

XL1G: 0H Create Histograms using Functions in Excel 2013 1

Create a Histogram using Functions in Excel 2013

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Slides and Demo output at: www.StatLit.org/pdf/Excel2013-Create-Histogram-Using-Functions-slides.pdf
[Excel2013-Create-Histogram-Using-Functions-demo.pdf](http://www.StatLit.org/pdf/Excel2013-Create-Histogram-Using-Functions-demo.pdf)

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Histogram versus Bar/Column Chart

A bar (or column) chart involves bars that are separated because the data is categorical (male/female) or discrete numeric (# of kids in family).

A histogram involves bars (horizontal or vertical) that can touch because the data is continuous numeric (heights or weights).

Ordinal data (small, medium, large) can be either type.

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The Goal and Approach

Goal: Summarize data using functions: COUNTIF and FREQUENCY (#8 and 9). Create histogram (#17).

Excel 2013 has two ways to summarize continuous data:

- Using functions: COUNTIF or FREQUENCY
- Using a command: **Histogram** in Data Analysis

Functions have a big advantage over commands.

- Functions update automatically when data changes.
- Commands require a manual update.

This presentation demonstrates both of the functions.

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Create Excel Histogram of Q7 from this data: B1:I241

Data for Q1-Q4 (B-E) is Binary: 0=No, 1=Yes.
 Data for Q5-Q6 (F-G) is Ordinal (discrete): 1-5.
 Data for Q7-Q8 (H-I) is quantitative continuous

	A	B	C	D	E	F	G	H	I
1	ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
2	1	0	1	0	0	3	5	67	5
3	2	0	1	0	1	4	1	62	4
4	3	0	1	0	1	3	4	60	5
5	4	0	1	1	0	4	5	60	4
6	5	0	0	1	0	3	1	71	3

Data is at: www.StatLit.org/xls/Excel2013-Histogram-Functions-Data.xls

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Steps in Creating a Histogram of Q7 (Col G) using functions

Summarize data into bins:

- Determine the number of bins and the bin width
- Setup bin ranges, bin maximums and bin counts
- C1 Insert COUNTIF function to generate bin counts
- C2 Insert FREQUENCY function to generate counts

Create a histogram chart using this summary data:

- 1a. Select bin range, maximum and data on spreadsheet
- 1b. From Insert ribbon, insert recommended chart
2. Delete extraneous series (Max series)
3. Create histogram: eliminate gaps between bars.

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A: Determine the # of bins and the width of bins

	J	K	L	M	N	O	P	Q	
5									
6	Step A: Determine # of bins								
7		# of data values	240	=COUNTA(G2:G241)					
8		Est. # of bins	7.9	=LOG(M7,2)		# data values = 2^(#bins)			
9		Select # bins	8	Manual entry					
10									
11		Maximum	100	=MAX(G2:G241)					
12		Minimum	34	=MIN(G2:G241)					
13		Range	66	=M11-M12		Range = Max - Min			
14		Bin Width	8.25	=M13/M9		Bin width = Range/#bins			
15		Select width	8	Manual entry					
16									
17	J	K	L	M	N	O	P	Q	

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B: Generate K25 and K26. Copy K26 down to K33.

17	J	K	L	M	N	O	P	Q
18	Step B: Set bin maximums ascending [Instructor already did this. See below.]							
19		K25 =M\$12+M\$15-1		K41 =M\$12+M\$15-1				
20		K26 =K25+M\$15		K42 =K41+M\$15				
21	Pull down K26 to K33		Pull down K42 to K49.					
22	J	K	L	M	N	O	P	Q
23	Step C1: Calculate bin count using COUNTIF							
24	Range	BinMax	Count	Formulas under Count for each bin**				
25	33-41	41	5	=COUNTIF(G\$2:G\$241,"<="&K25)				
26	41-49	49	10	=COUNTIF(G\$2:G\$241,"<="&K26)-SUM(L\$25:L\$25)				
27	49-57	57	48	=COUNTIF(G\$2:G\$241,"<="&K27)-SUM(L\$25:L\$26)				
28	57-65	65	62	=COUNTIF(G\$2:G\$241,"<="&K28)-SUM(L\$25:L\$27)				
29	65-73	73	56	=COUNTIF(G\$2:G\$241,"<="&K29)-SUM(L\$25:L\$28)				
30	73-81	81	37	=COUNTIF(G\$2:G\$241,"<="&K30)-SUM(L\$25:L\$29)				
31	81-89	89	14	=COUNTIF(G\$2:G\$241,"<="&K31)-SUM(L\$25:L\$30)				
32	89-97	97	6	=COUNTIF(G\$2:G\$241,"<="&K32)-SUM(L\$25:L\$31)				
33	97-105	105	2	=COUNTIF(G\$2:G\$241,"<="&K33)-SUM(L\$25:L\$32)				
34			240	=SUM(L\$25:L\$33)				

Inserting the range before the bin maximums allows the chart to use the function-generated counts as the source. This means the chart will auto-update whenever the underlying data changes.

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C1: Use COUNTIF function Enter L25 & L26. Pull L26 down.

