TOPIC: HYPOTHESIS TESTS FOR PROPORTION

Performing a Hypothesis Test for Population Proportion

◆ Recall: To run a hypothesis test 1) Write Hypotheses, 2) Calc. Test Statistic, 3) Find P-Value, & 4) State Conclusion.

EXAMPLE

A tech company says 90% of its devices pass inspection. A quality inspector thinks it's less, so they test 200 devices, 172 of which passed. At the 0.01 significance level, is there evidence the pass rate is below 90%?

New **Hypothesis Tests for Proportion**

1) Hyp

$H_0: p =$ ______ $H_a: p$ **[< | > | ≠]**

2) Test Stat

$$z = \frac{\hat{p} - p}{\sqrt{p(1-p)/n}}$$

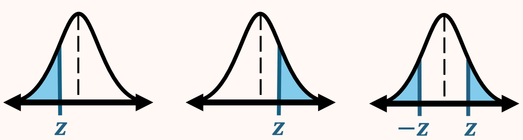
$n =$ _____ $x =$ _____ $\hat{p} = \frac{x}{n} =$ _____

$z =$

3) P-Value

Area "beyond" z

If $H_a: p <$ If $H_a: p >$ If $H_a: p \neq$



P-Value = ______

4) Conclusion

Because P-value **[< | >]** α, we **[REJECT | FAIL TO REJECT]** H_0.

There is **[ENOUGH | NOT ENOUGH]** evidence to suggest…

Criteria

Random Samples? ☐

$np \geq 5$ ☐

$nq \geq 5$ ☐

Recall $q = 1 - p$

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EXAMPLE Perform each hypothesis test using $n = 20$, $x = 14$, a claim of $p = 0.5$ & $\alpha = 0.05$.

Recall

$$z = \frac{\hat{p} - p}{\sqrt{p(1-p)/n}}$$

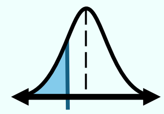
$$\hat{p} = \frac{x}{n}, \qquad q = 1 - p$$

$(\boldsymbol{A})$ One tail - Left

Random Samples? ☐ H_0: H_a:

$np \geq 5$ ☐ $n =$ ___ $x =$ ___ $\hat{p} =$ ___

$nq \geq 5$ ☐ $z =$



Because P-value = ___ **[< | >]** α = ____ , we **[REJECT | FAIL TO REJECT]** H_0.

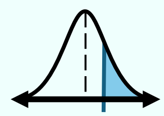
There is **[ENOUGH | NOT ENOUGH]** evidence to suggest $H_a: p$ **[< | > | ≠]** 0.5

$(\boldsymbol{B})$ One tail - Right

Random Samples? ☐ H_0: H_a:

$np \geq 5$ ☐ $n =$ ___ $x =$ ___ $\hat{p} =$ ___

$nq \geq 5$ ☐ $z =$



Because P-value = ___ **[< | >]** α = ____ , we **[REJECT | FAIL TO REJECT]** H_0.

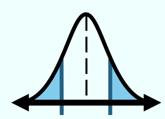
There is **[ENOUGH | NOT ENOUGH]** evidence to suggest $H_a: p$ **[< | > | ≠]** 0.5

$(\boldsymbol{C})$ Two tail

Random Samples? ☐ H_0: H_a:

$np \geq 5$ ☐ $n =$ ___ $x =$ ___ $\hat{p} =$ ___

$nq \geq 5$ ☐ $z =$



Because P-value = ___ **[< | >]** α = ____ , we **[REJECT | FAIL TO REJECT]** H_0.

There is **[ENOUGH | NOT ENOUGH]** evidence to suggest $H_a: p$ **[< | > | ≠]** 0.5

TOPIC: HYPOTHESIS TESTS FOR PROPORTION

PRACTICE Perform a 2-tailed hypothesis test for the true proportion of successes using the given values:

$(\boldsymbol{A})$ $\alpha = 0.01$, $n = 40$, $x = 28$, & claim is $p = 0.75$

Recall

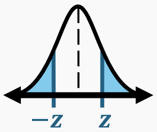
$$z = \frac{\hat{p} - p}{\sqrt{p(1-p)/n}}$$

$$\hat{p} = \frac{x}{n}, \qquad q = 1 - p$$

Random Samples? ☐ H_0: H_a:

$np \geq 5$ ☐ $\hat{p} =$ ___ $z =$

$nq \geq 5$ ☐



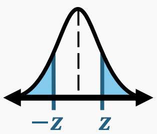
Because P-value = ___ **[< | >]** α = ____ , we **[REJECT | FAIL TO REJECT]** H_0.
There is **[ENOUGH | NOT ENOUGH]** evidence to suggest $H_a: p$ **[< | > | ≠]** 0.75

$(\boldsymbol{B})$ $\alpha = 0.10$, $n = 100$, $x = 42$, & claim is $p = 0.25$

Random Samples? ☐ H_0: H_a:

$np \geq 5$ ☐ $\hat{p} =$ ___ $z =$

$nq \geq 5$ ☐



Because P-value = ___ **[< | >]** α = ____ , we **[REJECT | FAIL TO REJECT]** H_0.
There is **[ENOUGH | NOT ENOUGH]** evidence to suggest $H_a: p$ **[< | > | ≠]** 0.25

TOPIC: HYPOTHESIS TESTS FOR PROPORTION

EXAMPLE

A company claims that 20% of its products are defective. A random sample of 150 products is tested, & 35 are found defective. At $\alpha = 0.05$, test whether the defect rate is different from 20%. Based on your results, should the company investigate its production process?

