

## Math 160/263 – Assignment #6

Title:  $\chi^2$  and Analysis of Variance

Worksheets: data6074.MTW, data6074a.MTW

The purpose of this assignment is to familiarize you with Minitab's capability to do  $\chi^2$  tests and Analysis of Variance for tabulated data. The assignment uses material from Chapters 20 and 22 of the Minitab Manual.

On April 10, 1912, the RMS Titanic set out from England on her first voyage across the North Atlantic. She was thought to be unsinkable, but on April 14, at 11:30 p.m she struck an iceberg and less than three hours later she sank, taking her captain and about 1500 of her 2200 passengers and crew with her.

We wish to explore the question of whether survival rates for passengers were related to factors such as class, gender, or age. The data on survival rates is given in the file data6074.MTW. (Source: The Mathematics Teacher, *Titanic: A Statistical Exploration* vol 92 no.8, November, 1999 and from *Report of a Formal Investigation into the Circumstances Attending the foundering . . . of the British Steamship "Titanic"* His Majesty's Stationary Office, London, 1912.)

Columns C1-C3 in data6074.MTW contains the number of passengers and crew broken down by two factors which appear to have influenced the survival rates.

Status: Man, Woman or Child

Class: First Class Passenger, Second Class Passenger, Third Class Passenger, or Crew Member.

### $\chi^2$ with Minitab

1. Because two factors appear to influence survival rates, we will explore the data using the  $\chi^2$  procedure. We first look at the relationship between status and survival. Use **Stat**  $\Rightarrow$  **Tables**  $\Rightarrow$  **Chi-square Test (Two-Way Table in Worksheet)** and select the columns containing the data by status to produce a Chi-square table of the data.
2. State the null and alternate hypothesis for this test. Give the statistic, the p-value, and interpret the results in terms of the null and alternate hypotheses.

3. The other factor influencing survival rate is class. Use **Stat**  $\Rightarrow$  **Tables**  $\Rightarrow$  **Chi-square Test (Two-Way Table in Worksheet)** and select the columns containing the data by class to produce a Chi-square table, examining the relationship between survival and class.
4. State the null and alternate hypothesis for this test. Give the statistic, and the p-value.
5. Interpret the results of this test in terms that can be understood by someone who knows no statistics.

Analysis of Variance with Minitab  
(263 Students only)

A single can of dried eggs was stirred well. Samples were drawn and a pair of samples (claimed to be of two “types”) was sent to each of six commercial laboratories to be analyzed for fat content. Each laboratory assigned two technicians, who each analyzed both “types” twice. The fat content should be the same for all samples since they were drawn from the same can. Thus the experiment is really a study of the labs’ performance. (Source, *Statistics in Biology*, Bliss, New York: MacMillan, 1967). The data from this experiment is in data6074a.MTW.

6. State the null hypothesis and the alternative hypothesis for this experiment.
7. Use **Stat**  $\Rightarrow$  **ANOVA**  $\Rightarrow$  **One-Way Analysis of Variance** to generate the Analysis of Variation table and the confidence intervals for each lab. In the “One-Way Analysis of Variance” dialog box enter “Fat Content” as the response variable and “Lab” as the factor. Enter 95.0 in the “Confidence level” window.
8. Give the value of the F-statistic and the p-value.
9. Interpret the results of this test in terms of the null and alternate hypotheses.
10. What do the confidence levels printed out by Minitab tell you?
11. Save, edit, and print out your report for submission.