22	J	K	L	M	N	O	P	Q
23	Step C1: Calculate bin count using COUNTIF							
24	Range	BinMax	Count	Cell	Formulas under Count for each bin**			
25	33-41	41	5	L25	=COUNTIF(G\$2:G\$241,"<="&K25)			
26	41-49	49	10	L26	=COUNTIF(G\$2:G\$241,"<="&K26)-SUM(L\$25:L\$25)			
27	49-57	57	48	L27	=COUNTIF(G\$2:G\$241,"<="&K27)-SUM(L\$25:L\$26)			
28	57-65	65	62	L28	=COUNTIF(G\$2:G\$241,"<="&K28)-SUM(L\$25:L\$27)			
29	65-73	73	56	L29	=COUNTIF(G\$2:G\$241,"<="&K29)-SUM(L\$25:L\$28)			
30	73-81	81	37	L30	=COUNTIF(G\$2:G\$241,"<="&K30)-SUM(L\$25:L\$29)			
31	81-89	89	14	L31	=COUNTIF(G\$2:G\$241,"<="&K31)-SUM(L\$25:L\$30)			
32	89-97	97	6	L32	=COUNTIF(G\$2:G\$241,"<="&K32)-SUM(L\$25:L\$31)			
33	97-105	105	2	L33	=COUNTIF(G\$2:G\$241,"<="&K33)-SUM(L\$25:L\$32)			
34			240	L34	=SUM(L\$25:L\$33)			

*&" links text strings

This use of the Max is the same as used by the Excel Histogram command in the Data-Analysis Toolpak.

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C2a: If K41:K49 entered, skip this step else pull K42 down

35	J	K	L	M	N	O	P	Q
36	Step C2: Calculate count for each bin using FREQUENCY							
37	a) Select L41:L49. [Array function will not fill all rows unless this is done]							
38	b) In the formula bar, enter =Frequency(G\$2:G\$241, K41:K49) [Don't press Enter]							
39	c) Press and hold CTRL-SHIFT and then press ENTER (CSE command)							
40	Range	BinMax	Count	Formulas under Count for each bin**				
41	33-41	41	5					
42	41-49	49	10					
43	49-57	57	48					
44	57-65	65	62					
45	65-73	73	56					
46	73-81	81	37					
47	81-89	89	14					
48	89-97	97	6					
49	97-105	105	2					

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C2b: Use FREQUENCY function to calculate Counts per Bin

35	J	K	L	M	N	O	P	Q
36	Step C2: Calculate count for each bin using FREQUENCY							
37	a) Select L41:L49. [Array function will not fill all rows unless this is done]							
38	b) In the formula bar, enter =Frequency(G\$2:G\$241, K41:K49) [Don't press Enter]							
39	c) Press and hold CTRL-SHIFT and then press ENTER: three-fingered CSE command.							
40	Range	BinMax	Count	Formulas under Count for each bin**				
41	33-41	41	5					
42	41-49	49	10					
43	49-57	57	48					
44	57-65	65	62					
45	65-73	73	56					
46	73-81	81	37					
47	81-89	89	14					
48	89-97	97	6					
49	97-105	105	2					

Step a) Select area: Most common mistake
Step b) Do not press Enter!!
Step c) This is the trickiest operation in Excel.

The FREQUENCY function is an array function: very tricky!

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1: Manually select bin data; Insert "Recommended Chart"

Select the Clustered-Column chart

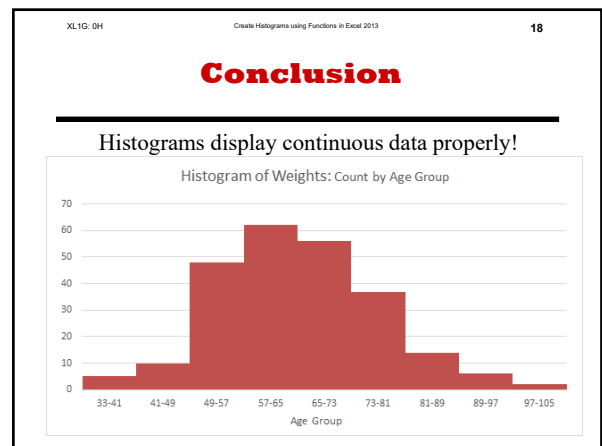
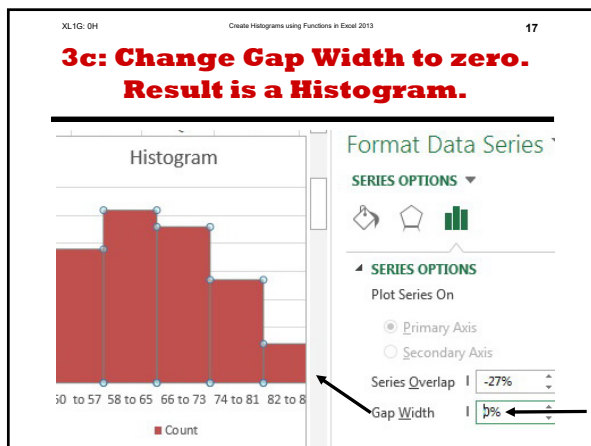
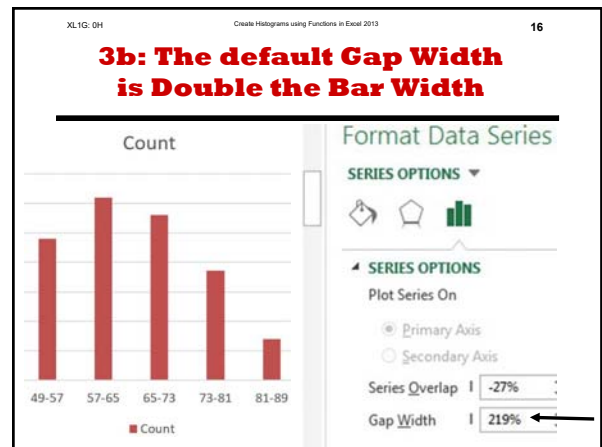
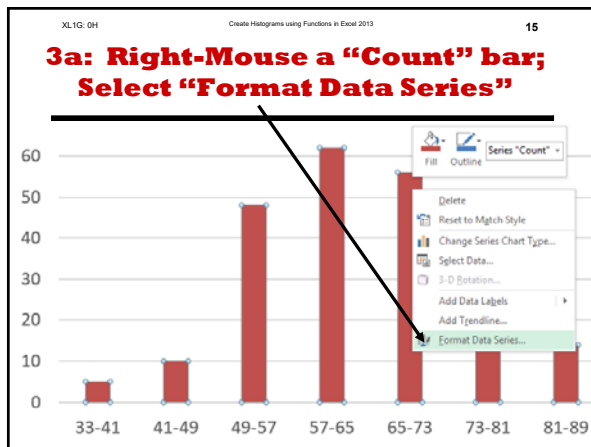
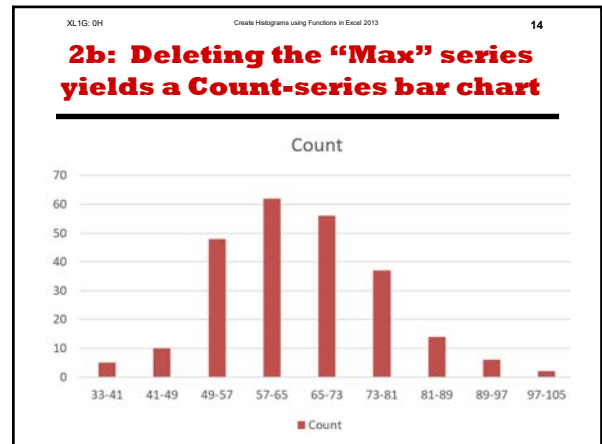
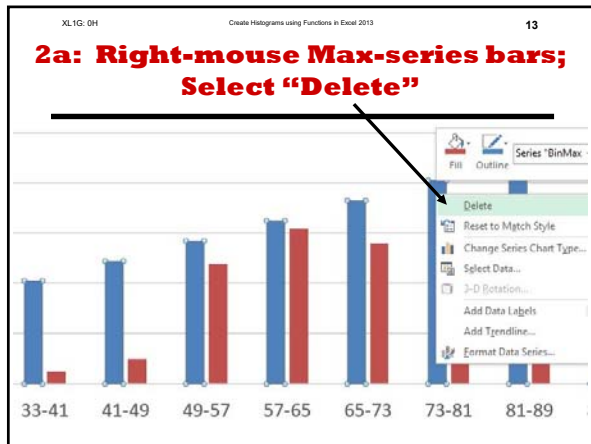
Range	BinMax	Count
33-41	41	5
41-49	49	10
49-57	57	48
57-65	65	62
65-73	73	56
73-81	81	37
81-89	89	14
89-97	97	6
97-105	105	2

