Hypothesis testing for a proportion: 1-Proportion Z-Test.

1. About 29% of all burglaries are through an open or unlocked door or window. A sample of 130 burglaries indicated that 43 took place via an open or unlocked door or window. At the 0.05 level of significance, can it be concluded that this differs from the stated proportion?
   A) No. There is not enough evidence to support the claim that the proportion of open or unlocked window or door burglaries differs from 29%.
   B) There is not enough information to draw a conclusion.
   C) Yes. There is enough evidence to support the claim that the proportion of open or unlocked window or door burglaries differs from 29%.

   Given:
   $p = 29\% = 0.29$ Therefore, $q = 0.71$
   $\hat{p} = 43/130 = 0.331$ significance, $\alpha = 0.05$

   Hypotheses:
   $H_0: p = 0.29$ $H_1: p \neq 0.29$

   Test Statistics:

$$z = \frac{\hat{p}-p}{\sqrt{\frac{p \cdot q}{n}}}$$

$$z = \frac{0.331-0.29}{\sqrt{\frac{0.29(0.71)}{130}}} = 1.02$$

Critical value: $\alpha = 0.05$ in a two-tailed test $z_{\alpha/2} = \pm 1.96$

CASIO 9750	TI 84
F3 for TEST, F1 for Z, F3 for 1-P	STAT, then TESTS, select 5: 1-PropZTest
1-Prop ZTest Prop :≠p0 p0 :0.29 x :43 n :130 Save Res:None Execute CALC	1-PropZTest p0:.29 x:43 n:130 prop:≠p0 <p0 >p0 Color: BLUE Calculate Draw
EXE	Enter
1-Prop ZTest Prop≠0.29 z =1.02441521 p =0.30563919 p̂ =0.33076923 n =130	1-PropZTest prop≠.29 z=1.024415215 p=.3056392285 p̂=.3307692308 n=130

Notice that test statistics $|1.02| < |1.96|$ therefore, we failed to reject the Null; accordingly, $p - value > \alpha$

A) No. There is not enough evidence to support the claim that the proportion of open or unlocked window or door burglaries differs from 29%.

2. A random sample of 450 shoppers at Quincy Mall found that 125 favored longer shopping hours. Is this sufficient evidence at the 0.10 level of significance to conclude that less than 30% of the shoppers at Quincy Mall favor longer hours?

A) There is not enough evidence to support the claim that less than 30% of the shoppers favor longer hours.
B) There is enough evidence to support the claim that less than 30% of the shoppers favor longer hours.

Given:
Significance level, $\alpha = 0.10$ in a one-tailed test $z_{\alpha/2} = -1.282$

$p = 30\% = 0.30$ Therefore, $q = 0.70$
$\hat{p} = 125/450 = 0.278$

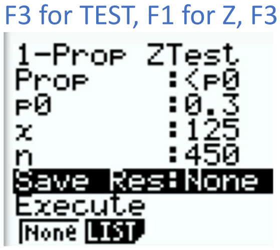
Hypotheses:
$H_0: p = 0.30$ $H_1: p < 0.30$

Test Statistics:

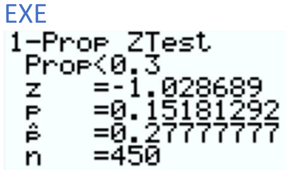
$$z = \frac{\hat{p}-p}{\sqrt{\frac{p \cdot q}{n}}}$$

$$z = \frac{0.278-0.30}{\sqrt{\frac{0.30(0.70)}{450}}} = -1.03$$

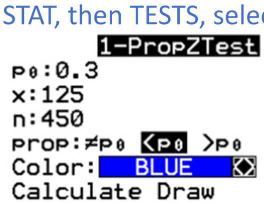
CASIO 9750
F3 for TEST, F1 for Z, F3 for 1-P



EXE



TI 84
STAT, then TESTS, select 5: 1-PropZTest



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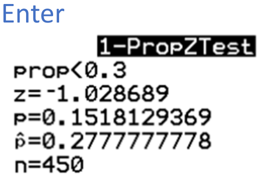


Notice that test statistics $|-1.03| < |-1.282|$ therefore, we failed to reject the Null; likewise, $p - value > \alpha$

A) There is not enough evidence to support the claim that less than 30% of the shoppers favor longer hours.

