1-Sample Hypothesis Testing

P arameter: Define your parameter - p=... OR μ= ...

H ypotheses:

$H_0: p = \#$ OR $\mu = \#$

$H_a: p < \#$ OR $p > \#$ OR $p \neq \#$ OR $\mu < \#$ OR $\mu > \#$ OR $\mu \neq \#$

A ssess Conditions:

- Random: look at the text of the problem or assume
- Normal:
    - Proportions: We can assume the distribution is normal if $np \geq 10$ and $n(1-p) \geq 10$. If you do not know p, use $\hat{p}$.
    - Means: If $n < 30$, draw a dotplot or histogram to check for skew or outliers. If $n \geq 30$, approximately normal by the central limit theorem (CLT).
- Independent: when the sample is less than 10% of the population, we can treat the sample as independent

N ame: One-sample z-test for p OR One-sample t-test for μ

T est Statistic:

$$test\ statistic = \frac{\text{statistic} - \text{parameter}}{st.dev.of\ statistic}$$

O btain your p-value: z-score table or t-table

M ake a decision:

- Because the p-value is less than the significance level of __, I reject the null hypothesis.
- Because the p-value is greater than the significance level of _____, I fail to reject the null hypothesis.

S tate your conclusion

There is/is not evidence to support _________ (put the alternative hypothesis into words)

One-Sided Test for Proportions

A drug company claims that less than 8% of patients who take drug A experience dizzy spells. To check this claim, scientists give the drug to a SRS of 400 patients. In all, 35 patients in the sample had dizzy spells. Test this claim at the 0.05 significance level.

P

H

A

- Random:
- Normal:
- Independent:

N

T

O

M

S

A popular coffee company claims that most people prefer their coffee to their competitors. To prove it, the took a SRS of 300 people in a large city and had them do a blind taste test; 182 people picked the company's coffee correctly. Test this claim at a 0.01 significance level.

P

H

A

- Random:
- Normal:
- Independent:

N

T

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M

S

One-Sided Test for Means

A candy company claims that the average YUM bar weighs 15 grams. Toby thinks that they are actually smaller. He weighs 40 random YUM bars and gets an a mean of 14.7 g and a standard deviation of 0.2 g. Test the company's claim at a 0.10 significance level.

P

H

A

- Random:
- Normal:
- Independent:

N

T

O

M

S

A restaurant claims that their diet dish has an average of 400 calories. The FDA thinks it is more and checks this by calculating the calories of 30 meals. Their sample has a mean of 415 with a standard deviation of 20. Test the claim at a 0.05 significance level.

P

H

A

- Random:
- Normal:
- Independent:

N

T

O

M

S

Two-sided Tests

A candidate for mayor claims that 68% of the constituents support his candidacy. A local news organization does a random sample of 500 constituents and find that 312 support him. Preform a test at the 0.05 significance level to check that he is correct.

P

H

A

- Random:
- Normal:
- Independent:

N

T

O

M

S

A silver polishing company claims to have a shininess rating of 9.5. A random sample of 65 items' ratings had a mean of 9.53 and a standard deviation of 0.3. Is there evidence at the 5% level that their shininess rating is different from their claim?

P

H

A

- Random:
- Normal:
- Independent:

N

T

O

M

S

1-Sample Hypothesis Testing

When constructing a confidence interval, remember PHANTOMS!

P arameter: Define your parameter - p=... OR μ= ...

H ypotheses:

$H_0: p = \#$ OR $\mu = \#$

$H_a: p < \#$ OR $p > \#$ OR $p \neq \#$ OR $\mu < \#$ OR $\mu > \#$ OR $\mu \neq \#$

A ssess Conditions:

- Random: look at the text of the problem or assume
- Normal:
    - Proportions: We can assume the distribution is normal if $np \geq 10$ and $n(1-p) \geq 10$. If you do not know p, use $\hat{p}$.
    - Means: If $n < 30$, draw a dotplot or histogram to check for skew or outliers. If $n \geq 30$, approximately normal by the central limit theorem (CLT).
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N ame: One-sample z-test for p OR One-sample t-test for μ

T est Statistic:

$$test\ statistic = \frac{\text{statistic}-\text{parameter}}{st.dev.of\ statistic}$$

O btain your p-value: z-score table or t-table

M ake a decision:

- Because the p-value is less than the significance level of ___, I reject the null hypothesis.
- Because the p-value is greater than the significance level of _____, I fail to reject the null hypothesis.

