HYPOTHESES AND P-VALUES

Hypotheses

A hypothesis is a specific, testable prediction. Hypothesis testing is generally used when comparing two or more groups or variables.

When evaluating a hypothesis, you need to consider the size of the sample and the variability of the sample. This is so you can determine if the difference is meaningful or due to chance.

Steps in hypothesis testing

1. Specify the null hypothesis
2. Specify the alternative hypothesis
3. Set the significance level
4. Calculate the test statistic and corresponding p-value (see overleaf for explanation of p-values)
5. Draw a conclusion

1. Null hypothesis

The null hypothesis (H_0) is a statement of no effect, relationship, or difference between groups or variables.

In science, researchers are usually trying to disprove the null hypothesis.

EXAMPLE

H_0: Exercising does not affect weight.

2. Alternative hypothesis

The alternative hypothesis (H_1) is the statement that there is an effect or difference.

This is usually the hypothesis the researcher is interested in proving.

EXAMPLE

H1: Exercising does affect weight.

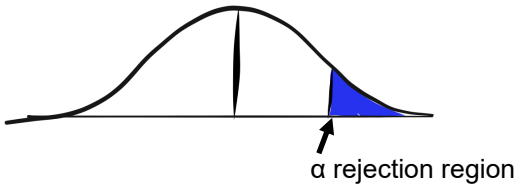
The alternative hypothesis can be one-sided (so that it is either greater than or less than a certain value, but not both) or two-sided (greater than or less than).

To figure out if your hypothesis is one- or two-sided, think about whether you are interested in change in *only one direction*.

EXAMPLE: ONE-SIDED

H0: Population mean equals 10.

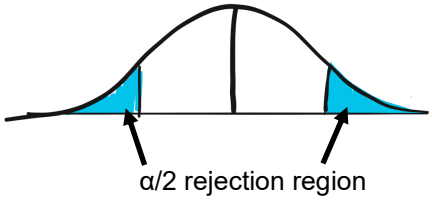
H1: Population mean is greater than 10.



EXAMPLE: TWO-SIDED

H0: Population mean equals 10.

H1: Population mean *does not* equal 10.



3. Significance level

In order to test your hypotheses, you need to set a significance level. This will determine if the differences are due to real difference, or chance or natural variation.

Significance is usually set at 0.05. This means that there is a 5% chance that you will accept your alternative hypothesis when your null hypothesis is actually true.

FACT

Significance level is denoted by the Greek letter alpha (α).

A significance value of 0.05 (α = 0.05) means 5 out of 100 times you will see a difference, even though the null hypothesis is true.

A significance value of 0.01 (α = 0.01) means 1 out of 100 times you will see a difference, even though the null hypothesis is true.

4. Test statistic

To calculate the test statistic you will need to know the sample mean, the population mean, the variance (standard deviation) and the sample size.

Normal (*z*), *t*, *F* or *chi*-squared distributions can be used.
Look up the value in the correct statistics table to find the p-value.

The p-value is determined based on the result of your test statistic.

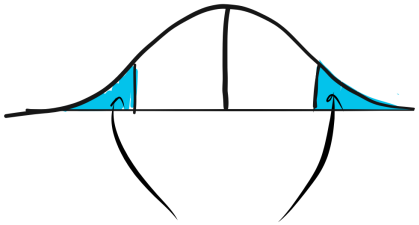
5. Conclusion

Your conclusions are based on your p-value and your significance level.

If your *p-value is less than your significance level*, you reject the null hypothesis. This means there is a statistically significant difference.

EXAMPLE

Significance level (α) = 0.05
P-value = 0.02
P-value (0.02) < α (0.05) therefore there is a significant difference.



Reject null

EXAMPLE

Significance level (α) = 0.05
P-value = 0.08
P-value (0.08) > α (0.05), therefore there is no significant difference.

If your *p-value is greater than your significance level*, you fail to reject the null hypothesis. There is no significance statistical difference.

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