3. The Energy Information Administration reported that 51.9% of homes in the United States were heated by natural gas. A random sample of 200 homes found that 109 were heated by natural gas. Does the evidence support the claim or has the percentage changed? Use $\alpha = 0.02$ and the P-value method.

A) There is enough evidence to reject the claim that the percentage of homes that are heated by natural gas is 51.9%.
B) No. There is not enough evidence to reject the claim that the percentage of homes that are heated by natural gas is 51.9%.
C) There is not enough information to draw a conclusion.

Given:
Significance level, $\alpha = 0.02$ in a two-tailed test $z_{\alpha/2} = \pm 2.326$
$p = 51.9\% = 0.519$ Therefore, $q = 0.481$
$\hat{p} = 109/200 = 0.545$

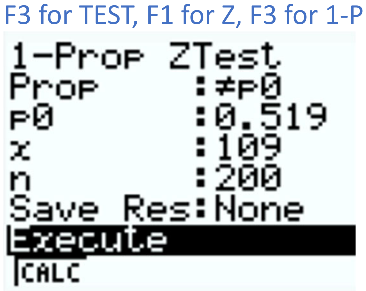
Hypotheses:
$H_0: p = 0.519$ $H_1: p \neq 0.519$

Test Statistics:

$$z = \frac{\hat{p} - p}{\sqrt{\frac{p \cdot q}{n}}}$$

$$z = \frac{0.545 - 0.519}{\sqrt{\frac{0.519\,(0.481)}{200}}} = 0.73$$

CASIO 9750
F3 for TEST, F1 for Z, F3 for 1-P



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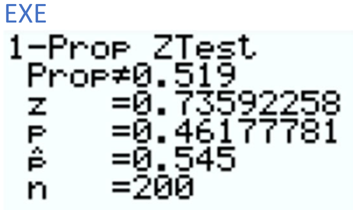
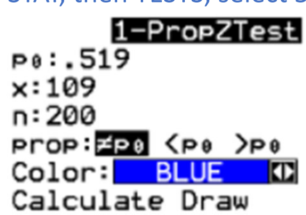


TI 84
STAT, then TESTS, select 5: 1-PropZTest



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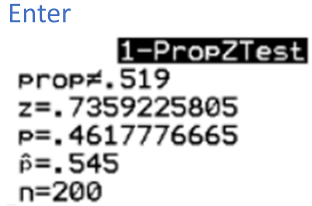


Notice that test statistics $|0.73| < |2.326|$ therefore, we failed to reject the Null; likewise, $p - value > \alpha$

B) No. There is not enough evidence to reject the claim that the percentage of homes that are heated by natural gas is 51.9%.

4. Researchers suspect that 21% of all high school students smoke at least one pack of cigarettes a day. At Wilson High School, a randomly selected sample of 300 students found that 49 students smoke at least one pack of cigarettes a day. At $\alpha = 0.05$, test the claim that less than 21% of all high school students smoke at least one pack of cigarettes a day. Use the P-value method.

A) There is not enough information to draw a conclusion.
B) Yes. There is enough evidence to support the claim that the percentage of students who smoke at least one pack of cigarettes a day is less than 21%.
C) No. There is not enough evidence to support the claim that the percentage of students who smoke at least one pack of cigarettes a day is less than 21%.

