Minitab Exercise 7 – Confidence Interval for means, 1 sample test for means
Rev 2-16 (Minitab 17)

In this session you will

- Generate confidence intervals for a mean (σ known)
- Generate confidence intervals for a mean with a small sample size (σ unknown)
- Perform hypothesis testing on a single sample mean.

Open Minitab worksheet: **Exercise 7 problem data2.mtw**

Step 1. Work an confidence interval problem- known sigma (by hand then in Minitab)

A) The percentage of shrinkage on drying is an important property of plastic clays. Fifty test specimens were recently taken showing an average percentage shrinkage of 52%. Historically, the standard deviation for test of this family of clays has been approximately 2.8%. With 99% certainty, what is the confidence interval for the true average percent shrinkage for this type of clay?

Verify your answers with Minitab. The data for this problem is in the Problem Data worksheet, in the Clays column. Note that the data has been entered with the percentage shrinkage in decimal format. Be sure to enter sigma as .028.

Stat>Basic Statistic>1 Sample Z
Select **One or more samples, each in a column** in drop-down menu
Samples in columns: Select variable **clays**
Standard deviation: 0**.028**
Options: confidence level: **99.0**
OK

Correct your calculations as necessary.

Step 2. Problems on Hypothesis testing – One sample means, Normal (Large sample size)

Work these manually, then in Step 3, check your work using Minitab and correct as necessary.

B) The percentage of shrinkage on drying is an important property of plastic clays. Fifty test specimens were recently taken showing an average percentage shrinkage of 52%. Historically, the standard deviation for test of this family of clays has been approximately 2.8%. The manufacturer of the clay claims the average shrinkage for his product is 51%. Can you reject his claim with a 99% confidence?

$H_{0:}$

$H_{a:}$

$\alpha =$

Test Value $= Z = \dfrac{\bar{x} - \mu}{\sigma / \sqrt{n}} =$

P value =

Conclusion:

Could you reject the claim at a 95% level of confidence?

C) Red blood cell concentrations average 5.2 million red blood cells per milliliter of blood for healthy adult men. Studies have shown that high endurance athletes have a significantly higher red blood count. A study of 55 weekend softball players showed an average count of 5.6 million cells milliliter of blood with a standard deviation of 2.3. With 95% confidence what conclusion can be made about whether or not the weekend athletes have a higher blood count than the average healthy adult man?

$H_{0:}$ $H_{a:}$

$\alpha =$

Test Value $= Z = \dfrac{\bar{x} - \mu}{\sigma / \sqrt{n}} =$

P value:

Conclusion:

If α = 10%, would you reject the null hypothesis? Y / N

What is the smallest level of α, that would lead to rejection of the null hypothesis? ______

Step 3. Minitab test for means, single sample case

For Problem B:

> Choose **Stat>Basic Statistic>1 Sample Z**
> Select **One or more samples, each in a column** in drop-down menu
> Samples in columns: Select variable **clays**
> Standard deviation: 0**.028**
> Perform Hypothesis test - checked
> Hypothesized mean**: 0.51**
> **Options**: confidence level: **99.0**
> Alternative**: Mean ≠ hypothesized mean**
> **OK**

Compare results to your calculations. Notice that the output does not tell you what your conclusion is. It gives you the 99% confidence interval about μ_0, and the Z value of your test statistic. Remember that the p value is the probability of getting a value more extreme than your test value. (Your p value is greater 1%. At α=1% you would not reject as the p value is not lower than α. If α=5%, reject the null hypothesis only if the p value is less that 5%.)

For problem C, you will use the Summarized Data fields rather than Samples in columns. Enter the sample size and mean. You will also need to change the Options. Compare result to your calculations.

Step 4. Problem – 1 sample means Confidence interval – small sample size

D) In laboratory work, it is desirable to run careful checks on the variability or readings produced on a single sample. In determining the amount of chlorine in drinking water, the same sample was run through the lab testing eight times at random intervals. The readings, in parts per million were

6.44 6.59 6.58 6.33 6.38 6.61 6.55 6.52

$\bar{x} = 6.50$ $\quad s = 0.1045$

What is the 90% confidence interval for the true mean?

Df = n-1 = α =

from table, $t_{\alpha/2} =$

lower limit $\bar{x} - t_{\alpha/2}\dfrac{s}{\sqrt{n}} =$

upper limit $\bar{x} + t_{\alpha/2}\dfrac{s}{\sqrt{n}} =$

Check your work in Minitab. Enter your data in a new column.

> Choose **Stat>Basic Statistics>1-Sample t**
> Select **One or more samples, each in a column** in drop-down menu
> Samples in columns: *select column you entered*
> Click **Options: Confidence Level: 90.0 OK OK**

Step 5. Another Problem – Graphical Summaries

According to the manufacturer's specifications, the efficiency rating of a light bulb has a mean of 10.3 lumens per watt. A test is conducted of ten light bulbs with the results given below.

E) Assuming normally distributed data, what is the 95% confidence interval for the mean of the efficiency of the bulbs? $\bar{x} = 10.326$ $s = 0.0372$

10.30 10.32 10.35 10.32 10.27 10.34 10.27 10.38 10.36 10.35

In Minitab, enter the data in a new column. This time verify your answer using **Stat>Basic Statistics> Graphical Summary**. Just select your variable and be sure to enter the confidence level.

F) Can you reject the claim, with a 95% level of confidence that the true mean is equal to 10.3?
(use 2 sided test)

$H_{0:}$ $H_{a:}$

$\alpha =$ n= d.f.=

Test Value = $t_{test} = \dfrac{\bar{x} - \mu}{\sigma / \sqrt{n}} =$

Because of the difficulty in determining p from the t tables, often t_{test} will often be compared to a $t_{critical}$ value when working problems manually. $t_{critical}$ is the t value associated with alpha (for a one sided test) or alpha/2 (for a two sided test.) If the t_{test} value is further out than the null hypothesis will be rejected.

Reject null if $|t_{test}| > t_{critical}$ Where $t_{critical} = t_{\alpha/2,v}$ for the two sided test

$t_{critical}$ = ____________

Statistical conclusion:

Practical conclusion:

Verify your t_{test} value using **Stat>Basic Statistics>1 Sample t.** Correct if necessary.

From the Minitab output, what is the p value? ____________

Comparing the p value to α, you should come to the same conclusion.

When using software, the accepted practice is to focus on the p value.