Create Confidence Intervals Using Excel 2010

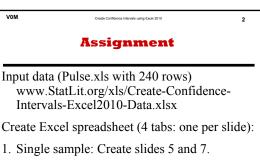
VOM

VOM

Milo Schield

Member: International Statistical Institute US Rep: International Statistical Literacy Project Director, W. M. Keck Statistical Literacy Project

Slides, Output and Data at www.StatLit.org/ pdf/Create-Confidence-Intervals-Excel2010-slides.pdf pdf/Create-Confidence-Intervals-Excel2010-Demo.pdf xls/Create-Confidence-Intervals-Excel2010-Data.xlsx



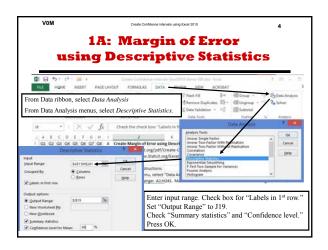
- 2. Two samples: Create slides 9 and 10. Note: slide 10 involves an array formula.
- 3. Upload completed spreadsheet.

Using Excel to Build One-group Margin of Error

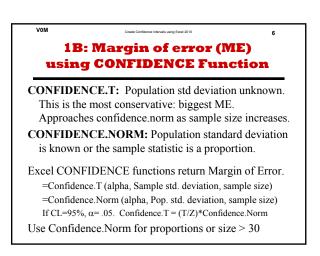
3

For single-sample (1-group) confidence intervals

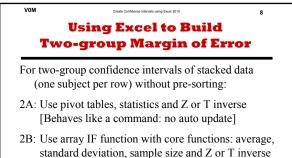
- 1A: Use Excel Toolpak Descriptive-Statistics. [Behaves like a command: no auto-update]
- 1B: Use CONFIDENCE function. It uses three simple inputs: alpha, Stdev and sample size. Recommended since it auto-updates.



/0M		Creat	e Confidence	Intervals usin	g Excel 2010				
	1A: 1	Ma	20	in.	of	Er	roi		
			- 9		~	-			
1	using De	esc	:riı	oti	ve	Sta	ati	stie	:s
									-
Row	1	к	- 1	M	N	0	р	Q	R
18		*		eV1		0		a	
19	-	01	Q2	Q3	Q4	Q5	Q6	Q7	Q8
20		41	-uz	43	04	45	00	u/	40
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	0.03	1	0.03	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	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%)	0.05	0.06	0.06	0.06	0.15	0.18	1.50	0.15



	using	J 2	τα	ev	.5 i	an	d	COI	n	dence.T
Row	J	К	L	М	Ν	0	Ρ	Q	R	Formula in col S is for col F
12								Alpha	0.05	Manual Entry
13							Samp	le size	240	=COUNTA(A2:A241)
14										
15	Question	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q 8	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 conf	idenc	e.T is r	nost c	onserv	vative				Enter dollar signs (\$) as show
19	Margin Error	0.06	0.06	0.06	0.06	0.15	0.18	1.50	0.15	=CONFIDENCE.T(\$R12,R17,\$R
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



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

	V	M		2010 9		
	2					nf. Intervals Statistics
Row	J	К	L	М	N	Formula for cell to the left
17	1	Go to Step 2	Confid	dence 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 san	nple proport	ions.	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 i	n columns L	and M are d	etermined	by those in column N
26	1	Confidence Int	ervals overl	ap/touch?	YES	Manual entry
27		Is difference s	tatistically s	ignificant?	NO	Manual entry. Use overlap test
28	V	** ** ** **	* ** **	** ** **	** ** *	* ** ** ** ** **
29	2		Column 💌	els		
30		Values	0	1	Grand Tota	al
31	3	Average of Q1	0.45	0.48	0.46	
32	4	StdDev of Q1_2		0.50	0.50	
33	5	Count of Q1_3	173	67	240	

	V	DM	Create C	ionfidence Intervals using	Excel 2010	10		
				_		Intervals		
	_		rag			tdev(IF)}		
14	J	К	L	м	N	Formula for cell to the left		
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	Cha	inge =1 to =0 in L20			Do not ent	er braces shown below!		
21	3	Q1 Stdev	50%	50%	{=STDEV(IF(\$B2:\$B241=1,\$A2:\$A241))}		
22					Use CTRL-S	HIFT-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			

YES

NC

Use overlap test

Overlap or touch

Is difference stat. significant

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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.

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

Survey 95% Margin of Error

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

This is the most conservative 95% margin of error for the entire survey. It is computed for Π =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 Π =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.

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Create Confidence Intervals Using Excel 2010

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Input data (Pulse.xls with 240 rows) www.StatLit.org/xls/Create-Confidence-Intervals-Excel2010-Data.xlsx

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.
- 3. Upload completed spreadsheet.

Using Excel to Build One-group Margin of Error

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

Image: Second	dence-Intervals-Excel2010-Dem	o-V0F.xlsx - Excel	1	? 🗇 — 🗆 S
From Data ribbon, select <i>Data Analysis</i> From Data Analysis menus, select <i>Descriptiv</i>	e Statistics. 🛛 🕷 Data	ove Duplicates 🛛 😨 🔹	123 A 100	 Data Analysis Solver Analysis
A B C D E F G H I J 1 Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 A Create Margin Descriptive Statistics ? X Input Input Range: SA\$1:SH\$241 CAncel Grouped By: Columns	K Anor	Da vsis Tools va: Single Factor va: Two-Factor With Rep va: Two-Factor Without R elation vriance riptive Statistics onential Smoothing st Two-Sample for Varian vier Analysis ogram	Replication	OK Cancel <u>H</u> elp
Output options Output Range: \$J\$19 New Worksheet Ply: New Workbook Summary statistics Confidence Level for Mean: 95 %	Enter input rang Set "Output Ran Check "Summa Press OK.	nge" to J19.		

1A: Margin of Error

using Descriptive Statistics

Row	J	К	L	М	Ν	0	Ρ	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	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
X	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

 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	К	L	М	Ν	0	Ρ	Q	R	Formula in col S is for col R
12								Alpha	0.05	Manual Entry
13							Sampl	e size	240	=COUNTA(A2:A241)
14										
15	Question	Q1	Q2	Q 3	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 cont	fidenc	e.T is r	most c	onser	vative				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

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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

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

Row	J	к	L	М	N	Formula for cell to t	he left	
17	1	Go to Step 2	Confic	dence 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.NOR	M(1-\$N17,N	132,N33)
21						Use Confidence.T if	data is qua	ntitative
22		Difference in sam	nple proport	ions.	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	n columns L	and M are d	etermined	by those in column N	J	
26	7	Confidence Int	ervals overl	ap/touch?	YES	Manual entry		
27		Is difference st	tatistically si	ignificant?	NO	Manual entry. Use	overlap te	st
28		** ** ** ** *	* ** **	** ** **	** ** **	** ** ** ** *	*	
29	2		Column 💌	els				
30		Values	0	1	Grand Tota	1		
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 from AverageIF and {Stdev(IF)}

14	J	К	L	М	Ν	Formula for cell to the left	
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	Cha	nge =1 to =0 in L20			Do not ente	er braces shown below!	
21	3	Q1 Stdev	50%	50%	{=STDEV(IF(\$B2:\$B241=1,\$A2:\$A241))}		
22					Use CTRL-SHIFT-ENTER to create brac		
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	Overl	ap or touch?	YES			
30		Is difference stat.	. significant?	NO	Use overlap	test	

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