Given:
Critical value: $\alpha = 0.05$ one-tailed test $z_{\alpha/2} = -1.645$
$p = 21\% = 0.21$ Therefore, $q = 0.79$
$\hat{p} = 49/300 = 0.163$

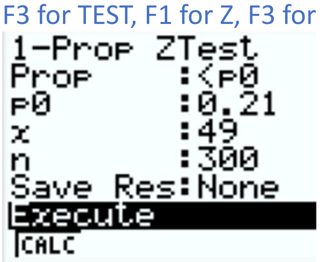
Hypotheses:
$H_0: p = 0.21$ $H_1: p < 0.21$

Test Statistics:

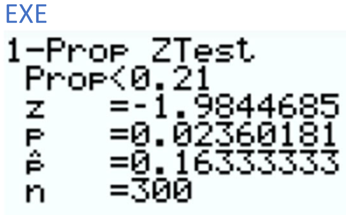
$$z = \frac{\hat{p}-p}{\sqrt{\frac{p \cdot q}{n}}}$$

$$z = \frac{0.163-0.21}{\sqrt{\frac{0.21\ (0.79)}{300}}} = -1.98$$

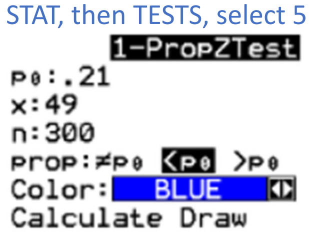
CASIO 9750
F3 for TEST, F1 for Z, F3 for 1-P



EXE



TI 84
STAT, then TESTS, select 5: 1-PropZTest



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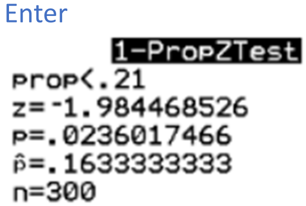

Notice that test statistics $|-1.98| > |1.96|$ therefore, we reject the Null; accordingly, $p - value < \alpha$

B) Yes. There is enough evidence to support the claim that the percentage of students who smoke at least one pack of cigarettes a day is less than 21%.

5. A survey by Men's Health magazine stated that 13% of all men said that they used exercise to relieve stress. A random sample of 100 men was selected, and 11 said that they used exercise to relieve stress. Use the P-value method to test the claim. Use $\alpha = 0.10$.

A) No. There is enough evidence to reject the claim that the percentage of men who use exercise to relieve stress is 13%.
B) Yes. There is not enough evidence to reject the claim that the percentage of men who use exercise to relieve stress is 13%.
C) There is not enough information to draw a conclusion.

Given:
$p = 13\% = 0.13$ Therefore, $q = 0.87$
Significance level, $\alpha = 0.10$ in a two-tailed test $z_{\alpha/2} = \pm 1.645$
$\hat{p} = 11/100 = 0.110$

Hypotheses:
$H_0: p = 0.13$ $H_1: p \neq 0.13$

Test Statistics:

$$z = \frac{\hat{p} - p}{\sqrt{\frac{p \cdot q}{n}}}$$

$$z = \frac{0.11 - 0.13}{\sqrt{\frac{0.13(0.87)}{100}}} = -0.59$$

CASIO 9750	TI 84
F3 for TEST, F1 for Z, F3 for 1-P 1-Prop ZTest Prop :≠p0 p0 :0.13 x :11 n :100 Save Res:None Execute CALC EXE 1-Prop ZTest Prop≠0.13 z =-0.594701 p =0.55204333 p̂ =0.11 n =100	STAT, then TESTS, select 5: 1-PropZTest 1-PropZTest p0:.13 x:11 n:100 prop:≠p0 <p0 >p0 Color: BLUE Calculate Draw Enter 1-PropZTest prop≠.13 z=-.5947010335 p=.5520432284 p̂=.11 n=100

Notice that test statistics $|-0.59| < |1.645|$ therefore, we failed to reject the Null; likewise, $p - value > \alpha$

A) No. There is enough evidence to reject the claim that the percentage of men who use exercise to relieve stress is 13%.