sample mean is 0.99.
  - E. The probability of getting an interval such as this (calculated with the same method) that has these same limits is 0.99.
- 6. Suppose I'm trying to determine whether a city's drinking water is safe or not, so I take 25 different samples and use each one to test  $H_0$ : the water is unsafe vs.  $H_A$ : the water is safe. Twenty times I fail to prove the water is safe, but 5 times I conclude the water is safe. What went wrong?
  - A. Nothing, 5 times I made a Type I error.
  - B. Nothing, 5 times I made a Type II error.
  - C. 5 out of 20 is too many mistakes, so something must be wrong with my method.
  - D. Hypothesis testing is never consistant, so nothing's wrong.
  - E. It doesn't matter; I'm going to drink bottled water anyway.
- 7. If I was to run the water test above only once, what  $\alpha$ -level should I use and why?
  - A. 5% since it is used most often.
  - B. 10% since a Type I error would be drinking unsafe water.
  - C. 1% since a Type I error would be drinking unsafe water.
  - D. 10% since a Type II error would be drinking unsafe water.
  - E. 1% since a Type II error would be drinking unsafe water.
- 8. Which of the following tests would have the most power if the true mean is 15?
  - A.  $H_0: \mu = 10$  vs.  $H_A: \mu \neq 10$
  - B.  $H_0: \mu \le 10$  vs.  $H_A: \mu > 10$
  - C.  $H_0: \mu \le 12$  vs.  $H_A: \mu > 12$
  - D.  $H_0: \mu \ge 12$  vs.  $H_A: \mu < 12$
  - E. Power only depends on the sample size.

#### Exam #2, Form A

- 9. 'Do women wish their men were taller?' How should we go about answering this question?
  - A. run a paired *t*-test looking at the difference between a woman's mate's height and her desired height in a mate
  - B. run a 2-sample *t*-test comparing the average height of men and the average height women want in a mate
  - C. run a pooled *t*-test comparing the average height of men and the average height women want in a mate since the two sets of heights should have about the same variance
  - D. run a 1-sample *t*-test using the overall average height of males as the comparison mean
  - E. run a 1-sample z-test using the overall average height and standard deviation of males

Summary statistics for Height:

Group by: Gender Std. Dev. Std. Err. Gender n Mean Median Min Max Female 117 65 3.4013183 0.314452 65 48 71 145 70.04138 4.222749 0.35068023 71 48 79 Male Summary statistics for Mate height: Group by: Gender Std. Dev. Std. Err. Gender n Mean Median Min Max Female 114 71.27193 3.7304893 0.34939232 72 47 84 140 66.14286 3.601701 0.3043993 66 51 75 Male Test for the difference between men's heights and women's preferred height in a mate: Difference Sample Mean Std. Err. DF T-Stat P-value 0.50241655 257 -2.4492624 0.015  $m_{11}1 - m_{11}2$ -1.23055

- 10. This data set contains responses to a survey run on the StatCrunch site between October 2nd and October 22nd (2009). Respondents provided their height (in inches), their opinion of the ideal height of their mate (in inches) and their gender. This may not correctly answer the question above, but it's what we have. What's the conclusion based on this data?
  - A. At the 5% level, there is a not significant difference between the average height of males and the average preferred height of women's mates.
  - B. At the 5% level, there is a significant difference between the average height of males and the average preferred height of women's mates.
  - C. At the 1% level, there is a not significant difference between the average height of males and the average preferred height of women's mates.
  - D. At the 5% level, there is a not proof of a significant difference between the average height of males and the average preferred height of women's mates.
  - E. Two of the above are correct conclusions.

- 11. Using the three confidence intervals below, what is the correct range of the *p*-value if I wanted to test  $H_0: \mu = 15$  vs.  $H_A: \mu \neq 15$ ?
  - 90% (15.08, 22.52) 95% (14.37, 23.23) 99% (12.98, 24.62)
  - 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
- 12. What would be the consequence of making a Type II error in the hypothesis test above?
  - A. concluding the true mean is 15 when it's not
  - B. concluding the true mean is not 15 when it is
  - C. failing to prove the true mean is 15 when it really is
  - D. failing to prove the true mean is not 15 when it really is not
  - E. failing to prove the true mean is 15 when it really is not

ANOVA table df SSMS F-Stat Source P-value Treatments 5 А 3.14 3.57 61.3 С Error в Total 75 77.0

