

XL8A-V0R Create Confidence Intervals using Excel 2013 1

## Create Confidence Intervals Using Excel 2013

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*Director, W. M. Keck Statistical Literacy Project*

Slides, Output and Data at [www.StatLit.org/pdf/Excel2013-Create-Confidence-Intervals-Slides.pdf](http://www.StatLit.org/pdf/Excel2013-Create-Confidence-Intervals-Slides.pdf)  
[www.StatLit.org/pdf/Excel2013-Create-Confidence-Intervals-Results.pdf](http://www.StatLit.org/pdf/Excel2013-Create-Confidence-Intervals-Results.pdf)  
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## Assignment

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Input data (Pulse.xls with 240 rows)  
[www.StatLit.org/xls/Excel2013-Create-Confidence-Intervals-Data.xls](http://www.StatLit.org/xls/Excel2013-Create-Confidence-Intervals-Data.xls)

Compete all five sheets (one sheet per tab).

1. Single sample: Create slides 5 and 7.
2. Two samples: Create slides 9, 10 and 11.  
 Note: slide 10 involves an array formula.
3. Upload completed spreadsheet.

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## 1. Using Excel to Build One-group Margin of Error

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For single-sample (1-group) confidence intervals

1A: Use Excel Toolpak Descriptive-Statistics. Excel describes the Margin of Error as the Confidence Level (95%).  
 [Behaves like a command: no auto-update]

1B: Use functions: CONFIDENCE (or STDEV and COUNT) and AVERAGE.  
 Recommended since it auto-updates.

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## 1A: Margin of Error using Descriptive Statistics

From Data ribbon, select **Data Analysis**  
 From Data Analysis menu, select **Descriptive Statistics**.

Check the check box: "Labels in 1<sup>st</sup> row."  
 Enter input range. Check box for "Labels in 1<sup>st</sup> row." Set "Output Range" to J19. Check "Summary statistics" and "Confidence level." Press OK.

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## 1A: Margin of Error using Descriptive Statistics

Row	J	K	L	M	N	O	P	Q	R
18									
19		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
20									
Mean		0.46	0.28	0.59	0.37	3.48	2.59	65.40	5.51
Standard Error		0.03	0.03	0.03	0.03	0.08	0.09	0.76	0.08
Median		0	0	1	0	4	2	65	6
Mode		0	0	1	0	3	2	76	6
Standard Deviation		0.50	0.45	0.49	0.48	1.21	1.42	11.79	1.16
Sample Variance		0.25	0.20	0.24	0.23	1.46	2.03	139.08	1.36
Kurtosis		-1.99	-1.03	-1.87	-1.70	-0.33	-1.22	0.39	0.21
Skewness		0.17	0.99	-0.38	0.56	-0.57	0.43	0.34	0.15
Range		1	1	1	1	4	4	66	6
Minimum		0	0	0	0	1	1	34	2
Maximum		1	1	1	1	5	5	100	9
Sum		110	67	142	88	835	622	15697	1323
Count		240	240	240	240	240	240	240	240
Confidence Level(95%)		0.06	0.06	0.06	0.06	0.15	0.18	1.50	0.15

**Confidence Level: Margin of Error = T\*StdDev()/Sqrt(n)**

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## 1B: Margin of error (ME) using CONFIDENCE Function

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**CONFIDENCE.T:** Population std deviation unknown. This is the most conservative: biggest ME. Approaches confidence.norm as sample size increases.

**CONFIDENCE.NORM:** Population standard deviation is known or the sample statistic is a proportion.

Excel CONFIDENCE functions return Margin of Error.  
 =Confidence.T (alpha, Sample std. deviation, sample size)  
 =Confidence.Norm (alpha, Pop. std. deviation, sample size)  
 If CL=95%, α= .05. Confidence.T = (T/Z)\*Confidence.Norm