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1b: This clustered-column Chart has two Series: Max and Count

Chart Title

BinMax Count



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Histogram versus Bar/Column Chart

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Excel 2013 has two ways to summarize continuous data:

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2. Using a command: **Histogram** in Data Analysis

Functions have a big advantage over commands.

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- Commands require a manual update.

This presentation demonstrates both of the functions.

Create Excel Histogram of Q7 from this data: B1:I241

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	A	B	C	D	E	F	G	H	I
1	ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
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3	2	0	1	0	1	4	1	62	4
4	3	0	1	0	1	3	4	60	5
5	4	0	1	1	0	4	5	60	4
6	5	0	0	1	0	3	1	71	3

Data is at: [www.StatLit.org/xls/
Excel2013-Histogram-Functions-Data.xls](http://www.StatLit.org/xls/Excel2013-Histogram-Functions-Data.xls)

Steps in Creating a Histogram of Q7 (Col G) using functions

Summarize data into bins:

- A. Determine the number of bins and the bin width
- B. Setup bin ranges, bin maximums and bin counts
- C1 Insert COUNTIF function to generate bin counts
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Create a histogram chart using this summary data:

- 1a. Select bin range, maximum and data on spreadsheet
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- 2. Delete extraneous series (Max series)
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A: Determine the # of bins and the width of bins

5	J	K	L	M	N	O	P	Q
6	Step A:	Determine # of bins						
7		# of data values	240	=COUNTA(G2:G241)				
8		Est. # of bins	7.9	=LOG(M7,2)			# data values = 2^{#bins}	
9		Select # bins	8	Manual entry				
10								
11		Maximum	100	=MAX(G2:G241)				
12		Minimum	34	=MIN(G2:G241)				
13		Range	66	=M11-M12			Range = Max - Min	
14		Bin Width	8.25	=M13/M9			Bin width = Range/#bins	
15		Select width	8	Manual entry				
16								
17	J	K	L	M	N	O	P	Q

B: Generate K25 and K26. Copy K26 down to K33.

17	J	K	L	M	N	O	P	Q	
18	Step B:	Set bin maximums ascending				<i>[Instructor already did this. See below.]</i>			
19		K25	=M\$12+M\$15-1			K41	=M\$12+M\$15-1		
20		K26	=K25+M\$15			K42	=K41+M\$15		
21		Pull down K26 to K33				Pull down K42 to K49.			
22	J	K	L	M	N	O	P	Q	
23	Step C1:	Calculate bin count using COUNTIF							
24	Range	BinMax	Count						
25	33-41	41		=Countif(G\$2:G\$241,"<="&K25)					
26	41-49	49		=Countif(G\$2:G\$241,"<="&K26)-Sum(L\$25:L25)					
27	49-57			* Pull-down L26 to L33					
28	57-65								
29	65-73								
30	73-81								
31	81-89								
32	89-97								
33	97-105								

Inserting the range before the bin maximums allows the chart to use the function-generated counts as the source. This means the chart will auto-update whenever the underlying data changes.

C1: Use COUNTIF function

Enter L25 & L26. Pull L26 down.

