

part 5 ch. 21	More about Tests
Alpha level, α	The threshold P-value selected in advance that determines when we reject a null hypothesis, H_0 . If we observe a statistic (\hat{p}) whose P-value based on the null hypothesis is less than α , we reject that null hypothesis.
Statistically significant	When the P-value falls below the alpha level, we say that the test is "statistically significant" at that alpha level. (But this doesn't necessarily have any practical importance.)
Significance level	The alpha level is also called the significance level, most often in a phrase such as a conclusion: "we reject the null hypothesis at the 5% significance level."
Don't just reject/fail to reject ___ at an _____ level. Report the _____ as an indication of the strength of the evidence.	H_0 Alpha/significance P-value

Of course, if the null hypothesis is true, no matter what alpha level you choose, you still have a probability α of rejecting the null hypothesis by mistake. This is the rare event we want to protect ourselves against. When we do reject the null hypothesis, no one ever thinks that this is one of those rare times. As statistician Stu Hunter notes: The statistician says, "Rare events do happen – but not to me!"

In fact, when we perform a hypothesis test, we can make mistakes. Let's investigate by modeling the outcomes of a legal trial and HIV testing.

LEGAL TRIAL

Jury

	Acquit (Not Guilty)	Convict	
Defendant	H_0 : Innocent	OK	mistake: innocent to jail α
	H_a : Guilty	mistake: guilty set free β	OK Power

HIV TEST

Diagnosis

	-	+	
patient	H_0 : Healthy	OK	mistake: Healthy told HIV+ False Positive α
	H_a : HIV	mistake: HIV not detected False Negative β	OK power

compare to before:
we used tree diagrams

HYPOTHESIS TESTING

	Fail to Reject H_0	Reject H_0
H_0 : True	OK	Type I error α
H_0 : False	Type II error β	Power

p. 491
p. 494

When we perform a hypothesis test we can make mistakes in two ways: The more serious mistake is _____	Type I error – the null hypothesis is true, but we mistakenly reject it. Type II error – the null hypothesis is false, but we fail to reject it. _____ depends on the situation.
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Type I error, α	The error of rejecting a null hypothesis, H_0 , when in fact it is true (also called a "false positive"). The probability of a Type I error is α , the chosen alpha level.
Type II error, β	The error of failing to reject a null hypothesis, H_0 , when in fact it is false (also called a "false negative"). The probability of a Type II error is β and is difficult to calculate because when H_0 is false, we don't know what value the parameter really is.
Power	$1 - \beta$ The probability of correctly rejecting a false null hypothesis, H_0 .

A19:

- 1) Begin Reading Ch. 21
- 2) p. 499-503 / 3, 5, 11, 20, 21.
- 3) p. 479 / 32.