

Introduction

In the context of testing of hypotheses, there are basically **two types of errors** we can make:-

TYPE I Error

TYPE II Error

Type I Error

- A **type I error**, also known as an **error of the first kind**, occurs when the null hypothesis (H_0) is true, but is rejected.
- A type I error may be compared with a so called *false positive*.
- A Type I error occurs when we believe a **falsehood**.
- The rate of the type I error is called the *size* of the test and denoted by **the Greek letter α (alpha)**.
- It usually equals the **significance level of a test**.
- If type I error is fixed at 5 %, it means that there are about 5 chances in 100 that we will reject H_0 when H_0 is true.

Type II Error

- **Type II error**, also known as an **error of the second kind**, occurs when the null hypothesis is false, but erroneously fails to be rejected.
- Type II error means accepting the hypothesis **which should have been rejected**.
- A type II error may be compared with a so-called *False Negative*.
- A Type II error is committed when **we fail to believe a truth**.
- A type II error occurs when one rejects the alternative hypothesis (**fails to reject the null hypothesis**) when the **alternative hypothesis is true**.
- The rate of the type II error is denoted by the **Greek letter β (beta)** and related to the power of a test (**which equals $1-\beta$**).





In the tabular form two error can be presented as follows:

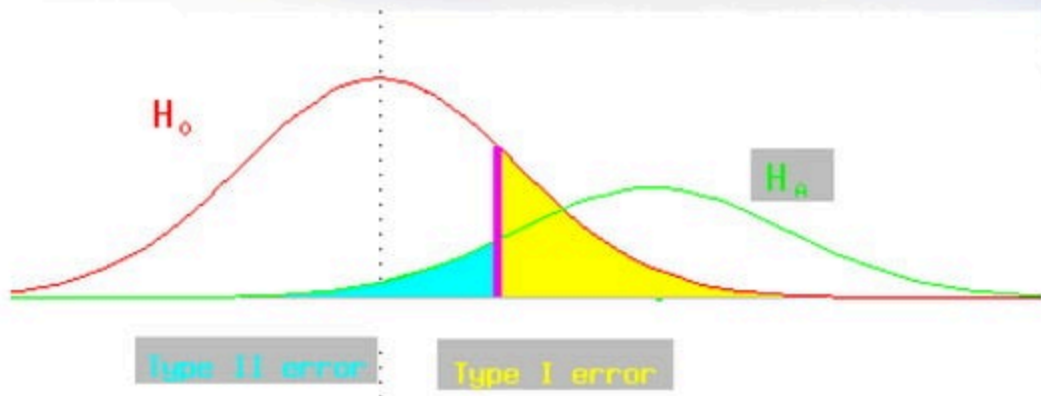
	Null hypothesis (H_0) is true	Null hypothesis (H_0) is false
Reject null hypothesis	Type I error False positive	Correct outcome True positive
Fail to reject null hypothesis	Correct outcome True negative	Type II error False negative

HYPOTHESIS TESTING
OUTCOMES

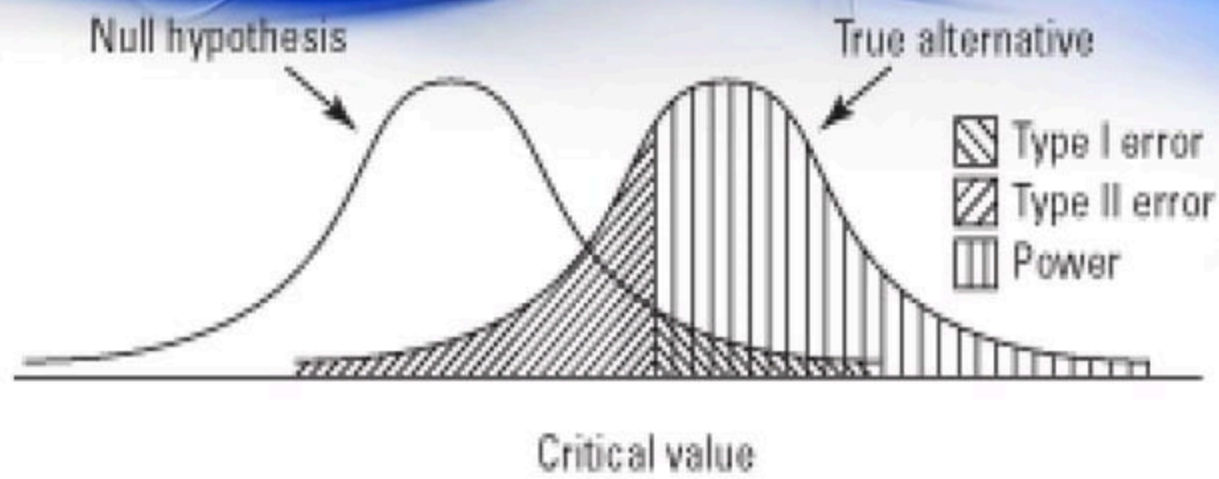
Reality

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	The Null Hypothesis Is True	The Alternative Hypothesis is True
The Null Hypothesis Is True	Accurate $1 - \alpha$ 	Type II Error β 
The Alternative Hypothesis is True	Type I Error α 	Accurate $1 - \beta$ 



If there is a diagnostic value distinguish the choice of two means, moving it to decrease type I error will increase type II error (and vice-versa)



Graphical depiction of the relation between Type I and Type II errors

What are the differences between Type 1 errors and Type 2 errors?

Type 1 Error

- A type 1 error is when a statistic calls for the rejection of a null hypothesis which is factually true.
- We may reject H_0 when H_0 is true is known as Type I error .
- A type 1 error is called a **false positive**.
- It denoted by **the Greek letter α (alpha)**.
- Null hypothesis and type I error

Type 2 Error

- A type 2 error is when a statistic does not give enough evidence to reject a null hypothesis even when the null hypothesis should factually be rejected.
- We may accept H_0 when infect H_0 is not true is known as Type II Error.
- A type 2 error is a false negative.
- It denoted by the ***Beta***
- Alternative hypothesis and type II error



Reducing Type I Errors

- **Prescriptive testing** is used to increase the level of confidence, which in turn reduces Type I errors. The chances of making a Type I error are reduced by increasing the level of confidence.

Reducing Type II Errors

- **Descriptive testing** is used to better describe the test condition and acceptance criteria, which in turn reduces Type II errors. This *increases the number of times we reject the Null hypothesis – with a resulting increase in the number of Type I errors* (rejecting H_0 when it was really true and should not have been rejected).

Therefore, reducing one type of error comes at the expense of increasing the other type of error! THE SAME MEANS CANNOT REDUCE BOTH TYPES OF ERRORS SIMULTANEOUSLY!



**Thank
You**