- 13. The ANOVA table above compares the average fat content in different manufacturers' cereals, but some of the pieces are missing. What are the A, B and C?
  - A. A = 15.7, B = 70, C = 0.88B. A = 0.628, B = 70, C = 0.88C. A = 15.7, B = 80, C = 0.766D. A = 138.3, B = 70, C = 0.88E. A = 138.3, B = 80, C = 0.766
- 14. What is the correct alternative for the previous ANOVA table?
  - A.  $H_A: \mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$
  - B.  $H_A: \mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6$
  - C.  $H_A$ : not all of the 5 means are the same
  - D.  $H_A$ : not all of the 6 means are the same
  - E.  $H_A$ : all of the 5 means are the different
- 15. When testing  $H_0: \mu_1 \ge \mu_2$  vs.  $H_A: \mu_1 < \mu_2$ , we get the following statistics:  $\bar{x}_1 = 10.67, s_1 = 4.35, n_1 = 8, \bar{x}_2 = 15.98, s_2 = 3.68, \text{ and } n_2 = 15$ . Assuming both populations are normal, what is the range of the *p*-value if the test statistic is -3.097?
  - A. 0.02 > p-value > 0.01 B. 0.01 > p-value > 0.005 C. 0.005 > p-value > 0.0025 D. 0.005 > p-value > 0.002 E. 0.0025 > p-value > 0.001

Spring 2010

Is there really a difference in the calorie content of chicken sandwiches for the various fast food restaurants?

Fast Food 1	Rest	aurant	n	Mean	Std.	Error	
Burger King	g		4	610		71.8	
Chick-Fil-	A		4	352.5		30.1	
Jack In The	e Bo	х	3	516.7		63.9	
KFC			7	371.4		45.0	
McDonald's			4	537.5		51.1	
Wendy's			5	410		41.5	
ANOVA table							
Source	df	SS		MS	3	F-Stat	P-value
Treatments	5	23550	5.0	3 4710	01.004	4 3.989962	0.0106
Error	21	247902.38		8 1180	04.87	5	
Total	26	48340	7.4				

- 16. The ANOVA table above tested this question. What is the conclusion?
  - A. At the 5% level, we can conclude that Burger King has the most calories per sandwich on average.
  - B. At the 5% level, we can conclude that Chick-Fil-A really is better since it has fewer calories on average.
  - C. At the 5% level, we can conclude that there is a difference in the average calorie content of chicken sandwiches for these restaurants.
  - D. At the 1% level, we can conclude that there is no difference in the average calorie content of chicken sandwiches for these restaurants.
  - E. More than one of the above are correct conclusions.
- 17. Which of the following is the best interpretation of the *p*-value above, 0.0106?
  - A. Only about 1% of the time should there be this big of a difference in the means.
  - B. Only about 1% of the time would we see this strong of an effect if one really didn't exist.
  - C. Only about 1% of the time would the true means be equal if the sample means were this different.
  - D. Only about 1% of the time should the sample means be equal if the true means are different.
  - E. Only about 1% of the time would we run this type of test.
- 18. If I tested  $H_0: \mu_1 = \mu_2$  vs.  $H_A: \mu_1 \neq \mu_2$  and found the *p*-value to be 0.083, what could I conclude?
  - A. 8.3% of the time the means will be different.
  - B. At the 1 and 5% levels, the true means are the same.
  - C. The difference in the sample means will be outside a 90% confidence interval.
  - D. The difference in the true means will be outside a 90% confidence interval.
  - E. None of the above are correct.

How is it that the American League can have more Runs on average than the National League but less At Bats in 2007?

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Summary statistics for At Bats:
Group by: League
League n
                          Std. Dev.
              Mean
AL
       14
            2125.7856
                          64.81118
       16
            2146.125
                          48.188347
NI.
Test for a
Difference
            Sample Mean
                          Std. Err. DF
                                         T-Stat
                                                    P-value
mu1 - mu2
             -20.3394
                          20.683256 28 -0.98337513 0.3338
Summary statistics for Runs:
Group by: League
League n
              Mean
                          Std. Dev.
AL
       14
            300.14285
                          38.163326
NL
       16
            276.5
                          22.648031
Test for a
            Sample Mean
                          Std. Err. DF T-Stat
Difference
                                                  P-value
m_{11}1 - m_{11}2
             23,64285
                          11.285592 28 2.0949588 0.0453
```

- 19. What does the information say?
  - A. There are less AL teams (14 vs. 16), so of course there are less At Bats.
  - B. The AL teams are just better (or the pitchers are worse), so they do more with less attempts.
  - C. Although there the AL has significantly more Runs, the difference in the At Bats is not statistically significant.
  - D. Although there is a significant difference in the number of Runs, the difference in the At Bats is not statistically significant.
  - E. None of the above are correct.
- 20. If I had tested  $H_A : \mu_{AL} > \mu_{NL}$  instead, what would have been the *p*-value?
  - A. Since it's the same data, it would be the same, 0.0453.
  - B. It would be twice the value, 0.0906.
  - C. It would be half the value, 0.0227.
  - D. It would be 1 half, 0.9773.
  - E. We need to know the sign of the test statistic in order to know which is correct.

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