22	J	K	L	M	N	O	P	Q	22	
23	Step C1:	Calculate bin count using COUNTIF							No \$ sign	23
24	Range	BinMax	Count	Cell	Formulas under Count for each bin**					24
25	33-41	41	5	L25	=COUNTIF(G\$2:G\$241,"<="&K25)					25
26	41-49	49	10	L26	=COUNTIF(G\$2:G\$241,"<="&K26)-SUM(L\$25:L25)					26
27	49-57	57	48	L27	=COUNTIF(G\$2:G\$241,"<="&K27)-SUM(L\$25:L26)					27
28	57-65	65	62	L28	=COUNTIF(G\$2:G\$241,"<="&K28)-SUM(L\$25:L27)					28
29	65-73	73	56	L29	=COUNTIF(G\$2:G\$241,"<="&K29)-SUM(L\$25:L28)					29
30	73-81	81	37	L30	=COUNTIF(G\$2:G\$241,"<="&K30)-SUM(L\$25:L29)					30
31	81-89	89	14	L31	=COUNTIF(G\$2:G\$241,"<="&K31)-SUM(L\$25:L30)					31
32	89-97	97	6	L32	=COUNTIF(G\$2:G\$241,"<="&K32)-SUM(L\$25:L31)					32
33	97-105	105	2	L33	=COUNTIF(G\$2:G\$241,"<="&K33)-SUM(L\$25:L32)					33
34			240	L34	=SUM(L25:L33)					34

↑ “&” links text strings

This use of the Max is the same as used by the Excel Histogram command in the Data-Analysis Toolpak.

C2a: If K41:K49 entered, skip this step else pull K42 down

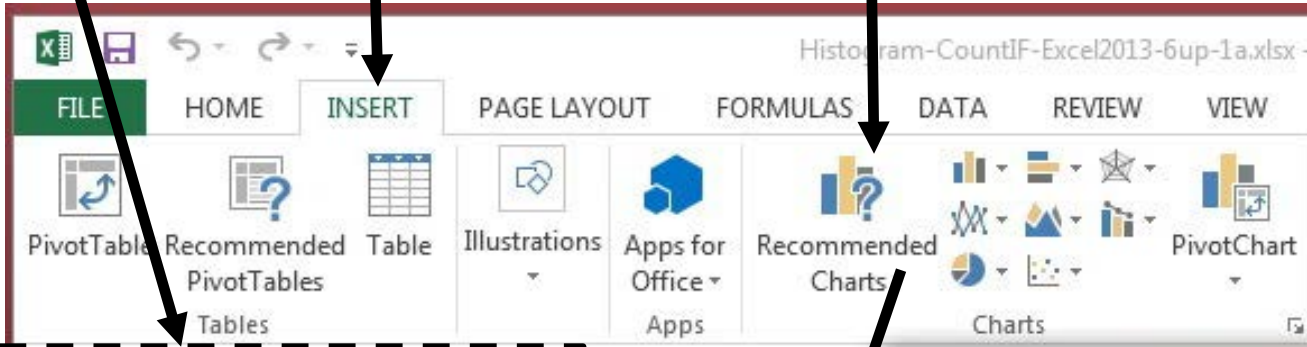
35	J	K	L	M	N	O	P	Q
36	Step C2:	Calculate count for each bin using FREQUENCY						
37	a)	Select L41:L49.	[Array function will not fill all rows unless this is done]					
38	b)	In the formula bar, enter =Frequency(G\$2:G\$241, K41:K49) [Don't press Enter]						
39	c)	Press and hold CTRL-SHIFT and then press ENTER (CSE command)						
40	Range	BinMax	Count	Formulas under Count for each bin**				
41	33-41	41						
42	41-49	49						
43	49-57							
44	57-65							
45	65-73							
46	73-81							
47	81-89							
48	89-97							
49	97-105							

C2b: Use FREQUENCY function to calculate Counts per Bin

35	J	K	L	M	N	O	P	Q
36	Step C2:	Calculate count for each bin using FREQUENCY						
37	a)	Select L41:L49.	[Array function will not fill all rows unless this is done]					
38	b)	In the formula bar, enter =Frequency(G\$2:G\$241, K41:K49) [Don't press Enter]						
39	c)	Press and hold CTRL-SHIFT and then press ENTER: three-fingered CSE command.						
40	Range	BinMax	Count	Formulas under Count for each bin**				
41	33-41	41						
42	41-49	49		Step a) Select area: Most common mistake				
43	49-57	57		Step b) Do not press Enter!!				
44	57-65	65		Step c) This is the trickiest operation in Excel.				
45	65-73	73						
46	73-81	81						
47	81-89	89						
48	89-97	97						
49	97-105	105						

The FREQUENCY function is an array function: very tricky!

1: Manually select bin data; Insert "Recommended Chart"



Select the
**Clustered
-Column
chart**

Range	BinMax	Count
33-41	41	5
41-49	49	10
49-57	57	48
57-65	65	62
65-73	73	56
73-81	81	37
81-89	89	14
89-97	97	6
97-105	105	2

