**Exercise 9.68**

In the study *Germination and Emergence of Broccoli*, conducted by the Department of Horticulture at Virginia Tech, a researcher found that at 5°C, 10 broccoli seeds out of 20 germinated, while at 15°C, 15 out of 20 germinated. Compute a 95% confidence interval for the difference between the proportions of germination at the two different temperatures and decide if there is a significant difference.

**Solution**

The confidence interval of the difference between these two studies can be computed using the following formula:

For these experiments:

Plugging into the equation we get:

Therefore, the 95% confidence interval for the difference between these two experiments is . This interval includes 0, therefore we cannot show that there is a significant difference at the 95% confidence level.

**Exercise 10.41**

A study was conducted by the Department of Biological Sciences at Virginia Tech to determine if there is a signiﬁcant diﬀerence in the density of organisms at two diﬀerent stations located on Cedar Run, a secondary stream in the Roanoke River drainage basin. Sewage from a sewage treatment plant and overﬂow from the Federal Mogul Corporation settling pond enter the stream near its headwaters. The following data give the density measurements, in number of organisms

per square meter, at the two collecting stations:

Can we conclude, at the 0.05 level of signiﬁcance, that the average densities at the two stations are equal? Assume that the observations come from normal populations with diﬀerent variances.

**Solution**

The first step is to state the hypothesis. The null hypothesis for this problem is that the population means between the two stations are equal, with the alternative being that they are different. Formally, this can be stated as:

To compute the test statistic, we use the following formula:

For this problem, and . Using Excel, and . The means for stations one and two, computed again in Excel, are 9897.5 and 4120.833 respectively. Plugging into the above formula, we get:

The next step, because the variances of the populations are both unknown and unequal, is to calculate the degrees of freedom, which can be done using the following formula:

For this problem, and . Using Excel, and . Plugging these values into the above equation we get:

Using this value, we can determine that the critical region at the 0.05 level of signiﬁcance is or . The calculated test statistic is inside this critical region; therefore, we reject and conclude that .

**Exercise 9.77**

Construct a 98% conﬁdence interval for in Exercise 9.42 on page 295, where and are, respectively, the standard deviations for the distances traveled p er liter of fuel by the Volkswagen and Toyota mini-trucks.

**Solution**

Calculating a confidence interval for a ratio of variances can be done by using the following formula:

From exercise 9.42, and . Additionally, and . To get the f-values, we first determine , then using the following R code:



We find that and . Plugging all these numbers in we can solve the above equation:

Converting this ratio to cover the standard deviation instead of the variance, we get:

Therefore, the 98% conﬁdence interval for is 0.5494 to 2.6901.

**Summary**

For this week’s assignment we had to solve three separate exercises. The first required us to calculate a confidence interval for the difference between two binomial studies. The second asked us to determine whether we could reject the hypothesis that the mean of measurements at two different measurement stations. The final exercise required us to compute the confidence interval for the ratio between the standard deviations of two different samples.