Final

Name:

For the section that you *attend* please indicate:
Instructor:(circle one) Chuang   Nordheim

TA: (circle one) Cong   Li   Zou

Instructions:

1. This exam is open book. You may use textbooks, notebooks, class notes, and a calculator.

2. Do all your work in the spaces provided. If you need additional space, use the back of the preceding page, indicating *clearly* that you have done so.

3. To get full credit, you must show your work. Partial credit will be awarded.

4. Note that some questions have multiple parts. For some questions, these parts are independent, and so you can work on part (b) or (c) separately from part (a).

5. Some partial computations have been provided on some questions. You may find some *but not necessarily all* of these computations useful. You may assume that these computations are correct.

6. Do not dwell too long on any one question. Answer as many questions as you can.

For graders' use:

Question	Possible Points	Score
1	20	
2	20	
3	20	
4	20	
5	20	
Total	100	

1. An experiment was conducted on the effects of different sugars on the length of pea sections grown in culture. Seven (random) petri plates were used for each of the 4 treatments. The treatments with sample means and standard deviations are given below:

	control	+glucose	+fructose	+sucrose
$\bar{y}$	68.6	55.7	56.4	64.0
s	6.9	6.3	7.4	5.7

   (a) Test the null hypothesis that the population means are the same for all 4 treatments. Interpret the results. (Note SSTrt = 811.21 and SSErr = 1047.30.)

   (b) Find a 95% confidence interval for the difference between the average of the 3 sugar treatments and the control treatment. Interpret the results.

   (c) Compare all pairs of means using the LSD method with a comparison-wise error rate of 0.05. (Use the form of display given in class.)

2. An experiment was undertaken to determine the effect of relative humidity on the weight loss of beetles subject to 5 days of starvation. At each value of relative humidity, a fixed number of randomly selected beetles were placed in a container. The combined weight loss of all the beetles in each container was recorded in mg. The following data were obtained.

x_i	relative humidity	0	15	30	45	60	75
y_i	weight loss	9.4	7.6	6.5	6.5	5.0	4.1

$\sum x_i = 225$ $\sum y_i = 39.1$ $\sum x_i^2 = 12375$ $\sum y_i^2 = 272.43$ $\sum x_i y_i = 1209.$

(a) Estimate the slope and intercept from a simple linear regression analysis of these data.

(b) Estimate the underlying regression error variance and find a 95% confidence interval for it.

(c) Test the null hypothesis that the regression slope has a value of -0.10 versus the two-sided alternative. Interpret your results.

3. (a) You have a green coin and a red coin. Let p_G and p_R be the probabilities of heads for the green coin and the red coin, respectively. Tosses of the green coin are independent of tosses of the red coin. You wish to test:

     i. $H_0 : p_G = 0.5$ vs. $H_A : p_G \neq 0.5$ and

     ii. $H_0 : p_R = 0.5$ vs. $H_A : p_R \neq 0.5$

     using the Bonferroni procedure with an experiment-wise error rate of 0.05. Each coin is tossed (randomly) 100 times. The green coin comes up heads 37 times and the red coin comes up heads 60 times. Do you reject (i)? Do you reject (ii)?

(b) Pine trees are susceptible to a particular fungus. They are either healthy or diseased. A scientist wishes to compare the effects of three fungicides A, B and C on the health of the pine trees. Randomly selected six-year old pine seedlings were used in this study. Given below are the number of trees sprayed with each fungicide and the number of healthy trees:

	number sprayed	healthy trees
A	57	12
B	63	5
C	80	23

     Perform a test of the null hypothesis that the tree fungicides are equally effective. Interpret your results.

4. For each of the questions below, the *italicized* statement is either True or False. Indicate whether the statement is True or False and provide a justification for your response.

(a) An environmental scientist wishes to compare atrazine contamination in groundwater in the Wisconsin River Valley with similar contamination in the uplands above the valley. One well is dug in the valley and another well is dug in the uplands. The scientist will obtain weekly readings of atrazine concentration from each well between May 1 and Oct. 30 of a given year and will compare the atrazine levels at the two sites with a paired t-test. (The pairing will be by date.) *The results of this test will give a good indication of the difference between atrazine groundwater contamination overall in the valley and overall in the uplands.*

(b) A large population of purebred mice is available for experimentation. It is known that mouse weight is normally distributed. A random sample of 16 mice is obtained and the sample mean and standard deviation are 120 gm and 20 gm, respectively ($\bar{y} = 120; s = 20$). You wish to predict the weight of a particular (new) randomly selected mouse. Your prediction is $\hat{Y}_p = 120$ gm. *A 95% confidence interval for the predicted weight is 120 ± 43.9 or, equivalently (76.1, 163.9).*

(Hint: Think first of the error in estimating the mean and the additional error for prediction.)

5. A researcher wishes to compare the efficacy of two drugs A and B for the control of a certain cancer in laboratory rabbits. Let p_A and p_B be the efficacy rates of drugs A and B respectively. The null hypothesis is that the two drugs are equally effective; the alternative is that drug A is more effective than drug B. H_0 will be rejected if $\hat{p}_A - \hat{p}_B > 0.12$. An experiment is to be conducted so that the sample size will be n for each drug. If $p_A = 0.8$ and $p_B = 0.6$, find n so that the power is 0.95.

(Hint: The random variable of interest is $\hat{p}_A - \hat{p}_B$. Assume that n is large enough so that the normal approximation applies.)