Use Confidence.Norm for proportions or size > 30

**1B: Confidence Intervals using Stdev.S and Confidence.T**

Row	J	K	L	M	N	O	P	Q	R	Formula in col S is for col R
12								Alpha	0.05	Manual Entry
13								Sample size	240	=COUNTA(A2:A241)
14										
15	Question	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Question
16	Average	0.46	0.28	0.59	0.37	3.48	2.59	65.4	5.51	=AVERAGE(H2:H241)
17	StDev Sample	0.50	0.45	0.49	0.48	1.21	1.42	11.79	1.16	=STDEV.S(H2:H241)
18	Stdev.S and confidence.T is most conservative								0.15	Enter dollar signs (\$) as shown
19	Margin Error	0.06	0.06	0.06	0.06	0.15	0.18	1.50	0.15	=CONFIDENCE.T(\$R12,R17,\$R13)
20	Cnflnt: Up-Right	0.52	0.34	0.65	0.43	3.63	2.77	66.90	5.66	=R16+R19
21	Cnflnt:Low-Left	0.39	0.22	0.53	0.31	3.33	2.41	63.90	5.36	=R16-R19

Average gives proportion if binary data is coded 0 or 1

**2. Using Excel to Build Two-group Margin of Error**

For two-group confidence intervals of stacked data (one subject per row) without pre-sorting:

2A: Use Average, Stdev and Count in pivot table; [Behaves like a command: no auto update]

2B: Use AverageIF and CountIF functions. Use Stdev(IF) within an array function.

2C: Use Data functions: dAverage, dStdev and dCount.

\*\* If stacked data is sorted contiguously, one can build two confidence intervals using two one-group approaches.

**2A: Build 2-Grp Conf. Intervals using Pivot Table Statistics**

Row	J	K	L	M	N	Formula for cell to the left
17	1	Go to Step 2	Confidence Level	0.95	Manual entry	
19			Q1 if Q2=0	Q1 if Q2=1	Q1	
20	6	Margin of Error	7%	12%	6%	=CONFIDENCE.NORM(1-\$N17,\$N32,\$N33)
21						Use Confidence.T if data is quantitative
22					3%	=ABS(M31-L31)
23					52%	=N31-N20
24					40%	=N31-N20
25						Note: Formulas in columns L and M are determined by those in column N
26	7	Confidence intervals overlap/touch?	YES		Manual entry	
27		Is difference statistically significant?	NO		Manual entry. Use overlap test	
30		Values	0	1	Grand Total	
31	3	Average of Q1	0.45	0.48	0.46	
32	4	StdDev of Q1_2	0.50	0.50	0.50	
33	5	Count of Q1_3	173	67	240	

**2B: Build 2-Grp Conf. Intervals. Use AverageIf, CountIf & {Stdev(IF)}**

Row	J	K	L	M	N	Formula for cell to the left
15	1	Confidence Level	0.95	Z (2 tail)	1.960	=NORM.S.INV(0.5+L15/2)
17		L18: Change 1 to 0	Q2=0	Q2=1		Drag M18 to L18. Change =1 to =0
18	2	Q1 average	45%	48%		=AVERAGEIF(\$B2:\$B241,"=1",\$A2:\$A241)
19						Pull left
20		L21: Change 1 to 0				Do not enter braces shown below!
21	3	Q1 Stdev	50%	50%		{=STDEV(IF(\$B2:\$B241=1,\$A2:\$A241))}
22						Pull left
23		L24: Change 1 to 0				Use CTRL-SHIFT-ENTER to create braces!
24	4	Q1 sample size	173	67		=COUNTIF(\$B2:\$B241,"=1")
25	5	Q1 Margin of Error	7%	12%		=N15*M21/SQRT(M24)
26						Pull left
27	6	Q1 Cnf Int Up-Right	53%	60%		=M18+M25
28		Q1 Cnf Int Low-Left	38%	36%		=M18-M25
29	7	Overlap or touch?	YES			
30		Is difference stat. significant?	NO			Use overlap test
31						Change =1 to =0 in L18, L21 and L24.

**2C: Build 2-Grp Conf. Intervals Use dAverage, dStdev & dCount**

Row	J	K	L	M	N	Formula for cell to the left
15			Confidence Level	0.95	Manual Entry	
16			Z (2 tail)	1.960		=NORM.S.INV(0.5+M15/2)
18		Q1	Q2	Q2		subgroups using Q2 data
19		Confidence Interval	0	1		
21		Average	0.45	0.48		=DAVERAGE(\$A\$1:\$H\$241,"Q1",M\$18:M\$19)
22		Std. Deviation	0.50	0.50		=DSTDEV(\$A\$1:\$H\$241,"Q1",M\$18:M\$19)
23		Count	173	67		=DCOUNT(\$A\$1:\$H\$241,"Q1",M\$18:M\$19)
25		95% Margin of Error	0.11	0.17		=SM16*SQRT(M22/M23)
27		Lower Limit	0.35	0.31		=M21-M25
28		Upper Limit	0.56	0.65		=M21+M25
30		Overlap	Yes			Manual entry (Yes or No)
31		Statistically-significant difference	No			Manual entry (Yes or No) Use overlap test

**Statistical Significance and Confidence Intervals**

If two 95% confidence intervals do not overlap, then the difference in means is statistically-significant. But the converse may be false: those cases that overlap may still have differences that are statistically significant.

