Hypothesis Testing

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***Step 1* : Formulate Hypothesis**

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Step 1 **: Formulate Hypothesis**

Step 2 **: Calculate the t-statistic**

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Hypothesis Testing

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Interpret results of hypothesis test as applied to the particular business application

Hypothesis Testing *from a previous lesson…*

checking the claim that bottling unit puts in 200 ml of beverage in bottles

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Two tailed test

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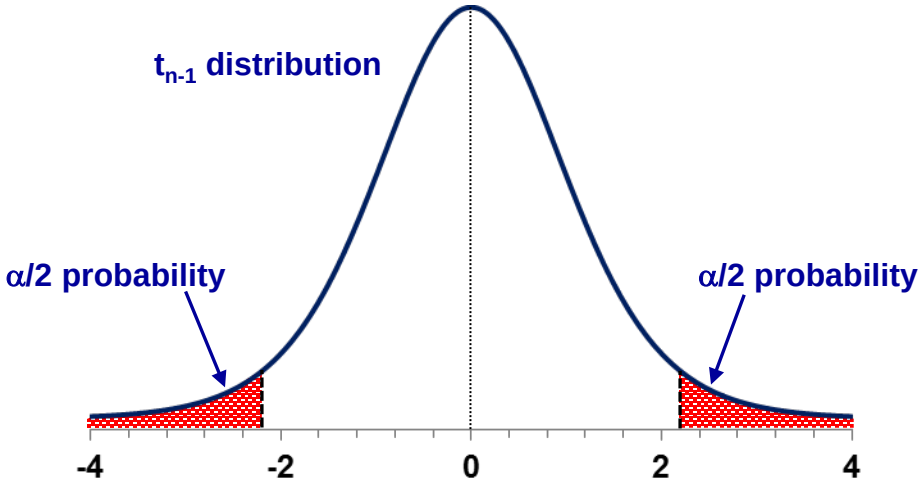

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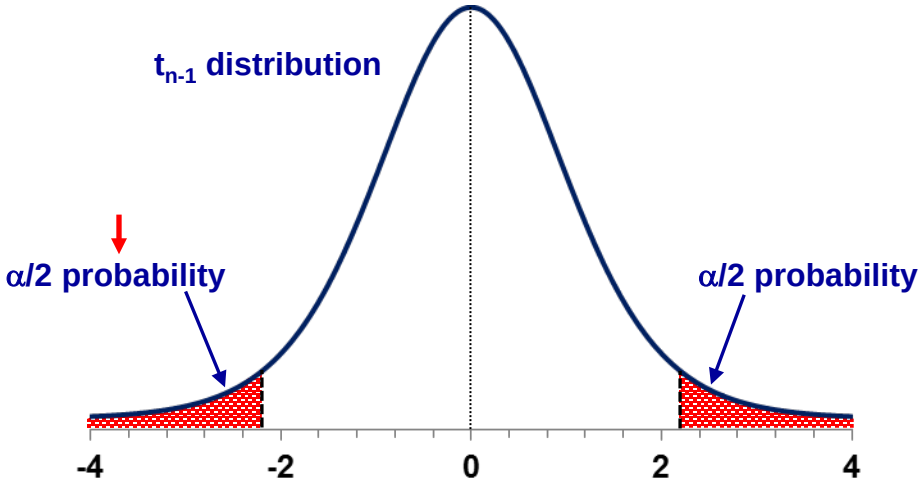