Insert Chart

Recommended Charts | All Charts

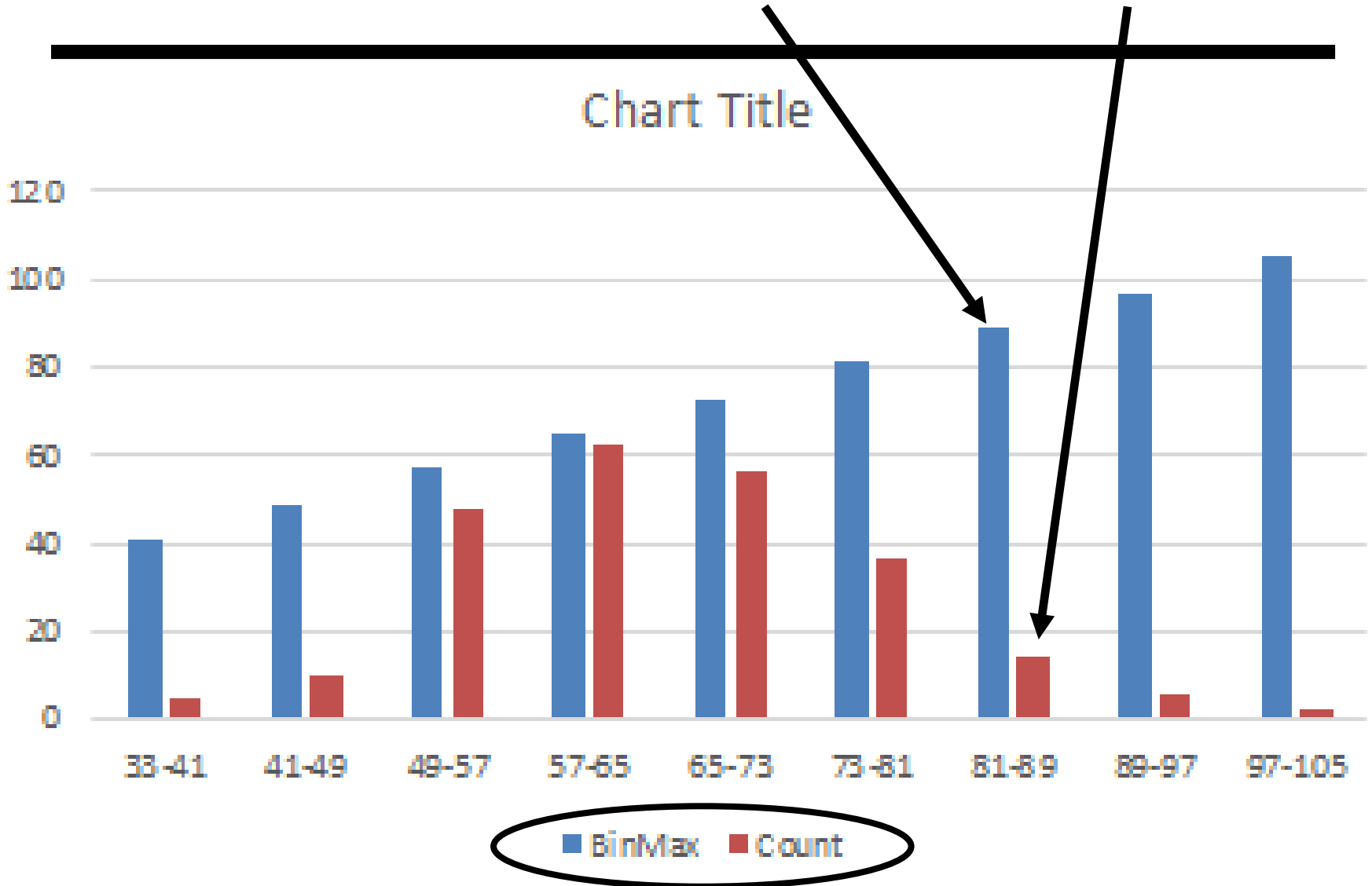
Clustered Column

Chart Title

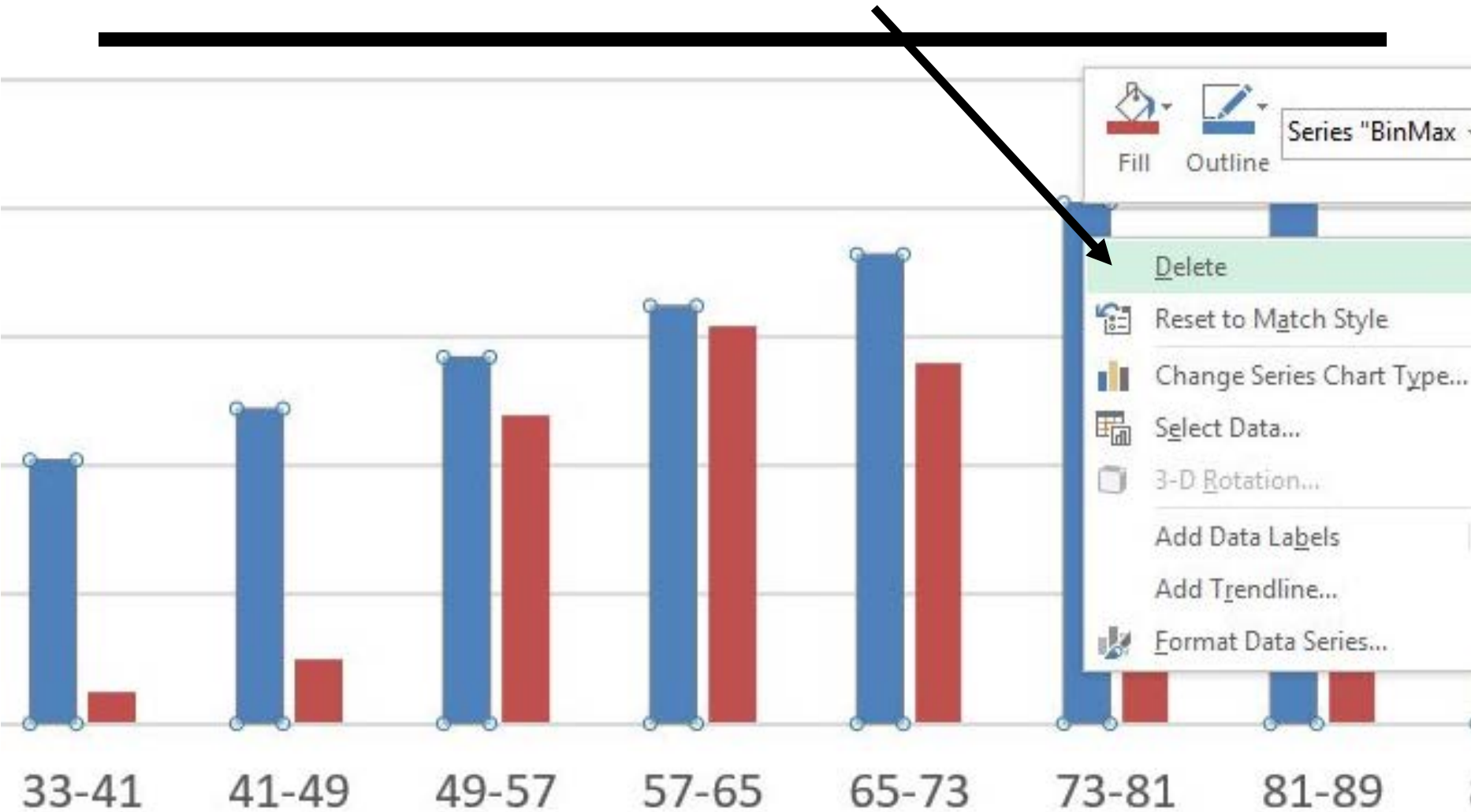
BinMax Count

A clustered column chart is used