Random Samples?	☐	H_0:	H_a:	
$np \geq 5$	☐	$n =$ ___	$x =$ ___	$\hat{p} =$ ___
$nq \geq 5$	☐	$z =$		

Recall

$$z = \frac{\hat{p} - p}{\sqrt{p(1-p)/n}}$$

$$\hat{p} = \frac{x}{n}, \qquad q = 1 - p$$

Because P-value = ___ **[< | >]** α = ____ , we **[REJECT | FAIL TO REJECT]** H_0.
There is **[ENOUGH | NOT ENOUGH]** evidence to suggest…

PRACTICE

A snack company claims that at least 70% of people prefer its new low-sugar granola bar over the original version. To test this claim, a grocery chain surveys a random sample of 80 customers, & 50 say they prefer the new version. Use $\alpha = 0.10$ to test whether more than 70% of customers prefer the new granola bar. Should the grocery chain stock more of the new product & reduce shelf space for the original version?

TOPIC: HYPOTHESIS TESTS FOR PROPORTION

Performing Hypothesis Tests: Proportion Using TI-84

◆ To perform a Hyp. Test for a pop. proportion using a calculator, use the **`5:1-PropZTest`** function.

EXAMPLE

A fast-food chain wonders if the proportion of orders with drinks is less than 0.87. They collect a random sample of 80 orders and find 68 include drinks. Perform a hypothesis test with $\alpha = 0.05$ to test the claim.

H_0:__________ H_a:__________

$x =$_________ $n =$_________ P-value: _______

Because P-value **[< | >]** α, we **[REJECT | FAIL TO REJECT]** H_0,
there is **[ENOUGH | NOT ENOUGH]** evidence to suggest…

HOW TO: Hyp. Test for Proportion On TI-84

1) STAT, >, **TESTS**
`5: 1-PropZTest`

2) `p₀:`
`x:`
`n:`
`prop: ≠p₀ <p₀ >p₀`
`Calculate` `Draw`

PRACTICE

A city government claims that no more than 25% of households have solar panels. A researcher suspects the rate is actually higher and surveys 200 households, finding that 62 have solar panels. Test if there is evidence that more than 25% of households have solar panels using $\alpha = 0.01$.

H_0:__________ H_a:__________

$\bar{x} =$_________ $n =$_________ P-value $=$ _______

Because P-value **[< | >]** α, we **[REJECT | FAIL TO REJECT]** H_0,
there is **[ENOUGH | NOT ENOUGH]** evidence to suggest…

HOW TO: Hyp. Test for Proportion On TI-84

1) STAT, >, **TESTS**
`5: 1-PropZTest`

2) `p₀:`
`x:`
`n:`
`prop: ≠p₀ <p₀ >p₀`
`Calculate` `Draw`

TOPIC: HYPOTHESIS TESTS FOR PROPORTION

PRACTICE

A cereal company advertises that 50% of households purchase its brand every month. A market research team wonders if the true proportion is different, so they survey 200 households, and 114 report that they purchase the brand at least once per month.

$(\boldsymbol{A})$ Use $\alpha = 0.10$ to test the claim.

H_0:__________ H_a:__________

$\bar{x} =$__________ $n =$__________ P-value = ________

Because P-value **[< | >]** α, we **[REJECT | FAIL TO REJECT]** H_0,

there is **[ENOUGH | NOT ENOUGH]** evidence to suggest…

$(\boldsymbol{B})$ Based on the research, should the company charge its advertising?

HOW TO: Hyp. Test for Proportion On TI-84

1) STAT, > **TESTS**

   5: 1-PropZTest

2) p_0:

   x:

   n:

   prop: $\neq p_0$ $<p_0$ $>p_0$

   Calculate Draw

TOPIC: HYPOTHESIS TESTS FOR PROPORTION

	Mean		Proportion	Variance
Step 1) Hypotheses	$H_0: \mu =$ ___ $H_a: \mu$ **[< | > | ≠]** ___		$H_0: p =$ ___ $H_a: p$ **[< | > | ≠]** ___	$H_0: \sigma^2 =$ ___ $H_a: \sigma^2$ **[< | > | ≠]** ___
Step 2) Calc. Test Statistic	*(σ Known):* $z = \frac{x - \mu}{\sigma/\sqrt{n}}$	*(σ Unknown):* $t = \frac{x - \mu}{s/\sqrt{n}}$	$z = \frac{\hat{p} - p}{\sqrt{p(1-p)/n}}$	$\mathcal{X}^2 = \frac{(n-1)s^2}{\sigma^2}$
Step 3) P-Value	$P(Z$ **[< | >]** $z)$ ***OR*** $2 \cdot P(Z$ **[< | >]** $z)$	$P(T_{n-1}$ **[< | >]** $t)$ ***OR*** $2 \cdot P(T_{n-1}$ **[< | >]** $t)$	$P(Z$ **[< | >]** $z)$ ***OR*** $2 \cdot P(Z$ **[< | >]** $z)$	$P(\mathcal{X}^2_{n-1}$ **[< | >]** $\mathcal{X}^2)$ ***OR*** $2 \cdot P(\mathcal{X}^2_{n-1}$ **[< | >]** $\mathcal{X}^2)$
Step 4) State Conclusion	Because P-value **[< | >]** α, we **[REJECT | FAIL TO REJECT]** H_0. There is **[ENOUGH | NOT ENOUGH]** evidence to { restate H_a }			