MATHEMATICS 360-255-LW
Quantitative Methods II
Martin Huard
Fall 2009

Inferences for μ with Excel

Confidence intervals for the mean

Example

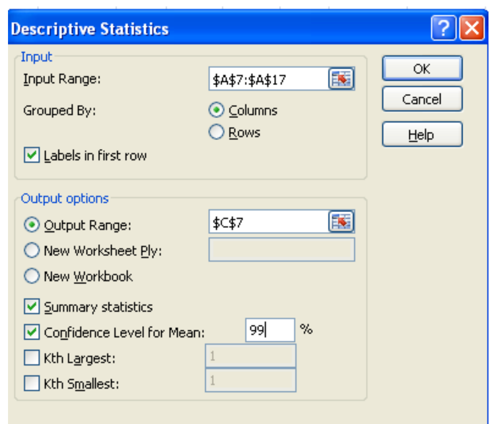
The height (in m) of 10 students chosen at random at SLC was measured. Here are the results.

1.55 1.68 1.70 1.72 1.74 1.79 1.80 1.82 1.83 1.94

Find a 99% confidence interval for the mean height of students at SLC, assuming that the height of SLC students are normally distributed.

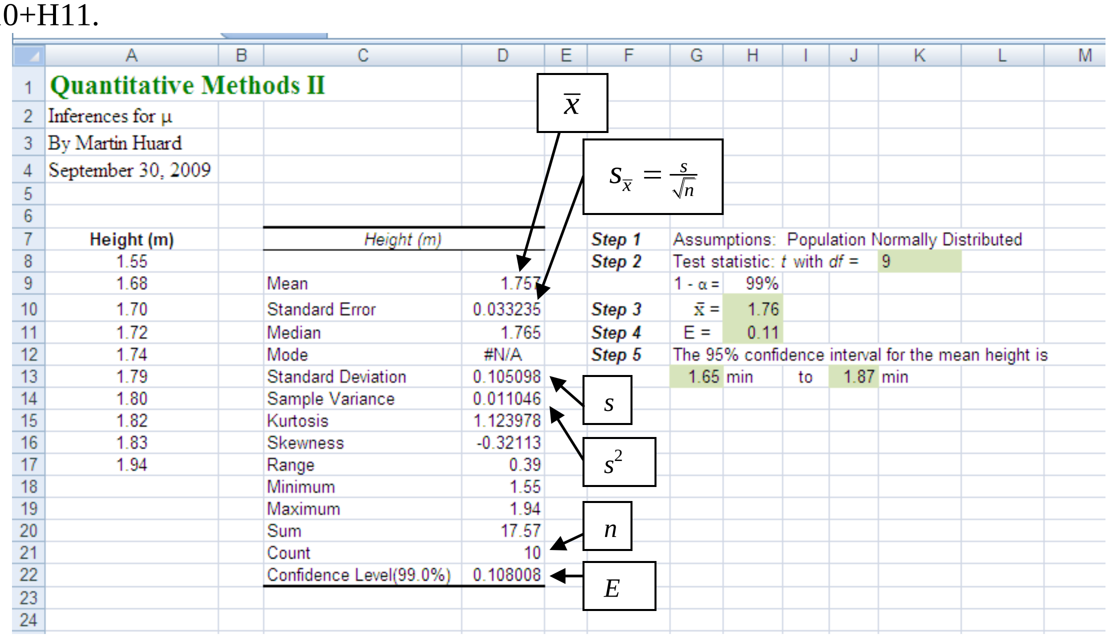
Make the usual heading in cells A1:A4. In cell A7 write “Height (m)”. Enter each of the above numbers below this (cells A8:A17).

To construct the interval, go to DATA – DATA ANALYSIS – DESCRIPTIVE STATISTICS to access the following dialogue box. If you cannot find DATA ANALYSIS, go to [Office button] - EXCEL OPTIONS – ADD-INS and include the ANALYSIS TOOLPAK.



For the INPUT RANGE, we use the heights in cells A7:A17. Click on LABELS IN FIRST ROW and SUMMARY STATISTICS. Use C7 for the OUTPUT RANGE, and make sure that you put 99% for the CONFIDENCE LEVEL FOR MEAN. Click OK, and then adjust the columns widths accordingly.