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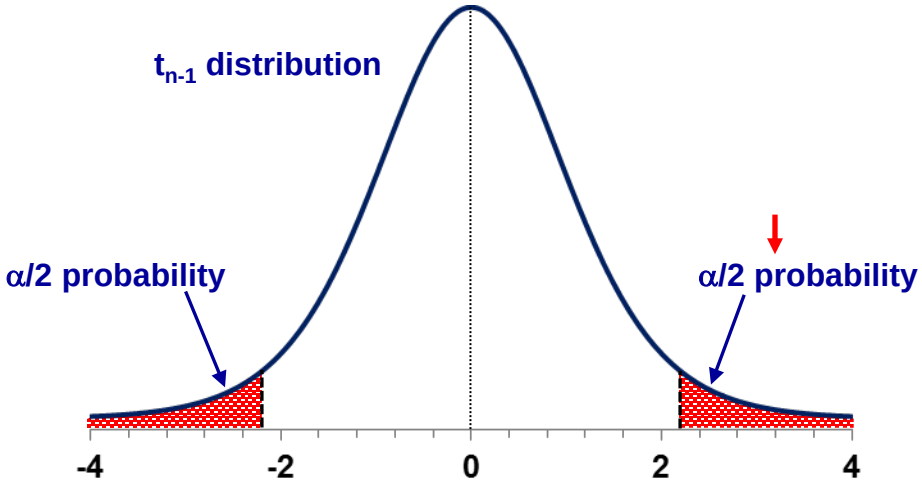
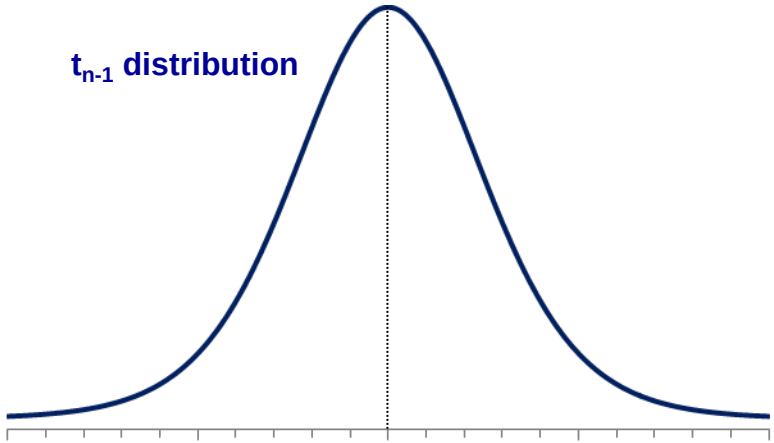


Hypothesis Testing

Single tail hypothesis test



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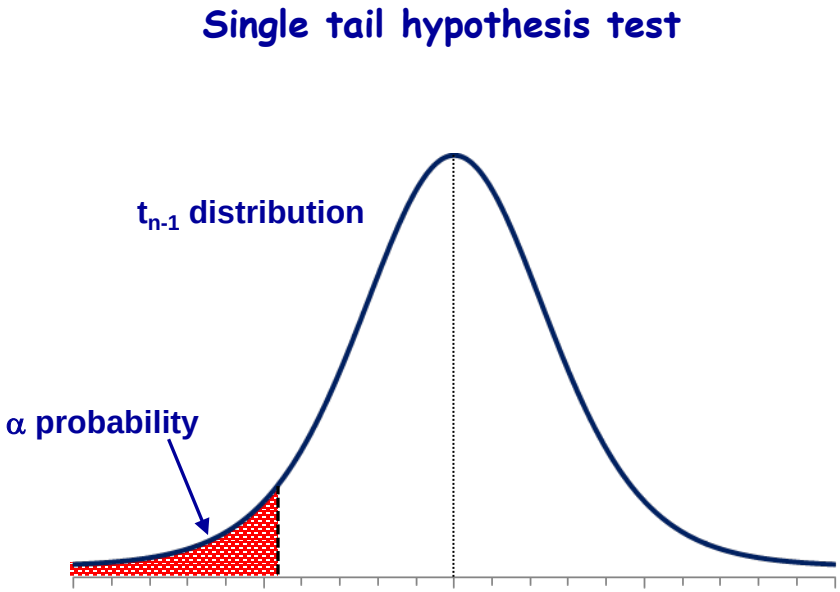

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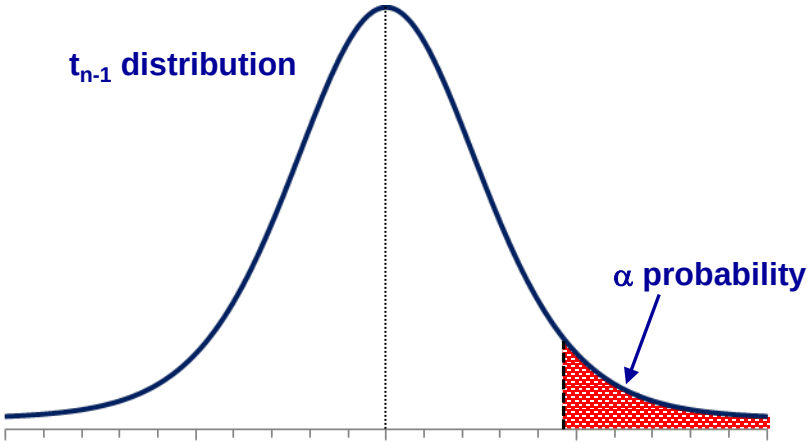

Hypothesis Testing

Example

A fuel additive manufacturer claims that through the use of its' fuel additive, automobiles in the small car category should achieve on average an increase of 3 miles or more per gallon of fuel.

