

# **Hypothesis Tests using Excel *Z.TEST* Function**

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by  
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*Slides and audio at: [www.StatLit.org/  
pdf/ZTEST-Function-Excel-2008-6up.pdf](http://www.StatLit.org/pdf/ZTEST-Function-Excel-2008-6up.pdf)  
[Audio/ZTEST-Function-Excel-2008.mp3](http://www.StatLit.org/Audio/ZTEST-Function-Excel-2008.mp3)*

# Function: ZTEST

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Purpose: Calculate the likelihood of getting the sample statistic (or more extreme) by chance – assuming null hypothesis is true.

## FEATURES:

Assumptions: There is a single population

Population standard deviation is known.

Nature: Excel functions automatically updated if data changes.

Three Arguments (or Inputs):

- 1) Range or Array: the range of sample data being tested
- 2) Mu-zero: Value of the null hypothesis
- 3) Sigma: Standard deviation of population

## **Run Hypothesis Tests 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 (ratio).

	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

Excel instructions and data at:

[www.StatLit.org/xls/2012Isaacson240Data.xls](http://www.StatLit.org/xls/2012Isaacson240Data.xls)

# A: From the Formula ribbon, Select “More Functions”

The screenshot shows the Microsoft Excel 2008 interface. The 'Formulas' ribbon is active, and the 'More Functions' button is highlighted. A tooltip for 'More Functions' is displayed, providing instructions on how to use it. Below the ribbon, a spreadsheet is visible with columns A through G and rows 1 through 11. The data in the spreadsheet is as follows:

	A	B	C	D	E	F	G
1	Question	Q1	Q2	Q3	Q4	Q5	Q6
2	1	0	1	0	0	3	
3	2	0	1	0	1	4	1
4	3	0	1	0	1	3	4
5	4	0	1	1	0	4	5
6	5	0	0	1	0	3	1
7	6	0	0	0	0	5	2
8	7	0	0	1	0	1	1
9	8	1	0	0	0	4	3
10	9	1	0	1	0	3	5
11	10	0	1	1	1	2	1

## **B: Select 'Statistical' and then select 'Z.Test'**

2011Isaacson240Data2.xls [Compatibility Mode]

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Function Library

*fx*

C	D	E	F	G
Q2	Q3	Q4	Q5	Q6
1	0	0	3	
1	0	1	4	1
1	0	1	3	4
1	1	0	4	5
0	1	0	3	1
0	0	0	5	2
0	1	0	1	1
0	0	0	4	3

Statistical

- Engineering
- Cube
- Information
- Compatibility

T.TEST

TREND

TRIMMEAN

VAR.P

VAR.S

VARA

VARPA

WEIBULL.DIST

**Z.TEST**

# GOAL

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How to conduct a one-population hypothesis-test using the Excel 2008 Z.TEST function in two situations:

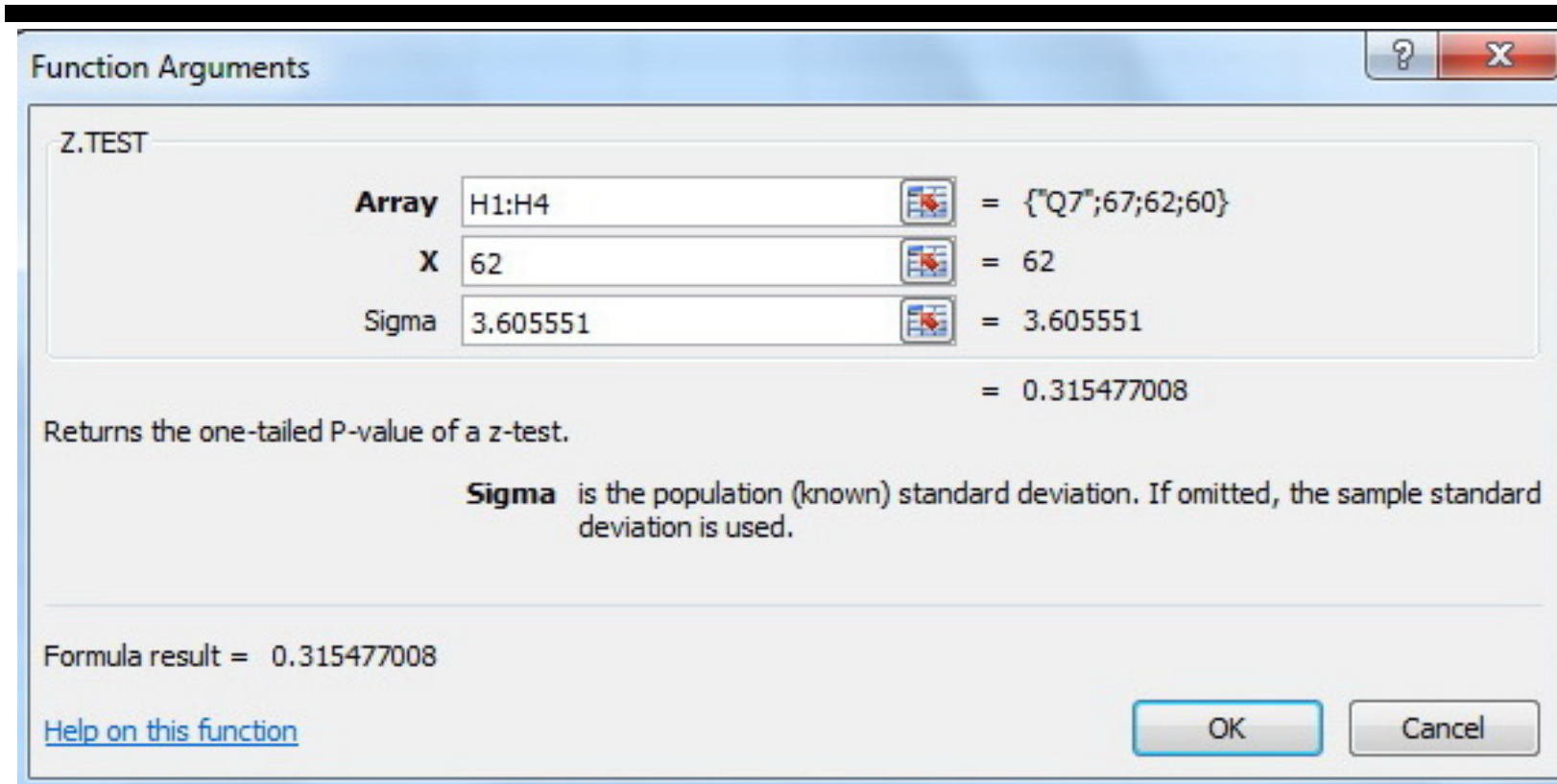
- 1) Test of Measurements
- 2) Test of Proportions

Assumption: Population standard deviation is known.

Notation for the three arguments of Z.TEST function:

- Array: the range of the sample data.
- X: The value,  $\mu$ , of the null hypothesis.
- Sigma: The population standard deviation.

# 1a Z-Test for Measures: Sigma is known (entered)



The image shows the 'Function Arguments' dialog box for the Z.TEST function in Excel. The dialog box has a title bar with a question mark and a close button. The function name 'Z.TEST' is displayed in the top left. The arguments are listed as follows:

Argument	Value	Result
Array	H1:H4	{"Q7";67;62;60}
X	62	62
Sigma	3.605551	3.605551

The result of the function is shown as 0.315477008. Below the arguments, there is a description: 'Returns the one-tailed P-value of a z-test.' and a note: 'Sigma is the population (known) standard deviation. If omitted, the sample standard deviation is used.' At the bottom, the formula result is displayed as 'Formula result = 0.315477008'. There are 'OK' and 'Cancel' buttons at the bottom right, and a 'Help on this function' link at the bottom left.

Sample mean is 63  
P-value is 0.315...



# 1b Z-Test for Measures: Sigma is estimated from sample

Function Arguments

Z.TEST

Array H1:H4 = {"Q7";67;62;60}

X 62 = 62

Sigma = number

= 0.315477021

Returns the one-tailed P-value of a z-test.

**Sigma** is the population (known) standard deviation. If omitted, the sample standard deviation is used.

Formula result = 0.315477021

[Help on this function](#) OK Cancel

Sample standard deviation is 3.605551  
Note: the p-value is still 0.315 (with n=3)