to compare values across a few categories. Use it when the order of categories is not important.

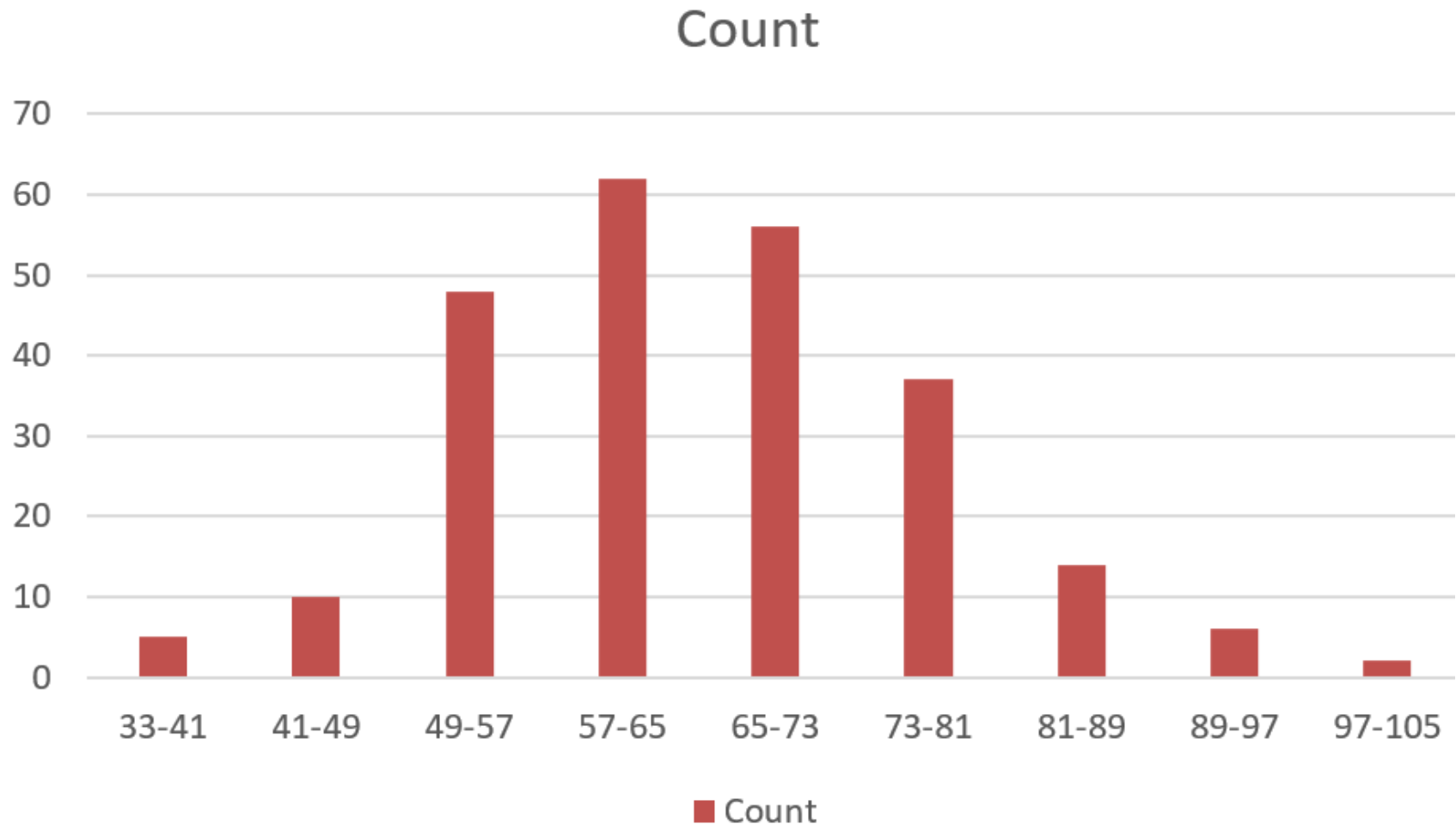
1b: This clustered-column Chart has two Series: Max and Count