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1) Random selection of 150 small cars

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1) Random selection of 150 small cars.
2) Their fuel efficiency measured before and after the use of fuel additive.

Hypothesis Testing

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Claim made: increase in fuel efficiency is 3 miles per gallon or more

To test the claim…

1) Random selection of 150 small cars.
2) Their fuel efficiency measured before and after the use of fuel additive.
3) 150 measurements obtained for the increase in miles per gallon achieved.

Hypothesis Testing

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A fuel additive manufacturer claims that through the use of its' fuel additive, automobiles in the small car category should achieve on average an increase of 3 miles or more per gallon of fuel.

Claim made: increase in fuel efficiency is 3 miles per gallon or more

To test the claim…

1) Random selection of 150 small cars.
2) Their fuel efficiency measured before and after the use of fuel additive.
3) 150 measurements obtained for the increase in miles per gallon achieved.

sample mean $\bar{x}$ = 2.9 miles per gallon
sample std deviation s = 1.35 miles per gallon

Hypothesis Testing

$n = 150$, $\bar{x} = 2.9$ mpg, $s = 1.35$ mpg

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Step 1 **: Formulate Hypothesis**

Null Hypothesis H_0: $\mu \geq 3.0$

Alternate Hypothesis H_A: $\mu < 3.0$

Hypothesis Testing

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One tailed test

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One tailed test

Reject Null hypothesis if $\bar{x}$ is way below 3.0

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One tailed test

Reject Null hypothesis if $\bar{x}$ is way below 3.0

≡

Reject Null hypothesis if t-statistic is way below 0

Hypothesis Testing

$n = 150$, $\bar{x} = 2.9$ mpg, $s = 1.35$ mpg

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One tailed test

Reject Null hypothesis if $\bar{x}$ is way below 3.0

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Reject Null hypothesis if t-statistic is way below 0

Only one rejection region on the Left-Hand-Side

Hypothesis Testing

Single tail hypothesis test with rejection region on the L.H.S.

H_0: $\mu \geq \ldots$

H_A: $\mu < \ldots$

Hypothesis Testing

Single tail hypothesis test with rejection region on the L.H.S.

H_0: $\mu \geq \ldots$

H_A: $\mu < \ldots$

Single tail hypothesis test with rejection region on the R.H.S.

H_0: $\mu \leq \ldots$

H_A: $\mu > \ldots$

Hypothesis Testing

Single tail hypothesis test with rejection region on the L.H.S.

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Hypothesis Testing

Single tail hypothesis test with rejection region on the L.H.S.

H_0: $\mu \geq \ldots$

H_A: $\mu < \ldots$

Single tail hypothesis test with rejection region on the R.H.S.

H_0: $\mu \leq \ldots$

H_A: $\mu > \ldots$

Two tail hypothesis test with rejection regions on both sides

H_0: $\mu = \ldots$

H_A: $\mu \neq \ldots$

Hypothesis Testing

$n = 150$, $\bar{x} = 2.9$ mpg, $s = 1.35$ mpg

Step 1 : Formulate Hypothesis

Null Hypothesis H_0: $\mu \geq 3.0$

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Step 2 **: Calculate the t-statistic**

$$\text{t-statistic} = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

Hypothesis Testing

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$$\text{t-statistic} = \frac{\bar{x}-\mu}{s/\sqrt{n}} = -0.9072$$

Hypothesis Testing

$n = 150$, $\bar{x} = 2.9$ mpg, $s = 1.35$ mpg

Step 1 : Formulate Hypothesis

H_0: $\mu \geq 3.0$

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Step 2 : Calculate the t-statistic = -0.9072

Step 3 **: Cutoff values for the t-statistic**

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Step 3 **: Cutoff values for the t-statistic** $\alpha = 0.05$

Hypothesis Testing

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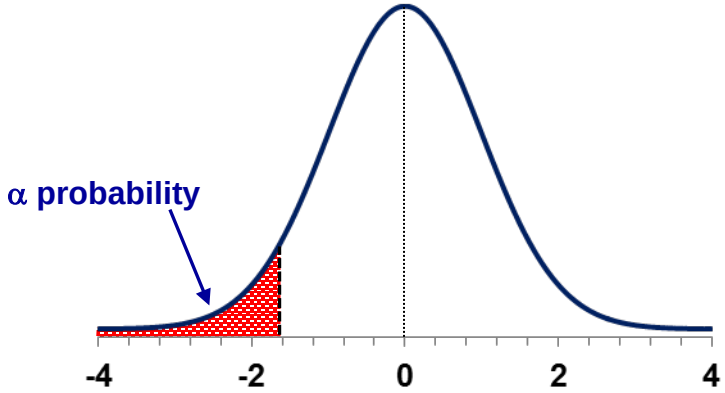

