

Steps for Hypothesis Testing

1. Population (s)
2. Parameter (s)
3. Type of Test
4. Conditions
- * 5. Hypothesis
6. Formula / Calculations (STAT CRUNCH)
Symbols, Statistics, P-value
7. Conclusion

Hypothesis:

The null hypothesis (H_0) is what is being stated or what is assumed to be true.

(Court Case)
 H_0 : Not Guilty

Hypothesis

$$H_0: \text{parameter } \mu \text{ or } p =$$

(Null)

$$H_a: \text{parameter } \mu \text{ or } p > \text{ or } < \text{ or } \neq$$

(Alternative)

- * Alternative hypothesis is what we believe to be true if the null is false.
(Why we are conducting a test)

~~$$H_0: \bar{x} =$$~~

~~$$H_0: P =$$~~

Symbol

>

<

≠

Key Words

* more than, * greater than
at least, higher than

* fewer than, * less than
at most, lower than

* different, * not equal

* something else, * not the same
(Doesn't as
Specify a direction)

Only difference
between H_0 & H_a
is the inequality

Proportions

$$\begin{cases} H_0: p = .70 \\ H_a: p > .70 \end{cases}$$

↑
must
be the
same

70% of
students take
math 153

(p)

* Want to
test to see
if enrollment
in math 153
has gone up.

Means

$$\left\{ \begin{array}{l} H_0: \mu = 40,000 \\ H_a: \mu \neq 40,000 \end{array} \right.$$

* The avg.

salary in
MD is \$40,000

* You believe
that is not
true.

P-Value (STAT CRUNCH)

- * The probability we would observe our statistic (or something as extreme) given the null hypothesis is true.

Ex: * $H_0: p = .7$

$H_a: p < .7$

Interpret the p-value *

There is a .44% chance that I would make 58 or fewer free throws out of 100 if I really was a 70% free throw shooter.

* $\hat{P} = .58$
I made 58 out of 100
p-naught
Hypothesized proportion
 $Z = \frac{\hat{P} - P_0}{\sqrt{\frac{P_0(1-P_0)}{n}}} = \frac{.58 - .7}{\sqrt{\frac{(.7)(.3)}{100}}} = -2.62$
 $P = .0044$ *

Significance Level (Alpha-Level) $\alpha =$

- * We use 5% as our alpha level unless otherwise stated.

If our p-value is less than the α -level
we reject the H_0 .

If our p-value is not less than the α -level
we fail to reject the H_0 .

* NEVER ACCEPT

Reject

$$\cdot H_0: p = .7$$

$$* H_a: p < .7$$

Conclusion: Since the p-value is less than
(the α -level) 5%. we reject the H_0 , which
means the evidence suggests (H_a in words)

Fail to
Reject

Conclusion: Since the p-value is not less than
(α -level) 5%. we fail to reject the H_0 , which
means we do not have enough evidence to
suggest (H_a in words).

1. Two chefs were having a discussion about bacon and one of them stated that he believed that 75% of the people in the United States like Bacon. The other chef said that it had to be higher than that. She decided to test the claim and randomly selected 44 people from different restaurants and discovered that 38 of the 44 people said they like Bacon. Is this enough evidence to support her claim? (Conduct an appropriate hypothesis test)

Population: All people in the U.S

Parameter: (p) proportion of people who like bacon

Type of Test: 1-Proportion Test

Conditions: Random Samp. ✓

$10n < \text{Pop. Size}$ ✓

$np_0 \geq 10$ ✓

$n(1-p_0) \geq 10$

$$H_0: p = .75 \quad n = 44$$

$$H_a: p > .75 \quad \hat{p} = \frac{38}{44}$$

$$Z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}} = 1.74$$

p-value = .0409

SE. Z p-value
0.065279121 1.7407766 0.0409

Since our p-value is less than 5%, we reject the H_0 , which means the evidence suggests that the actual proportion of people in the U.S who like bacon is greater than .75.

↓ **(σ) One Sample Z & One Sample T (s) (Means)**

$$H_0: \mu =$$

$$H_a: \mu \begin{matrix} > \\ < \\ \neq \end{matrix}$$

Formulas

* (Normality)
 $n \geq 30$

$$Z = \frac{\bar{x} - \mu_0}{\left(\frac{\sigma}{\sqrt{n}}\right)}$$

$$t = \frac{\bar{x} - \mu_0}{\left(\frac{s}{\sqrt{n}}\right)}$$

d.f = degrees of freedom

$$* d.f = n - 1$$

1. We would like to determine if the typical amount spent per customer for dinner at a new restaurant in town is more than \$20.00. A sample of 36 customers over a three-week period were randomly selected and the mean amount spent was \$23.60. The standard deviation of the sample was found to be \$2.50. Conduct an appropriate hypothesis test to see if the typical amount spent per customer is more than \$20.00?

$$n = 36 \quad \bar{x} = 23.60 \quad s = 2.50$$

Population: All people eating dinner at a new restaurant

Parameter: (μ) Mean amount of money spent per person in \$.

Type of Test: 1-Sample t Conditions: Random Samp✓ $n < Pop. Size$ ✓ $n \geq 30$ ✓

$$H_0: \mu = 20 \quad \text{Formula: } t = \frac{\bar{x} - \mu}{\left(\frac{s}{\sqrt{n}}\right)} \quad \begin{array}{l} \text{SE} \\ 0.41666667 \end{array} \quad \begin{array}{l} \text{d.f} \\ 35 \end{array} \quad \begin{array}{l} \text{t p-value} \\ 8.64 < 0.0001 \end{array}$$

$$* H_a: \mu > 20$$

Since our p-value is less than 5%, we reject the H_0 which means the evidence suggests the mean amount spent on dinner per person at the new restaurant is greater than \$20.

H_0 : medicine
does not work * ←
 H_a : it does work

* Type I reject when H_0 is true
Medicine does not work
but we mass produce it.
(Loss of \$ for
the company)

Type II fail to reject when
 H_0 is false.
Medicine does work but
we do not produce it.
(Sick people)