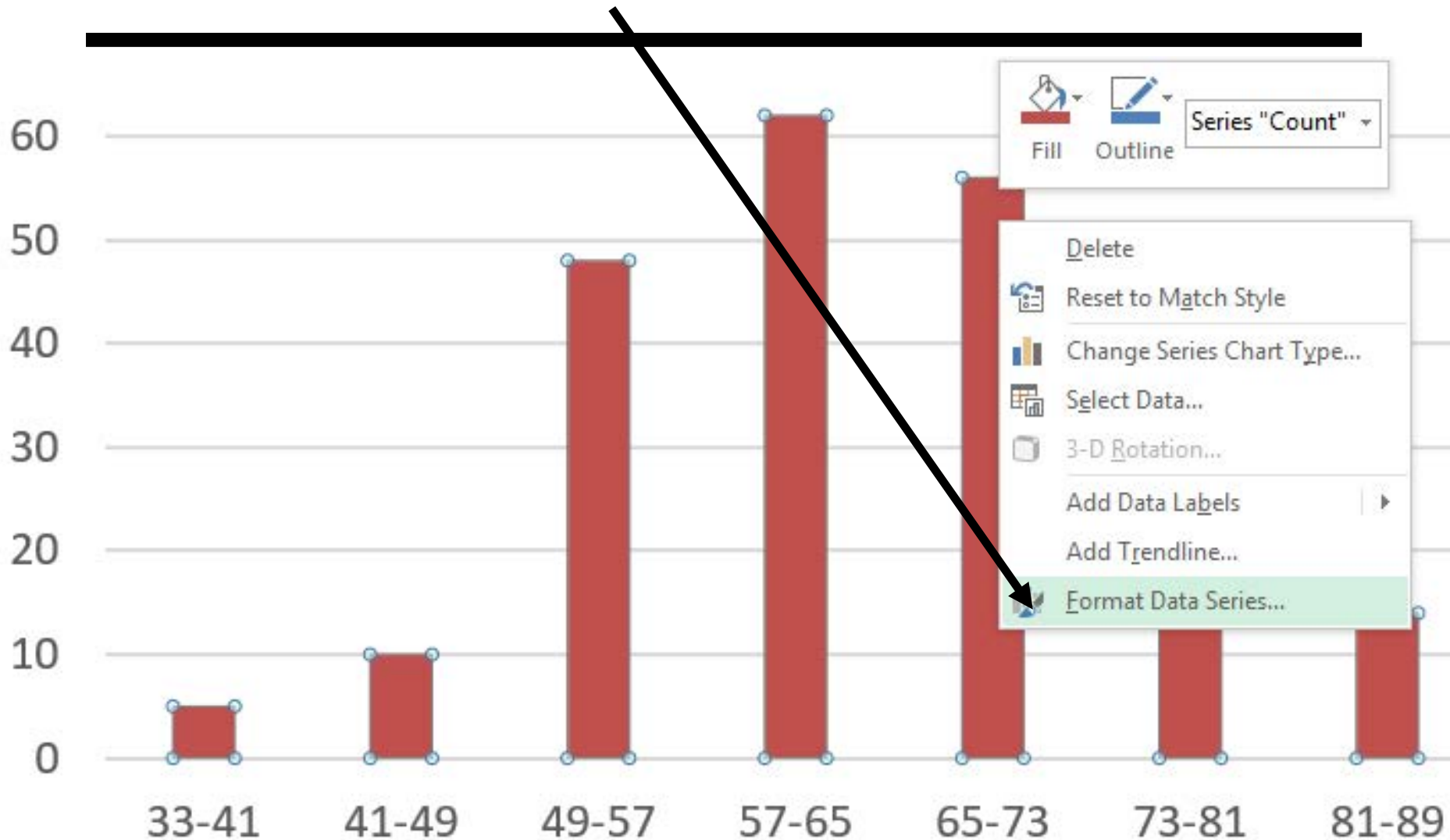
2a: Right-mouse Max-series bars; Select "Delete"



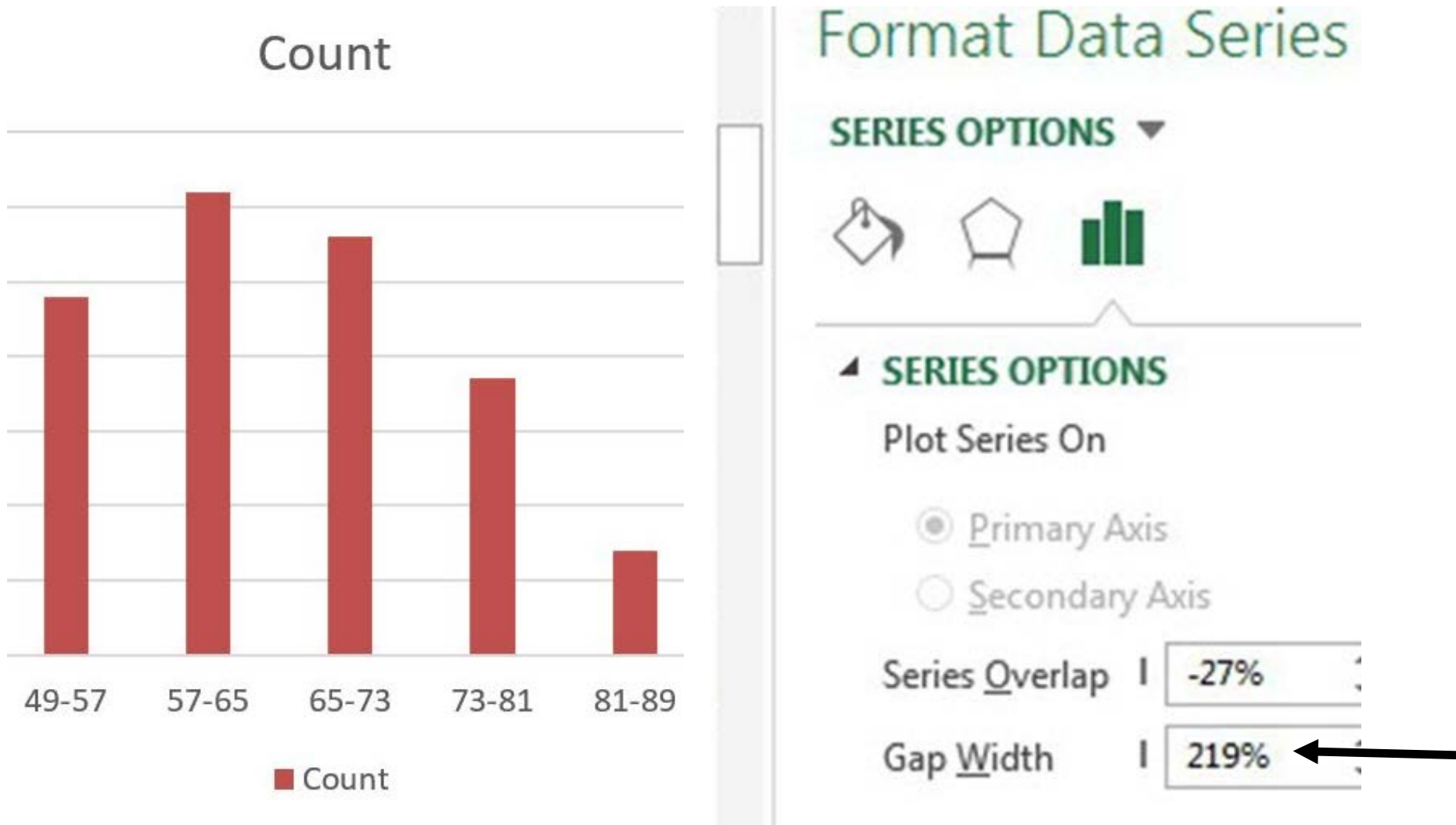
2b: Deleting the “Max” series yields a Count-series bar chart



