

Name \_\_\_\_\_

Please circle your TA: Adam Suzanne Yiyu

**Psychology 318 Exam #5**  
**May 31, 2017**

**Instructions**

1. Use a pencil, not a pen
2. Put your name on each page where indicated, and in addition, put your section on this page.
3. Exams will be due at 10:20!
4. If you find yourself having difficulty with some problem, go on to the rest of the problems, and return to the troublemaker if you have time at the end of the exam.
5. Leave your answers as reduced fractions or decimals to three decimal places.
6. CIRCLE ALL ANSWERS: You will lose credit if an answer is not circled!!
7. Check to make sure that you have all questions (see grading below)
8. SHOW ALL YOUR WORK: An answer that appears from nowhere will receive no credit!!
9. Assume homogeneity of variance unless told otherwise.
- 10 Use  $\alpha = .05$  unless told otherwise.

**Grading**

<u>Problem</u>	<u>Points</u>	<u>Grader</u>
1a	/10	Adam
1b-d	/20	Yiyu
2	/25	Adam
3	/45	Suzanne
Total	/100	

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1. Wanda, a criminologist, is studying cities. She is interested in the relation between church prevalence in a city (X, a measure of total number of churches in a city) and alcohol prevalence in the city (Y, a measure of total number of alcoholics in a city). Data from  $n = 12$  cities—6 large cities and 6 small cities—are shown in the table below.

<b>Large Cities</b>	X = Church Prevalence	Y = Alcohol Prevalence
Chicago	5.15	4.30
Philadelphia	4.77	4.40
Los Angeles	4.52	5.00
Miami	3.99	5.50
New York	3.64	5.60
Houston	2.93	6.60
<b>Small Cities</b>		
Yakima	1.50	2.00
Moses Lake	1.20	2.40
Wenatchee	0.95	2.70
Walla Walla	0.52	3.00
Tacoma	0.50	3.00
Bellingham	0.30	3.50

Summary data are as follows

$$n = 12$$

$$\Sigma X = 29.97$$

$$\Sigma X^2 = 112.663$$

$$\Sigma Y = 48.00$$

$$\Sigma Y^2 = 215.320$$

**NOTE: Pearson  $r = 0.676$**

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- a) Compute the upper and lower limits of the **80%** confidence interval around both the Pearson  $r$  and the Pearson  $r^2$ . (10 points)

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b) What is the *variance* of the predicted  $Y'$ -scores, i.e., what is  $S^2_{Y'}$ ? NOTE: This should be a relatively easy question to answer with the information provided at the start of the question. You should not have to actually compute the values of any of the  $Y'$  scores. (10 points)

c. Suppose a new city's church-prevalence score were found to be  $X = 2.00$ . What would the predicted alcohol prevalence score,  $Y'$ , for that city?

**IMPORTANT NOTE:** please solve this problem by using the information presented in lecture about "regression to the mean" that requires computing z scores. (5 points)

d. Note that there is a positive correlation (Pearson  $r = 0.676$ ) between  $X$  and  $Y$ . Briefly describe, either in terms of the pattern of the  $n = 12$   $X$  and  $Y$  scores themselves and/or by reference to a rough scatterplot of the data, why the obtained positive correlation is misleading (5 points)

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2. Colbert Pharmaceuticals Inc. creates a new headache reliever which they call "Endache." Colbert compliance engineers are now investigating side effects of Endache and are focusing on puzzle-solving time (PST). They have reason to believe that PST will *increase linearly* with Endache dosage. To test this hypothesis, an experiment is devised in which subjects are to be randomly divided into five groups. The groups will differ in terms of how much Endache they are given: 2, 11, 20, 33, or 57 mg. An hour after taking their prescribed doses, all subjects are to be given a puzzle to solve and their PSTs are to be measured.
- What are the weights corresponding to the hypothesis: "PST increases linearly with dosage"? Use the smallest weights that are integers. Enter these weights in the appropriate row in the table below. (25 points)

	Endache Dose (mg)				
$W_j$ :	2	11	20	35	57

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3. Colbert Pharmaceuticals Inc. decides to run a simpler experiment prior to the one described in Question 2. They again want to test the theory that PST increases linearly with Endache dosage.

In this new experiment,  $N = 120$  subjects are randomly divided into four groups of  $n = 30$  subjects per group. Again the groups differ in terms of how much Endache they are given: 11, 17, 23, or 29 mg.

An hour after taking their prescribed doses, all subjects are given a puzzle to solve and their PSTs are measured. Data (mean PST's in minutes) are as follows:

	Endache Dose (mg)			
	11	17	23	29
$M_j$ :	13	16	18	24
$W_j$ :				

USEFUL INFORMATION:

We have calculated for you that...

$$T = 2,130$$

$$\sum T_j^2 = 203,400$$

$$\sum M_j = 26$$

$$\sum M_j^2 = 226$$

Assume that,

$$SSW = 23,200$$

- a) What are appropriate weights corresponding to the hypothesis: "PST increases linearly with dosage"? Use the smallest weights that are integers. Enter these weights in the appropriate row in the table. (10 points)
- b) Test two null hypotheses: first the "uselessness  $H_0$ " i.e., that your weights from Part (a) have 0.0 correlation with the four  $\mu_j$ 's, and second the "perfection  $H_0$ " i.e., that your weights from Part (a) have 1.0 correlation with the four  $\mu_j$ 's. Make an ANOVA table that shows the results of these tests. Include total degree of freedom and sum of squares in the table (15 points)

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c) What percentages of SSB are accounted for by your hypothesis and the residual? (10 points)

d) Compute the Pearson  $r^2$  between your weights and the sample means. Use the equation for Pearson  $r^2$  from Chapter 14 to do this. **Be sure to show your work.** How do your answers for Parts (c) and (d) compare? (5 points)

e) Calculate  $\omega^2$  for these data (5 points).