

Name Jerry

Student Number _____

STA 441s 2016⁸ Quiz 7A

1. (4 points) In a study comparing the effectiveness of different exercise programmes, volunteers were randomly assigned to one of three exercise programmes (A, B, C) or put on a waiting list and told to work out on their own. Thus, there were four experimental treatments. Denote the true treatment means by μ_a, μ_b, μ_c and μ_w .

Aerobic capacity is the body's ability to process oxygen. Using a standard treadmill test, aerobic capacity was measured before and after 6 months of participation in the program (or 6 months of being on the waiting list). The response variable was improvement in aerobic capacity.

(a) What null hypothesis would you test to determine whether experimental treatment (including the wait list control) had any effect on aerobic capacity? State the null hypothesis in symbols.

$$H_0: \mu_a = \mu_b = \mu_c = \mu_w$$

(b) For the test of whether experimental treatment had any effect on average aerobic capacity, give the contrast or contrasts you would test. Make a table. There is one column in your table for each treatment mean, and one row for each contrast.

μ_a	μ_b	μ_c	μ_w
1	-1	0	0
0	1	-1	0
0	0	1	-1

for example

(c) What null hypothesis would you test to determine whether the average expected improvement from the three exercise programs was greater than expected improvement in the wait list control? State the null hypothesis in symbols.

$$H_0: \mu_w = \frac{1}{3}(\mu_a + \mu_b + \mu_c)$$

(d) For the test of whether average expected improvement from the three exercise programs was greater than expected improvement in the wait list control, give the contrast or contrasts you would test. Make a table. There is one column in your table for each treatment mean, and one row for each contrast.

μ_a	μ_b	μ_c	μ_w
1	1	1	-3

for example

2. Please refer to your analysis of the Chick Weights data.

- (a) (1 point) What proportion of the variation in the chicks' weight is explained by type of feed? The answer is a number on your printout. Write the number in the space below. On the printout, circle the number and write "Question 2a" beside it.

$$R^2 = 0.542$$

- (b) (2 points) You carried out an F -test for differences among sunflower, casin and meatmeal. Fill in the table below. On your printout, circle the ~~chi-squared~~ F statistic and write "Question 2b" beside it.

F Statistic (a number)	p -value (a number)	Reject Null Hypothesis? (Yes or No)	Statistically Significant? (Yes or No)
13.08	0.0527	No	No

- (c) (3 points) You followed up the significant overall F -test with Scheffé tests for all pairwise differences between means. Consider the comparison between horsebean and meatmeal.
- i. What is the Scheffé-adjusted p -value for this comparison? Write the answer in the space below. On your printout, circle then number and write "Question 2c" beside it.

$$p = 0.0009$$

- ii. In plain, non-statistical language, what do you conclude from this test? You have more room than you need.

Chicks fed meatmeal weighed more on average than chicks fed horse bean.

Attach your complete log file and your **COMPLETE** results file to the quiz paper. Make sure your name and student number are written clearly on both printouts.

Name Jenny

Student Number _____

STA 441s 2018 Quiz 7B

1. (4 points) In a study of tutoring methods, volunteer High School students provided after-school help to Grade School students who were having trouble with math. The High School students were randomly assigned to one of three training programs, or to a control condition in which they were simply instructed to help the Grade School students with their homework. Thus, there were four experimental treatments.

For each High School student, investigators calculated the average *improvement* in the math marks of the Grade school students they were helping. This was the response variable. So if you are tutoring five students, your y is the mean of five improvement scores. Denote the true treatment means by μ_1, μ_2, μ_3 and μ_c , where c is for *control* group.

- (a) What null hypothesis would you test to determine whether experimental treatment (including the control condition) had any effect on average improvement in math grades? State the null hypothesis in symbols.

$$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_c$$

- (b) For the test of whether experimental treatment had any effect on average improvement in math grades, give the contrast or contrasts you would test. Make a table. There is one column in your table for each treatment mean, and one row for each contrast.

μ_1	μ_2	μ_3	μ_c
1	-1	0	0
1	0	-1	0
1	0	0	-1

for example

- (c) What null hypothesis would you test to determine whether the average expected improvement from the three training programs was greater than expected improvement in the control condition? State the null hypothesis in symbols.

$$H_0: \mu_3 = \frac{1}{3}(\mu_1 + \mu_2 + \mu_3)$$

- (d) For the test of whether average expected improvement from the three exercise programs was greater than expected improvement in the control, give the contrast or contrasts you would test. Make a table. There is one column in your table for each treatment mean, and one row for each contrast.

μ_1	μ_2	μ_3	μ_c
$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$	-1

for example

2. Please refer to your analysis of the Chick Weights data.

- (a) (1 point) What proportion of the variation in the chicks' weight is explained by type of feed? The answer is a number on your printout. Write the number in the space below. On the printout, circle the number and write "Question 2a" beside it.

$$R^2 = 0.5417$$

- (b) (2 points) You carried out an F -test for differences among horsebean, linseed and soybean. Fill in the table below. On your printout, circle the ~~chi-square~~ F statistic and write "Question 2b" beside it.

F Statistic (a number)	p -value (a number)	Reject Null Hypothesis? (Yes or No)	Statistically Significant? (Yes or No)
7.30	0.0014	Yes	Yes

- (c) (3 points) You followed up the significant overall F -test with Scheffé tests for all pairwise differences between means. Consider the comparison between horsebean and soybean.

- i. What is the Scheffé-adjusted p -value for this comparison? Write the answer in the space below. On your printout, circle then number and write "Question 2c" beside it.

$$p = 0.0206$$

- ii. In plain, non-statistical language, what do you conclude from this test? You have more room than you need.

Chicks fed soybean weighed more on average than chicks fed horse bean

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