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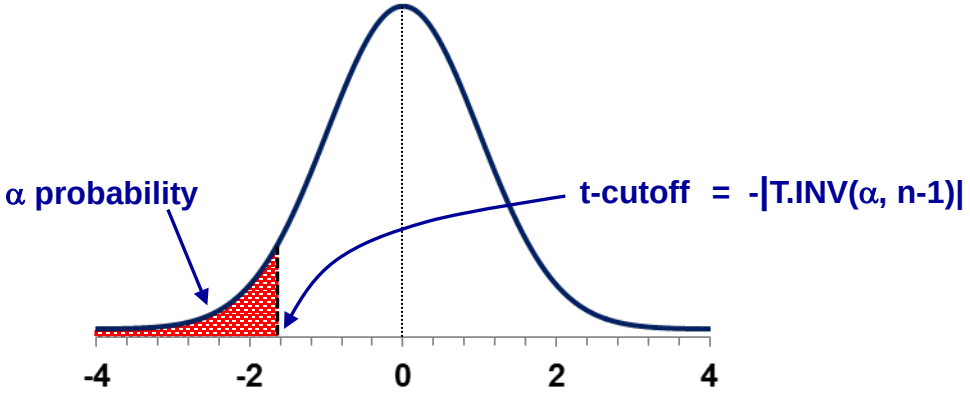

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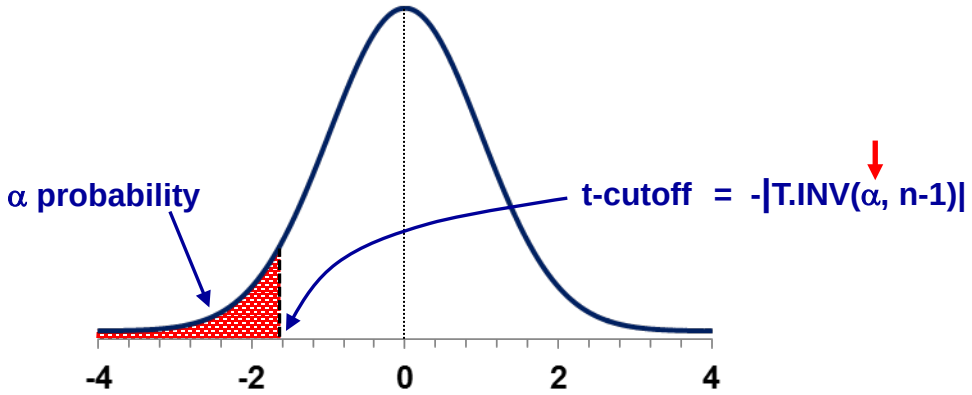

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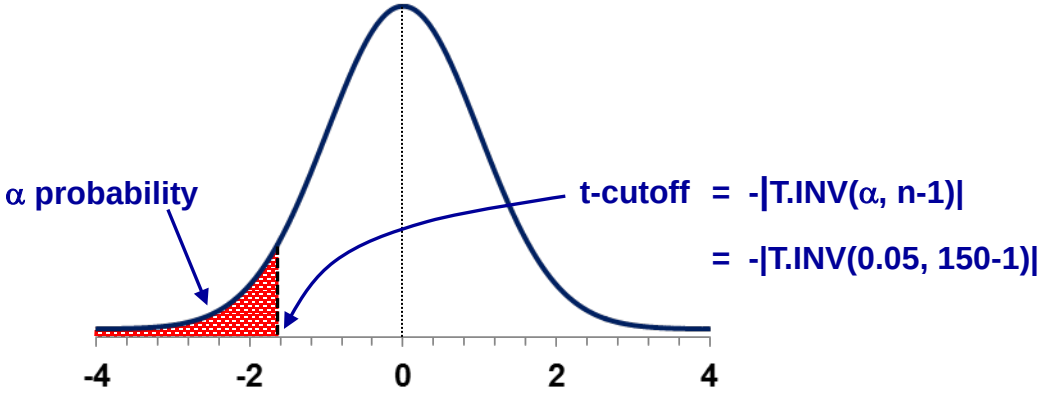

