Stat/For/Hort 571 **Clayton and Lin** **November 26, 2002**

Midterm II

Name:____

For the section that you *attend* please indicate:

Instructor:(circle one) Clayton Lin

TA: (circle one) Gaffigan Tang Zheng

Instructions:

1. This exam is open book. You may use textbooks, notebooks, class notes, and a calculator.
2. You do not need to check the assumptions of the procedures that you use unless you are specifically directed to do so. In checking for normality it is sufficient to construct a stem and leaf display. It is *not* necessary to make a normal scores plot.
3. 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.
4. To get full credit, you must show your work. Partial credit will be awarded.
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.
7. 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).

For graders' use:

Question	Possible Points	Score
1	20	
2	20	
3	24	
4	20	
5	16	
Total	100	

1. A study was conducted to compare the wing lengths of several species of bat. For each species, several bats were trapped and their wing lengths were measured. The data are summarized below. Let x_{ij} be the wing length for the jth bat corresponding to the ith species.

Species	Number of Bats	$\bar{x}_{i\cdot}$
A	4	10.656
B	5	10.142
C	4	7.631
D	5	7.534
E	3	10.063

You may also use the fact that $\sum_{i=1}^{k}\sum_{j=1}^{n_i} x_{ij}^2 = 1852.599$ and $\sum_{i=1}^{k}\sum_{j=1}^{n_i} x_{ij} = 191.7217$.

(a) Complete the ANOVA table below, and conduct a test of the null hypothesis that the population mean wing lengths corresponding to the 5 species are all equal, versus the alternative that they are not all equal. (Hint: Begin by calculating the Total Sum of Squares.)

Source	df	SS	MS
Insecticide			
Error			3.968
Total			

(b) Consider the underlying variance of the observations: σ^2. The researchers hypothesize that $\sigma^2 = 8.5$. Test this against the two-sided alternative.

2. An entomologist is studying the behavior of wasps. The main purpose of the study is determining whether the wasps have a right or left "preference." The experiment is conducted as follows. A wasp is placed at the end of a long tube. At the other end of the tube is a T-shaped fitting such that when a wasp gets to that end of the tube, it can turn left or it can turn right. The researchers will experiment with 11 wasps. Each wasp will be observed once, and the wasps are believed to behave independently. Let p represents the probability that a wasp turns to the right. Based on previous studies, the null hypothesis is that $p = 0.65$. The researchers will reject $H_0 : p = 0.65$ if the number of wasps turning to the right is either 0, 1, or 11.

   What is the probability of a Type I Error (i.e. what is α) for their rejection rule?

3. In a study of plant disease epidemiology, researchers inoculated several potato plants with a pathogen and then recorded how long it took before each of the plants exhibited disease symptoms. The researchers were particularly interested in comparing these times for two different varieties of potato: Russet Burbank (RB) and Yukon Gold (YG). The data are given below:

RB	YG
9	52
7	88
6	12
11	72
	66
	8
	14
	91

Here are some summary statistics for these data:

	RB	YG
Sample Mean	8.25	50.375
Sample Variance	4.9167	1195.982

(a) The investigators in this experiment are unwilling to assume that the two groups have equal variance. However, they are willing to assume any necessary normality. Therefore, they proceed as follows:

$$T' = \frac{8.25 - 50.375}{\sqrt{\frac{4.9167}{4} + \frac{1195.982}{8}}} = -3.43$$

Complete this test.

(b) Upon further reflection, the investigators have decided that they are also uncomfortable with the assumption of normality. Perform a test to see whether there is a significant difference between the two varieties; your test should not require the assumption of normality.

(c) Of the two tests in (a) and (b) that you have conducted, which one do you believe is the more appropriate test to use? Explain your response.

4. (a) A study was conducted to examine the proportion of chickens that are contaminated with salmonella in different processing plants. Two processing plants were studied. In the first plant, 60 chickens were randomly sampled, and 35 were found to be contaminated; in the second plant, 75 chickens were sampled, and 30 were found to be contaminated. Find a 90% confidence interval for the difference in probabilities of contamination for the two processing plants.

   (b) State the assumptions necessary for constructing your confidence interval, and, where possible, justify them.

5. I am drawing tickets from a box. My null hypothesis is that the box looks like:

$$\boxed{0}\quad\boxed{2}\quad\boxed{7}$$

My alternative hypothesis is that the box looks like:

$$\boxed{0}\quad\boxed{2}\quad\boxed{7}\quad\boxed{7}\quad\boxed{7}\quad\boxed{7}\quad\boxed{7}$$

To test my null hypothesis, I will randomly sample a ticket from the box, replace the ticket, and repeat this so that I have, in total, 100 observations. Let $\bar{X}$ represent the sample mean of the tickets that I have observed. Find the rejection region in terms of $\bar{X}$ if $\alpha = 0.01$, and state the assumptions you make in determining that rejection region.