If the 95% confidence interval for one group does not overlap the mean for the second, then the difference in means is statistically-significant – at the 0.05 level. In this case, the converse is also true: those cases where the confidence interval overlaps the mean are not statistically significant. See Conrad Carlberg's article: [www.quepublishing.com/articles/article.aspx?p=1717265&seqNum=3](http://www.quepublishing.com/articles/article.aspx?p=1717265&seqNum=3)

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# Assignment

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For single-sample (1-group) confidence intervals

- 1A: Use Excel Toolpak Descriptive-Statistics.  
Excel describes the Margin of Error as the  
Confidence Level (95%).  
[Behaves like a command: no auto-update]
- 1B: Use functions: CONFIDENCE (or STDEV  
and COUNT) and AVERAGE.  
Recommended since it auto-updates.

# 1A: Margin of Error using Descriptive Statistics

From Data ribbon, select *Data Analysis*

From Data Analysis menus, select *Descriptive Statistics*.

Enter input range. Check box for “Labels in 1<sup>st</sup> row.”  
Set “Output Range” to J19.  
Check “Summary statistics” and “Confidence level.”  
Press OK.

# 1A: Margin of Error using Descriptive Statistics

Row	J	K	L	M	N	O	P	Q	R
18									
19		<i>Q1</i>	<i>Q2</i>	<i>Q3</i>	<i>Q4</i>	<i>Q5</i>	<i>Q6</i>	<i>Q7</i>	<i>Q8</i>
20									
	Mean	0.46	0.28	0.59	0.37	3.48	2.59	65.40	5.51
	Standard Error	0.03	0.03	0.03	0.03	0.08	0.09	0.76	0.08
	Median	0	0	1	0	4	2	65	6
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	Standard Deviation	0.50	0.45	0.49	0.48	1.21	1.42	11.79	1.16
	Sample Variance	0.25	0.20	0.24	0.23	1.46	2.03	139.08	1.36
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	Skewness	0.17	0.99	-0.38	0.56	-0.57	0.43	0.34	0.15
	Range	1	1	1	1	4	4	66	6
	Minimum	0	0	0	0	1	1	34	3
	Maximum	1	1	1	1	5	5	100	9
	Sum	110	67	142	88	835	622	15697	1323
	Count	240	240	240	240	240	240	240	240
	Confidence Level(95%)	0.06	0.06	0.06	0.06	0.15	0.18	1.50	0.15

Confidence Level: Margin of Error =  $T * StdDev() / \sqrt{n}$



# **1B: Margin of error (ME) using CONFIDENCE Function**

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**CONFIDENCE.T:** Population std deviation unknown.

This is the most conservative: biggest ME.

Approaches confidence.norm as sample size increases.

**CONFIDENCE.NORM:** Population standard deviation is known or the sample statistic is a proportion.

Excel CONFIDENCE functions return Margin of Error.

=Confidence.T (alpha, Sample std. deviation, sample size)

=Confidence.Norm (alpha, Pop. std. deviation, sample size)

If CL=95%,  $\alpha = .05$ . Confidence.T = (T/Z)\*Confidence.Norm

Use Confidence.Norm for proportions or size > 30



# 1B: Confidence Intervals using Stdev.S and Confidence.T

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18	Stdev.S and confidence.T is most conservative										Enter dollar signs (\$) as shown
19	Margin Error	0.06	0.06	0.06	0.06	0.15	0.18	1.50	0.15	=CONFIDENCE.T(\$R12,R17,\$R13)	
20	CnfInt: Up-Right	0.52	0.34	0.65	0.43	3.63	2.77	66.90	5.66	=R16+R19	
21	CnfInt:Low-Left	0.39	0.22	0.53	0.31	3.33	2.41	63.90	5.36	=R16-R19	

Average gives proportion if binary data is coded 0 or 1

## 2. Using Excel to Build Two-group Margin of Error

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For two-group confidence intervals of stacked data  
(one subject per row) without pre-sorting:

2A: Use Average, Stdev and Count in pivot table;  
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Use Stdev(IF) within an array function.