To construct the confidence interval, go through the five steps. Your results should look like this, where the shaded cells indicate that the result was obtained with a cell reference or with a formula. For the mean, it is cell D9, for *E* it is cell D22, and the interval itself is given by H10-H11 and H10+H11.



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Quantitative Methods II												
2	Inferences for μ												
3	By Martin Huard												
4	September 30, 2009												
5													
6													
7	Height (m)		*Height (m)*			**Step 1**	Assumptions: Population Normally Distributed						
8	1.55					**Step 2**	Test statistic: *t* with *df* =			9			
9	1.68		Mean	1.757			1 - α =	99%					
10	1.70		Standard Error	0.033235		**Step 3**	$\bar{x}$ =	1.76					
11	1.72		Median	1.765		**Step 4**	E =	0.11					
12	1.74		Mode	#N/A		**Step 5**	The 95% confidence interval for the mean height is						
13	1.79		Standard Deviation	0.105098			1.65	min	to	1.87	min		
14	1.80		Sample Variance	0.011046									
15	1.82		Kurtosis	1.123978									
16	1.83		Skewness	-0.32113									
17	1.94		Range	0.39									
18			Minimum	1.55									
19			Maximum	1.94									
20			Sum	17.57									
21			Count	10									
22			Confidence Level(99.0%)	0.108008									
23													
24													

Note: This method gives the confidence interval using the *t* statistic. For a confidence interval with the *z* statistic (when σ is known) then use the CONFIDENCE command to find E. Note that it asks for α, not the level of significance $1-\alpha$, so for a 99% confidence interval, you would enter 0.01 (or 1-H9). The standard deviation and the size can be found using the values calculated in Descriptive Statistics above (cells D13 and D21).

Hypothesis testing for the mean

Example

The height (in m) of 10 students chosen at random at SLC was measured. Here are the results.

1.55 1.68 1.70 1.72 1.74 1.79 1.80 1.82 1.83 1.94

Test the claim that the average height of an SLC student is 1.7 meters at the 1% level of significance, assuming that the height of SLC students are normally distributed.

For this, we start in the same way as before, that is, we use DESCRIPTIVE STATISTICS to obtain the mean and standard deviation of our sample. Next, go through the five steps. For the Greek letters μ and α and the ≠ symbol, you can find them by going to INSERT – SYMBOL and going to SYMBOL in FONT. The whole Greek alphabet should be there.

To find the value of *t*, we use the formula $t = \frac{\overline{x}-\mu}{\frac{s}{\sqrt{n}}}$. Using cell references, this becomes (D9-I8)/D10 where D10 is the standard error $\frac{s}{\sqrt{n}}$. For the *t* critical, we use the function TINV, where for probability we have α (H12) and for the degrees of freedom $n-1$ (D21-1). If using the *p*-value approach, we use the function TDIST to find the *p*-value, where we have the *t* value just calculated for *x* (H14), the degrees of freedom are the same as before, and for tails, we will write 2 since this is a two tailed test. Note that this last command will only work it *t* is positive. If it is not, then you can enter –H15 so that it will become positive. Your results should look like this (if using the classical approach):

6								
7	**Height (m)**	*Height (m)*		***Step 1***	Assumptions: Population Normally Distributed			
8	1.55			***Step 2***	H_0:	μ =	1.7	m
9	1.68	Mean	1.757		H_A:	$\mu \neq$	1.7	m
10	1.70	Standard Error	0.033235	***Step 3***	Test statistic: *t* with *df* =			9
11	1.72	Median	1.765		Two-tailed Test			
12	1.74	Mode	#N/A		α =	5%		
13	1.79	Standard Deviation	0.105098		$t_{(df,\alpha/2)}$ =	2.262		
14	1.80	Sample Variance	0.011046	***Step 4***	t =	1.72		
15	1.82	Kurtosis	1.123978	***Step 5***	*t* is not in the critical region			
16	1.83	Skewness	-0.32113		Fail to reject Ho			
17	1.94	Range	0.39		There is not sufficient evidence, at the 5% level			
18		Minimum	1.55		of significance to conclude that student heights			
19		Maximum	1.94		are different than 1.7 m.			
20		Sum	17.57					
21		Count	10					
22		Confidence Level(99.0%)	0.108008					

Note: this test works in the same way when σ is known. We simply replace the *t* by *z* and use the commands NORMSINV and NORMSDIST instead of TINV and TDIST.