

Stat 401 A XM Homework 6
On-Campus Due Date: Wednesday, October 15
Off-Campus Due Date: Wednesday, October 22

1. We conducted a paper airplane experiment in lab on October 6 to determine if there was a difference in mean flight distance among three paper airplane designs and to describe any differences in as much detail as possible. This problem focuses on the analysis of the data that we collected in lab. The program *airplane.sas* on the course web site will help you answer the following questions. You may choose to add code to the program in some instances.

a) One way to check the appropriateness of the one-way ANOVA assumptions of normality and constant variance for all groups is to examine residuals. Residuals are formed by computing observed values minus their estimated means according to the model. In one-way ANOVA, the estimated mean value for an observation in group i is simply the average of all the observations in group i . Compute residuals for (i) a Dart that flew 260 inches, (ii) a Flyer that flew 200 inches, and (iii) a Floater that flew 200 inches.

b) If the one-way ANOVA model assumptions of normality and constant standard deviation are approximately satisfied, (i) the collection of all the residuals should have a distribution that is approximately normal, and (ii) the standard deviation of the residuals in each group should be about the same. Does this appear to be the case? Examine the stem-and-leaf plot, the box plot, the normal probability plot, and the residual plot in the SAS output to help you decide.

c) Which of the four plots examined in part (b) helps you determine whether the constant standard deviation assumption is approximately satisfied?

d) In the case of one-way ANOVA, the standard deviations of the observations in each group can be compared to assess whether the constant standard deviation assumption is approximately satisfied. Give the standard deviations for each of the groups in this problem and explain whether you are willing to accept the constant standard deviation assumption.

e) Could the mean flight distances for the three plane designs be the same? Provide a test statistic, p -value, and a conclusion.

f) Determine a 95% confidence interval for the mean flight distance of each airplane design.

g) Fill in the blanks in the following sentence: The mean flight distance for the Dart design is significantly _____ than the mean flight distance for the Floater design (t -statistic=_____ with degrees of freedom _____ and two-sided p -value=_____).

h) Fill in the blanks in the following sentence: The mean flight distance for the Dart design is estimated to be _____ inches longer than the mean flight distance for the Floater design (95% confidence interval _____ to _____ inches).

i) The previous two problems involve the comparison of the Dart and Floater designs. Provide analogous statements for the Dart vs. Flyer comparison.

j) Provide a 95% confidence interval for the contrast that compares the average of the Dart and Flyer mean flight distances to the mean flight distance of the Floater.

2. Do Chapter 6 Problem 15 on page 169.