## **1c Z-Test for Measures: Summary**

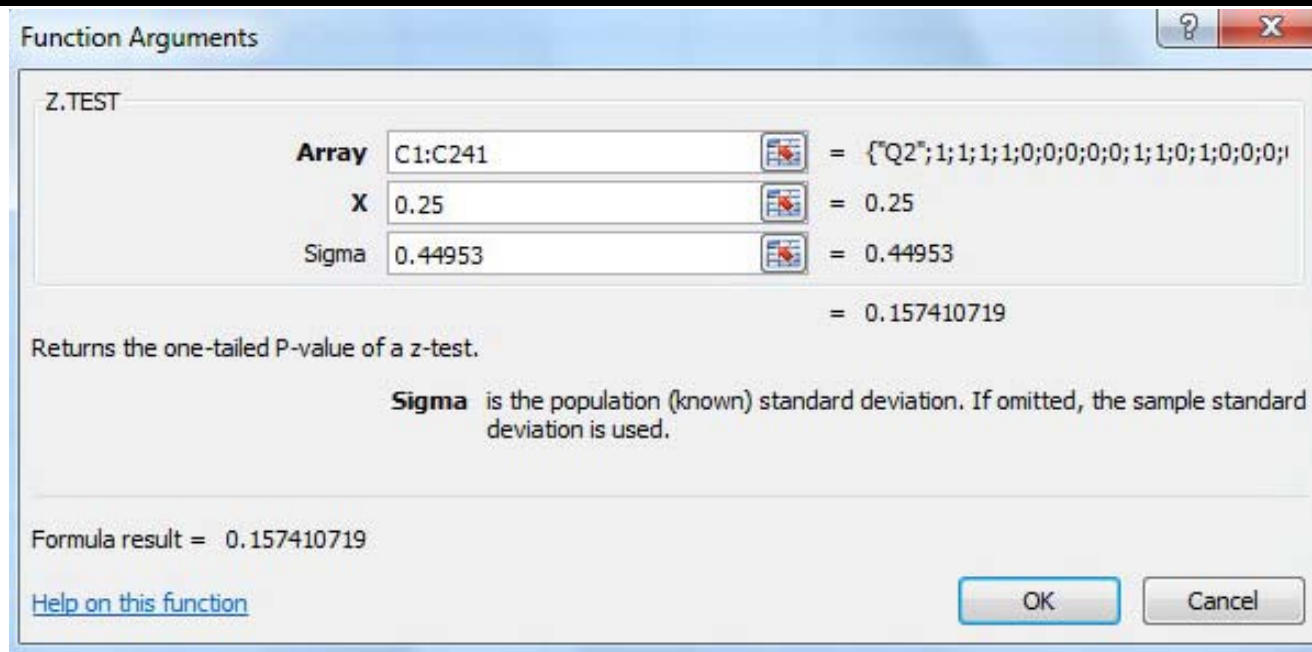
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The sample standard deviation can be used to estimate the population standard deviation.

There is no adjustment for this new source of variation. This modified Z.TEST is not the same as a T-TEST.

Using the sample standard deviation for small samples ( $n < 30$ ) can result in p-values that smaller than those given by a T-Test. This increases false positives.

## 2a: Test for Proportions Sigma is entered



This analysis assumes the data are zeros and ones.  
In this case, the mean is always the proportions of ones.

Sample mean is 0.28

P-value is 0.1574...

## 2b: Test for Proportions

### Sigma is estimated from sample

Leave blank

Function Arguments

Z.TEST

Array C1:C241 = {"Q2";1;1;1;0;0;0;0;1;1;0;1;0;0;0;1}

X 0.25 = 0.25

Sigma = number

= 0.15740916

Returns the one-tailed P-value of a z-test.

**Sigma** is the population (known) standard deviation. If omitted, the sample standard deviation is used.

Formula result = 0.15740916

[Help on this function](#) OK Cancel

Sample mean ( $p$ ) is 0.28.  $p*q = 0.2016$

Sample Std Dev =  $\text{Sqrt}(p*q) = \text{Sqrt}(0.2016) = .4495$

P-value is 0.1574....

# Conclusions

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Excel 2008 offers a single-population Z-Test function for measures and proportions. It does not offer a single-population T-Test.

To use this function for proportions, the outcomes must be coded as zero and one.

Excel can do this test when the proportions are coded differently from zero and one. Showing how is beyond the scope of this presentation.

Excel does allow for two-tail tests, but that is more involved. See the Excel Help system for details.

## B: From “More Functions”, select “Statistical”

The screenshot shows the Microsoft Excel 2008 interface. The 'Formulas' ribbon is active, and the 'More Functions' dropdown menu is open, showing the following categories:

- Statistical
- Engineering
- Cube
- Information
- Compatibility

The spreadsheet data is as follows:

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# C: From “Statistical”, select “Z.Test”

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$fx$

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1	0	1	3	4
1	1	0	4	5
0	1	0	3	1
0	0	0	5	2
0	1	0	1	1
0	0	0	4	3

Statistical

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T.TEST  
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## **2c Z.Test for Proportions: Summary**

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Z.TEST is a good hypothesis test of proportions in a single population if the data is coded as zero and one.