S tate your conclusion

There is/is not evidence to support _________ (put the alternative hypothesis into words)

One-Sided Test for Proportions

A drug company claims that less than 8% of patients who take drug A experience dizzy spells. To check this claim, scientists give the drug to a SRS of 400 patients. In all, 35 patients in the sample had dizzy spells. Test this claim at the 0.05 significance level.

P p= the true proportion of patients on drug A who experience dizzy spells

H H_0: p=0.08 H_a: p<0.08

A

- Random: text says SRS
- Normal: np=(400)(0.08)=32>10, n(1-p)=(400)(.92)=368>10
- Independent: It is fair to assume there are more than 4000 patients taking drug A

N One-sample z-test for p

T z=0.5529

O p-value = 0.7098

M Since our p-value is greater than our significance level of 0.05, we fail to reject our null hypothesis.

S There is not evidence to conclude that less than 8% of patients taking drug A would experience dizzy spells.

A popular coffee company claims that most people prefer their coffee to their competitors. To prove it, the took a SRS of 300 people in a large city and had them do a blind taste test; 182 people picked the company's coffee correctly. Test this claim at a 0.01 significance level.

P p= the true proportion of people who can correctly identify the company's coffee

H H_0: p=0.5 H_a: p>0.05

A

- Random: text says SRS
- Normal: np=(300)(0.5)=150>10, n(1-p)=(300)(.5)=150>10
- Independent: It is fair to assume there are more than 3000 people in the city

N One-sample z-test for p

T z=3.695

O p-value = 0.0001

M Since our p-value is less than our significance level of 0.01, we reject our null hypothesis.

S There is evidence to conclude that the majority of people prefer the company's coffee.

One-Sided Test for Means

A candy company claims that the average YUM bar weighs 15 grams. Toby thinks that they are actually smaller. He weighs 40 random YUM bars and gets an a mean of 14.7 g and a standard deviation of 0.2 g. Test the company's claim at a 0.10 significance level.

P μ= the true mean weight of YUM bars

H H_0: $\mu = 15$ H_a: $\mu < 15$

A

- Random: text says random
- Normal: n=40>30, so approximately normal by CLT
- Independent: It is fair to assume there are more than 400 YUM bars

N One-sample t-test for μ

T t=-9.4868 df=39

O p-value = 0

M Since our p-value is less than our significance level of 0.10, we reject our null hypothesis.

S There is evidence to conclude that the YUM bars weigh less than 15 grams on average.

A restaurant claims that their diet dish has an average of 400 calories. The FDA thinks it is more and checks this by calculating the calories of 30 meals. Their sample has a mean of 415 with a standard deviation of 20. Test the claim at a 0.05 significance level.

P μ= the true mean number of calories in the diet dish

H H_0: $\mu = 400$ H_a: $\mu > 400$

A

- Random: assume random
- Normal: n=30=30, so approximately normal by CLT
- Independent: It is fair to assume there are more than 300 diet dishes made

N One-sample t-test for μ

T t=-4.1079 df=29

O p-value = 0.0001

M Since our p-value is less than our significance level of 0.05, we reject our null hypothesis.

S There is evidence to conclude the diet dish has more than 400 calories on average.

Two-sided Tests

A candidate for mayor claims that 68% of the constituents support his candidacy. A local news organization does a random sample of 500 constituents and find that 312 support him. Preform a test at the 0.05 significance level to check that he is correct.

P p= the true proportion of constituents who support the candidate

H H_0: p=0..68 H_a: $p \neq 0.68$

A

- Random: text says randomly selected
- Normal: np=(500)(0.68)=340>10, n(1-p)=(500)(.68)=160>10
- Independent: It is fair to assume there are more than 5000 constituents

N One-sample z-test for p

T z=2.6844

O p-value = 0.0073

M Since our p-value is less than our significance level of 0.05, we reject our null hypothesis.

S There is evidence to conclude that 68% is not the correct proportion of constituents that support the candidate.

A silver polishing company claims to have a shininess rating of 9.5. A random sample of 65 items' ratings had a mean of 9.53 and a standard deviation of 0.3. Is there evidence at the 5% level that their shininess rating is different from their claim?

P μ= the true average shininess rating for the company

H H_0: μ =9.5 H_a: $\mu \neq 9.5$

A

- Random: text says random sample
- Normal: n=65>30, so approximately normal by CLT
- Independent: It is fair to assume there are more than 650 items shined

N One-sample t-test for μ

T t=0.8062 df=64

O p-value = 0.4231

M Since our p-value is greater than our significance level of 0.05, we fail to reject our null hypothesis.

S There is not evidence to conclude the shininess rating is different than the company's claim.