Stat 202 - 20155 - Last Lecture

The level of significance α of a test of significance can be interpreted as a probability.

α is the probability of what?

The probability of
- Rejecting the null hypothesis when in fact the null hypothesis is true. (Equivalently, accept the alternative hypothisis when it is false)

- The probability of a type I error

There is another type of error — a type II error. What do you suppose a type II error is?

- Accept the null hypothesis when it is false (Equivalently, reject the alternative hypothesis when it is true)

	H_0 true	H_0 false
Accept H_0	no error	type II error
Reject H_0	type I error	no error

	H_a false	H_a true
Reject H_a	no error	type II error
Accept H_a	type I error	no error

The level of significance is related to the probability of a type I error

In fact, it is the probability of a type I error.

The power of a test is related to the probability of a type II error.

Specifically the power is "1 − the probability of a type II error," or the probability of accepting Ha when Ha is true

One thing to be careful of: the probability of a type II error depends on the actual value of the parameter being tested.

IE

$H_0: \mu = 0$
$H_a: \mu \neq 0$

IF μ is small the probability of a type II error is large (i.e. probability of rejecting Ha is large) and the power is low

OTOH if μ is large the probability of a type II error (reject Ha) is small and the power is high.

The power of a significance test measures its ability to detect an alternative hypothesis

$H_a: \mu \neq 0$

Power is a function of the true μ.

High power is desirable.

That minimizes the probability of a type II error

Increasing power

increase α – type II error, reject H_a when H_a is true. A 5% ~~α~~ test will have ~~a greater chance of rejecting~~ 5% probability of rejecting the null hypothesis, when true. A 1% test will have a 1% probability of rejecting H_0

95% probability for rejecting alternative versus 99%

Lower α means more stringent evidence needed to accept H_a more likely to reject H_a, more likely to ~~accept~~ make a type II error, power lower. Higher α higher power,

Increasing power

- Increase α (see above)
- Consider a particular alternative that is farther away from μ_0
- Increase sample size
- Decrease σ

Relationship between Power and α

α is the probability of ~~accepting~~ rejecting H_0 when H_0 is true

Also the probability of accepting H_a when H_0 is true.

Power is the probability H_a when a particular value of the parameter is true

$\mu = 1$ or $\mu = 2$

When $\mu = \mu_0$ power $= \alpha$ although in this case the null hypothesis is true so accepting H_a is an error

One can say the power approaches α as the null hypothesis becomes true.

Statcrunch

One sample t-test