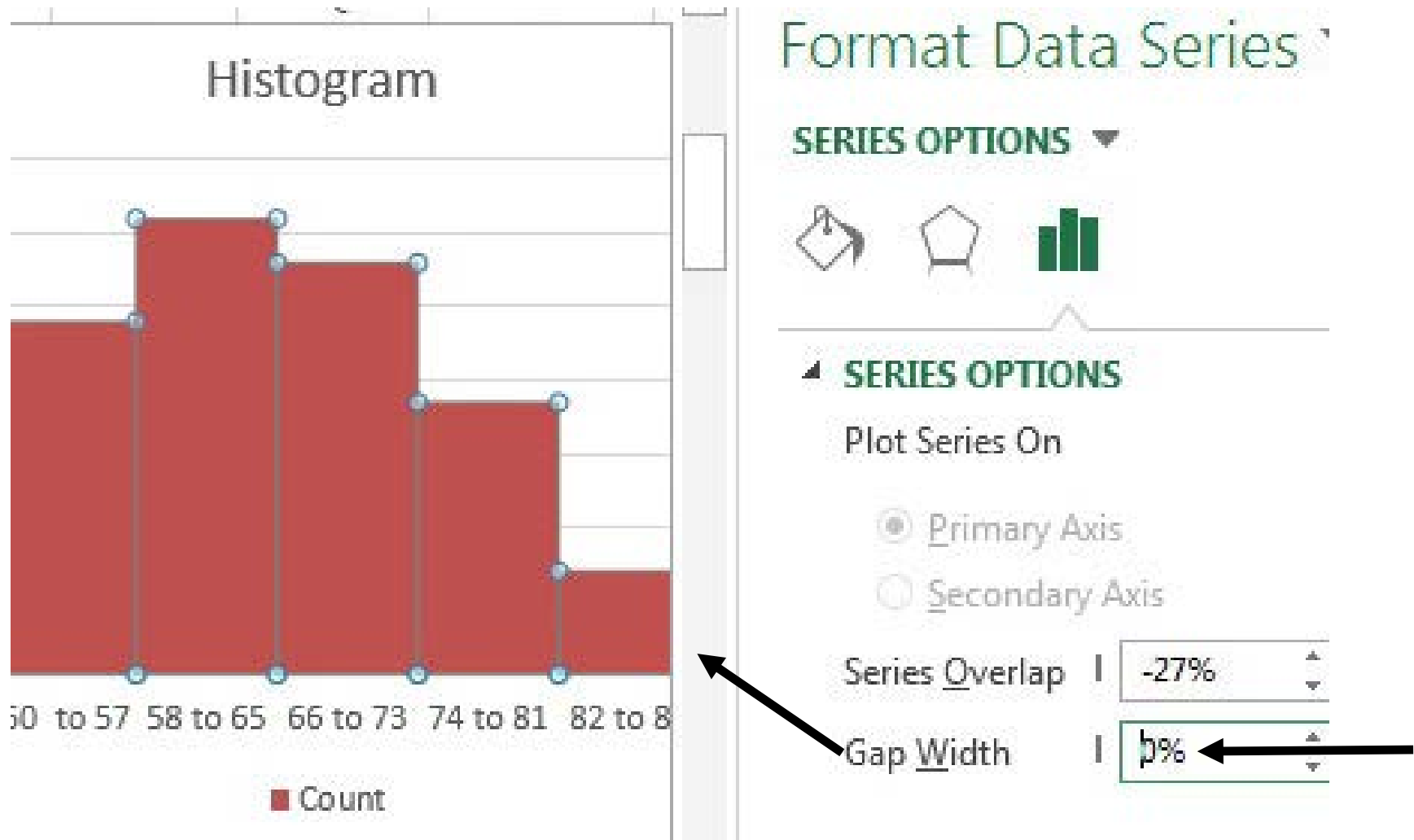
3a: Right-Mouse a “Count” bar; Select “Format Data Series”



3b: The default Gap Width is Double the Bar Width



3c: Change Gap Width to zero. Result is a Histogram.



Conclusion

Histograms display continuous data properly!