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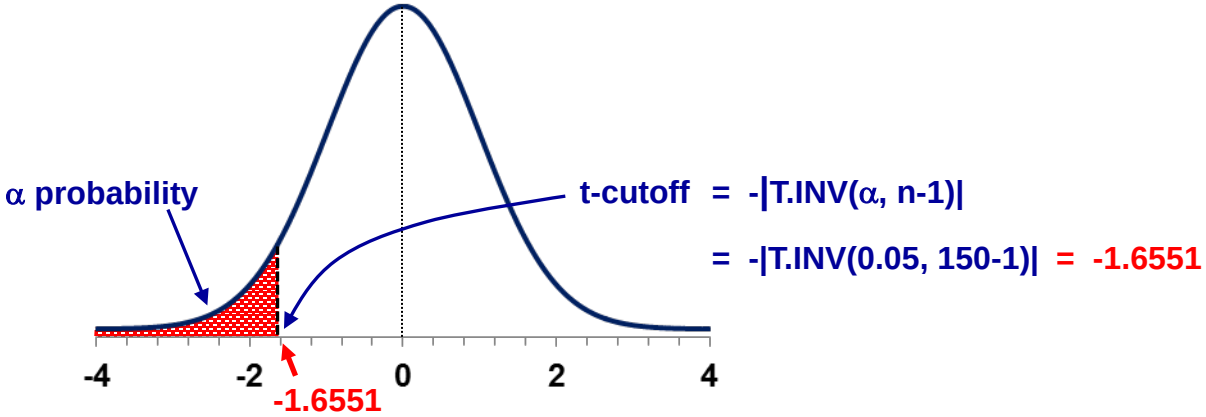

t-cutoff = -|T.INV(α, n-1)|

= -|T.INV(0.05, 150-1)| = -1.6551

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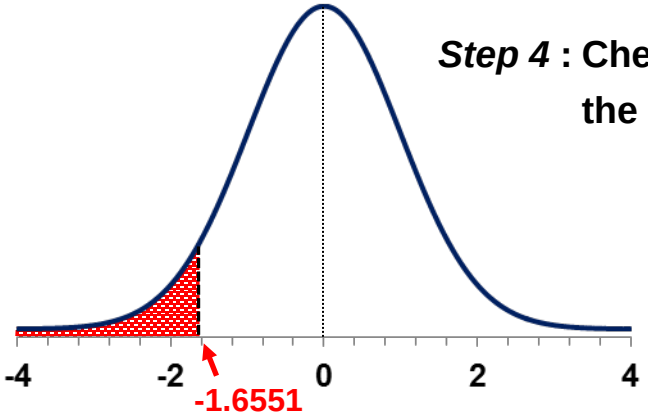

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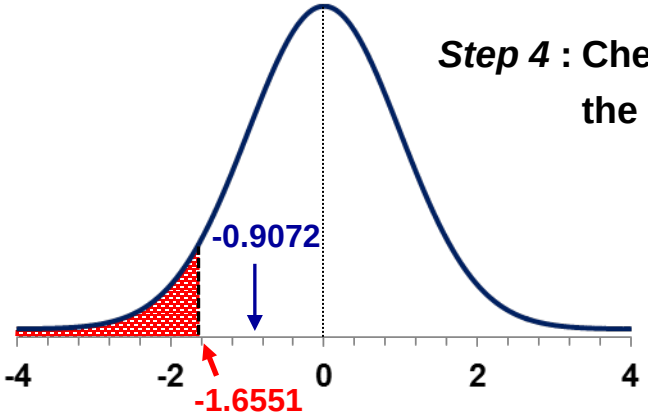

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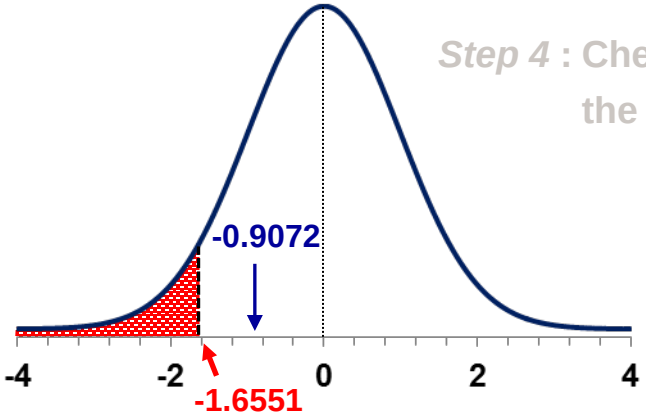

Step 4 : Check whether t-statistic falls in the rejection region

Conclusion:

- **Do not reject Null hypothesis**
- **Our evidence is consistent with the claim made**