

VOM Create Confidence Intervals using Excel 2010 1

## Create Confidence Intervals Using Excel 2010

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

Slides, Output and Data at [www.StatLit.org/pdf/Create-Confidence-Intervals-Excel2010-slides.pdf](http://www.StatLit.org/pdf/Create-Confidence-Intervals-Excel2010-slides.pdf)  
[pdf/Create-Confidence-Intervals-Excel2010-Demo.pdf](http://www.StatLit.org/pdf/Create-Confidence-Intervals-Excel2010-Demo.pdf)  
[xls/Create-Confidence-Intervals-Excel2010-Data.xls](http://www.StatLit.org/xls/Create-Confidence-Intervals-Excel2010-Data.xls)

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## Assignment

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Input data (Pulse.xls with 240 rows)  
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Create Excel spreadsheet (4 tabs: one per slide):

1. Single sample: Create slides 5 and 7.
2. Two samples: Create slides 9 and 10.  
 Note: slide 10 involves an array formula.
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## 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. [Behaves like a command: no auto-update]

1B: Use CONFIDENCE function. It uses three simple inputs: alpha, Stdev and sample size. 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

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### 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									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

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### 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 pivot tables, statistics and Z or T inverse [Behaves like a command: no auto update]
- 2B: Use array IF function with core functions: average, standard deviation, sample size and Z or T inverse

\*\* If stacked data is sorted contiguously, can build two separate confidence intervals use 1-group approach

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### 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%	=N31+N20	
24			CI-Lower-Left	38%	36%	=N31-N20	
25			Note: Formulas in columns L and M are determined by those in column N				
26			Confidence intervals overlap/touch?	YES	Manual entry		
27			Is difference statistically significant?	NO	Manual entry. Use overlap test		
28			*	*	*	*	
29	2		Column	Values	0	1	Grand Total
30							
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		

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### 2B: Build 2-Grp Conf. Intervals from AverageIF and {Stdev(IF)}

Row	J	K	L	M	N	Formula for cell to the left
14						
15	1	Confidence Level	0.95	Z (2 tail)	1.96	=NORM.S.INV(0.5+L15/2)
16						
17			Q2=0	Q2=1		Drag M19 to M18. Change =1 to =0
18	2	Q1 average	45%	48%		=AVERAGEIF(\$B2:\$B241,"=1",\$A2:\$A241)
19						
20			Change =1 to =0 in L20			Do not enter braces shown below!
21	3	Q1 Stdev	50%	50%		=STDEV(IF(\$B2:\$B241=1,\$A2:\$A241))
22						Use CTRL-SHIFT-ENTER to create braces!
23						
24	4	Q1 sample size	173	67		=COUNTIF(\$B2:\$B241,"=1")
25	5	Q1 Margin of Error	7%	12%		=\$N15*M21/SQRT(M24)
26						
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

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### 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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### Survey 95% Margin of Error

Surveys typically give the size of the 95% margin of error. E.g., ± 3 percentage points.

This is the most conservative 95% margin of error for the entire survey. It is computed for  $\Pi=50\%$  so it is the broadest for that sample size.

*Bigger:* A subgroup that is 25% of the whole group will have a 95% margin of error that is twice as big.

*Smaller:* If  $\Pi=6.25\%$  (1/16) for the whole group, the actual 95% margin of error will be about a fourth of the most conservative 95% margin of error.

# **Create Confidence Intervals Using Excel 2010**

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[xls/Create-Confidence-Intervals-Excel2010-Data.xlsx](http://www.StatLit.org/xls/Create-Confidence-Intervals-Excel2010-Data.xlsx)*

# Assignment

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# 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.

[Behaves like a command: no auto-update]

1B: Use CONFIDENCE function. It uses three simple inputs: alpha, Stdev and sample size. 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*.

The screenshot shows the Excel 2010 interface. The 'DATA' ribbon is active, and the 'Data Analysis' button is highlighted. The 'Data Analysis' task pane is open, showing a list of analysis tools with 'Descriptive Statistics' selected. The 'Descriptive Statistics' dialog box is also open, showing the 'Input Range' set to '\$A\$1:\$H\$241', 'Labels in first row' checked, and 'Output Range' set to '\$J\$19'. The 'Confidence Level for Mean' is set to 95%.

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.

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

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

Use Confidence.Norm for proportions or size  $> 30$



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Average gives proportion if binary data is coded 0 or 1

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

2A: Use pivot tables, statistics and Z or T inverse  
[Behaves like a command: no auto update]

2B: Use array IF function with core functions: average,  
standard deviation, sample size and Z or T inverse

\*\* If stacked data is sorted contiguously, can build two  
separate confidence intervals use 1-group approach

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

Row	J	K	L	M	N	Formula for cell to the left
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19			Q1 if Q2=0	Q1 if Q2=1	Q1	
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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	
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19						
20	Change =1 to =0 in L20				Do not enter braces shown below!	
21	3	Q1 Stdev	50%	50%	={STDEV(IF(\$B2:\$B241=1,\$A2:\$A241))}	
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*Bigger:* A subgroup that is 25% of the whole group will have a 95% margin of error that is twice as big.

*Smaller:* If  $\Pi=6.25\%$  (1/16) for the whole group, the actual 95% margin of error will be about a fourth of the most conservative 95% margin of error.