Grace Auld

Hope Barnhart

Ryleigh Turner

Written Paper Project

In this paper we will be discussing confidence intervals. To be more specific, we will be discussing confidence intervals for μ1-μ2 when the standard deviation isn’t known. The data that was used for the calculations was taken from a survey that was given to all MATH 171 students at the beginning of the semester. Our continuous random variable is the weights of males and females.

We calculated n1 for the female population to be 53, while n2 for the male population is 43. The sample mean for the female population was 151.28 and 181.93 for the male population. The sample standard deviation for the female population 29.78 and 36.76 for the male population. To calculate these values we used the calculator. On the calculator we went to STAT, EDIT, 1:Edit, and entered all the female weight values into list 1. Then, we went to STAT, CALC, 1:1-Var Stats, highlighted List 1 and pressed calculate. By doing this, we were given n, the sample size for the female population, the x̅, the sample mean for the female population and s (the sample standard deviation) for the female population. The same process was used to calculate these same values for sample two, which is the male population.

The mean for population 1 represents the average female weight for all the females at Longwood University who took part in the survey that was presented to all MATH 171 students. The mean for population 2 represents the average male weight for all the males at Longwood University who took part in the survey that was presented to all MATH 171 students. There is a difference of 30.65 between the mean of population 1 and 2 this is because the mean value for male weight is higher than the mean value for female weight. The mean weight for male’s is higher because all of the weights for males were higher than the females in general.

A confidence interval measures whether a parameter for a statistic falls within that interval. A confidence interval defines a range of values in which you can be certain that the estimate is true. The purpose of calculating confidence intervals shows whether there is a difference between the parameter and the statistic or not. Finding a difference allows us to make a conclusion about the confidence interval. Some conclusions can be that the population 1 is greater than the population 2, the population 2 is greater than population 1, or there is not enough evidence to conclude a difference between the two. The information it gives is applicable to real life scenarios. Calculating the confidence intervals for this paper itself is a real life application as it has to do with weights for females and males.

Since the sample standard deviations are not known we are working with a Student’s Sample t Distribution. Our sample sizes are large enough for us to assume the distribution to be normal because both n1 and n2 are greater than 30.

For the 99.9% confidence interval we calculated the lower value to be -55.29 and the upper value to be -6.01. For the 95% confidence interval we calculated the lower value to be -44.67 and the upper value to be -16.63. Lastly, for the 90% confidence interval we calculated the lower value to be -43.34 and the upper value to be -18.96.

In order to calculate these intervals by hand, we first need the degrees of freedom. Since there are two different sample sizes, we use the smallest which is 43. We then subtract 1 from 43 to get the value 42. We next look at the t table and use the value 40 since 42 was not on the table and we find the t values that correlate with each confidence interval. The t value for the 99.9% confidence interval was 3.551, for the 95% confidence interval the t value was 2.021, and for the 90% confidence interval the t value was 1.684. We then multiply these values individually with the point estimate. When we do this we get the value 54.64 for the 99.9% confidence interval, 14.02 for the 95% confidence interval, and 11.69 for the 90% confidence interval. These are our E values which are our maximal margin of error. In order to get the lower value for our intervals we take x̅1and subtract it from x̅2and then subtract that value from E. Then to get the upper values we take E and value from x̅1minus x̅2. x̅1 minus x̅2 is how we get our point estimate and this value is -30.65.

In this particular scenario we don’t know the values of either population means and are only given the sample means. The confidence intervals we calculated contain only negative numbers. With only negative numbers we can conclude that the second sample of data, the male population is greater than the first sample of data, the female population. As the confidence intervals decreased the width of the confidence interval got narrower. With a narrower range we have less confidence that μ is in the interval. Changing the level of confidence will not affect whether the means were different or not, but changing the confidence levels will either result in a narrower or wider width. Since all of our intervals were negative numbers, this shows μ1<μ2. This means our populations means remained the same in all of the confidence intervals.

Before calculating the confidence intervals we expected that μ2 would always be greater than μ1. All three confidence intervals, 99%, 95%, and 90% contained all negative numbers. When a confidence interval contains all negative numbers that means that μ2>μ1. By having all negative numbers this proves our expectations to be true. One of the limitations to a confidence interval is that we have a wide range of data where our mean value can fall. A limitation is that it gives us a range of values and not an exact value. You may want to know the difference and not range of values. You can only be so certain in the confidence interval.

This paper gave us a better understanding on how to calculate confidence intervals. This paper gave us practice calculating confidence intervals with the difference in weights between females and males.