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confidence intervals using two one-group approaches.

# 2A: Build 2-Grp Conf. Intervals using Pivot Table Statistics

Row	J	K	L	M	N	Formula for cell to the left
17	1	Go to Step 2	Confidence Level		0.95	Manual entry
18	**	**	**	**	**	**
19			Q1 if Q2=0	Q1 if Q2=1	Q1	
20	6	Margin of Error	7%	12%	6%	=CONFIDENCE.NORM(1-\$N17,N32,N33)
21						Use Confidence.T if data is quantitative
22		Difference in sample proportions.			3%	=ABS(M31-L31)
23		CI-Upper-Right	53%	60%	52%	=N31+N20
24		CI-Lower-Left	38%	36%	40%	=N31-N20
25		Note: Formulas in columns L and M are determined by those in column N				
26	7	Confidence Intervals overlap/touch?			YES	Manual entry
27		Is difference statistically significant?			NO	Manual entry. Use overlap test
28	**	**	**	**	**	**
29	2	Column Labels				
30		Values	0	1	Grand Total	
31	3	Average of Q1	0.45	0.48	0.46	
32	4	StdDev of Q1_2	0.50	0.50	0.50	
33	5	Count of Q1_3	173	67	240	

# 2B: Build 2-Grp Conf. Intervals.

## Use AVERAGEIF, COUNTIF & {STDEV(IF)}

14	J	K	L	M	N	Formula for cell to the left
15	1	Confidence Level	0.95	Z (2 tail)	1.960	=NORM.S.INV(0.5+L15/2)
16						
17		L18: Change 1 to 0	<b>Q2=0</b>	<b>Q2=1</b>	Drag M18 to L18. Change =1 to =0	
18	2	Q1 average	45%	48%	=AVERAGEIF(\$B2:\$B241,"=1",\$A2:\$A241)	
19				Pull left		
20		L21: Change 1 to 0			<b>Do not enter braces shown below!</b>	
21	3	Q1 Stdev	50%	50%	{=STDEV(IF(\$B2:\$B241=1,\$A2:\$A241))}	
22				Pull left	<b>Use CTRL-SHIFT-ENTER to create braces!</b>	
23		L24: Change 1 to 0				
24	4	Q1 sample size	173	67	=COUNTIF(\$B2:\$B241,"=1")	Pull left
25	5	Q1 Margin of Error	7%	12%	=N15*M21/SQRT(M24)	Pull left
26				Pull left		
27	6	Q1 Cnf Int Up-Right	53%	60%	=M18+M25	Pull left
28		Q1 Cnf Int Low-Left	38%	36%	=M18-M25	Pull left
29	7	Overlap or touch?		YES		
30		Is difference stat. significant?		NO	Use overlap test	
31		Change =1 to =0 in L18, L21 and L24.				

## 2C: Build 2-Grp Conf. Intervals

### Use dAverage, dStdev & dCount

14	J	K	L	M	N	Formula for cell to the left
15			Confidence Level	0.95	Manual Entry	
16			Z (2 tail)	1.960	=NORM.S.INV(0.5+M15/2)	
17						
18		Q1	Q2	Q2	subgroups using Q2 data	
19		Confidence Interval	0	1		
20					Enter formula and then drag left to column L	
21		Average	0.45	0.48	=DAVERAGE(\$A\$1:\$H\$241,"Q1",M\$18:M\$19)	
22		Std. Deviation	0.50	0.50	=DSTDEV(\$A\$1:\$H\$241,"Q1",M\$18:M\$19)	
23		Count	173	67	=DCOUNT(\$A\$1:\$H\$241,"Q1",M\$18:M\$19)	
24				Drag left		
25		95% Margin of Error	0.11	0.17	=\$M16*SQRT(M22/M23)	
26		Confidence Interval		Drag left		
27		Lower Limit	0.35	0.31	=M21-M25	
28		Upper Limit	0.56	0.65	=M21+M25	
29				Drag left		
30			Overlap	Yes	Manual entry (Yes or No)	
31		Statistically-significant difference		No	Manual entry (Yes or No)	Use overlap test

# Statistical Significance and Confidence Intervals

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If two 95% confidence intervals do not overlap, then the difference in means is statistically-significant. But the converse may be false: those cases that overlap may still have differences that are statistically significant.

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