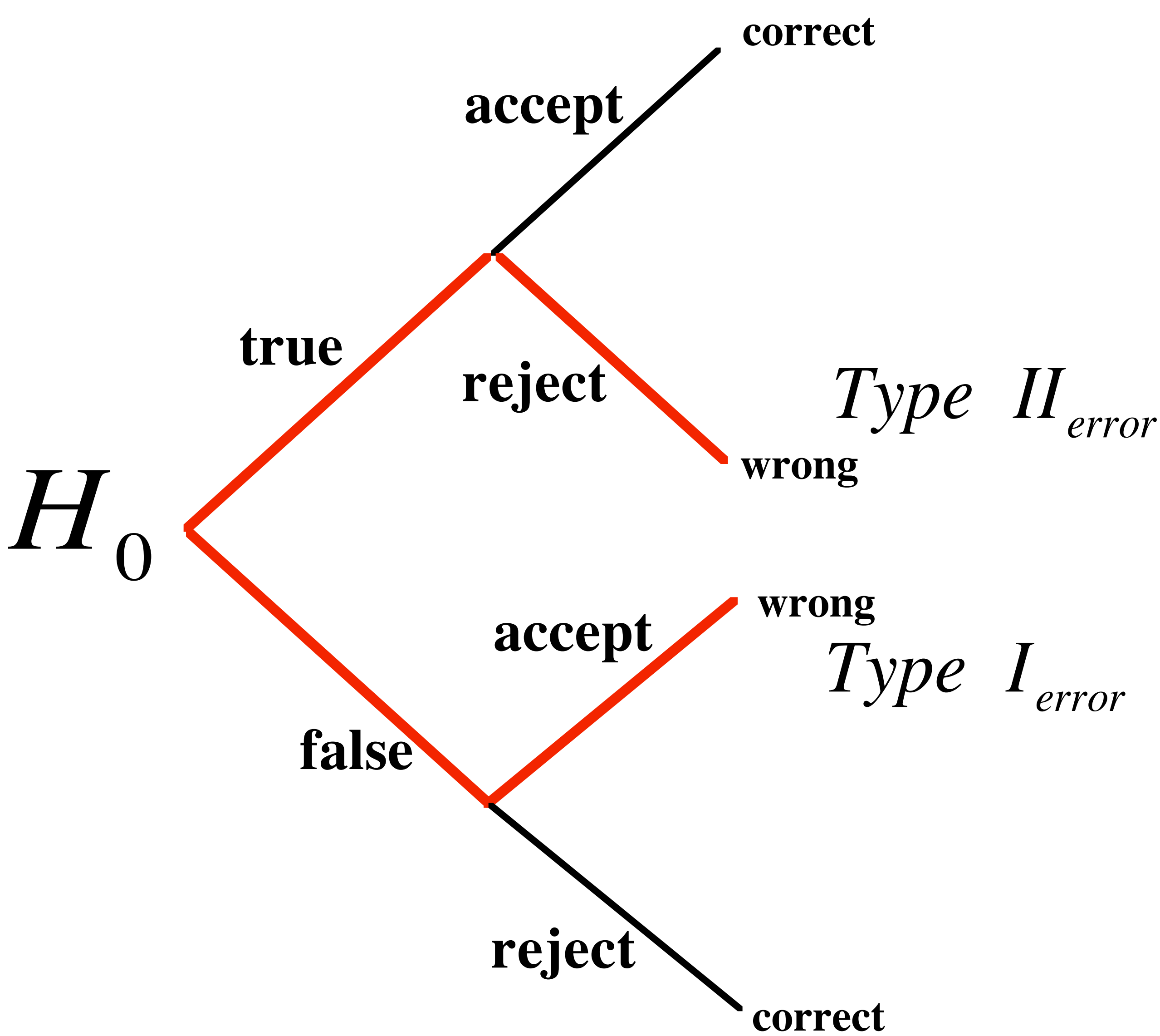
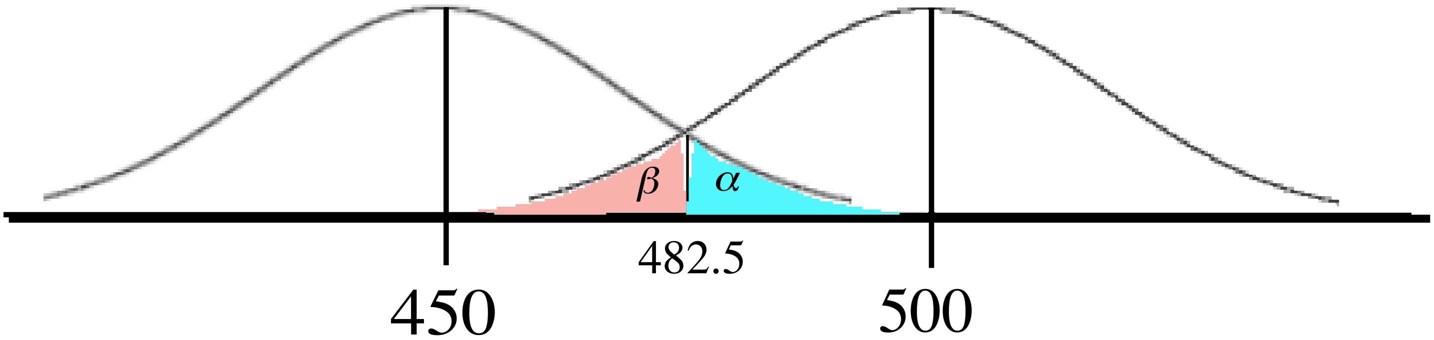
Hypothesis Testing

(Type I and Type II errors)



- $p\left(Type\ \ I_{error}\right) = \alpha$
- $p\left(Type\ \ II_{error}\right) = \beta$

Example:



For a mean of 450, standard deviation of 60, sample size of 9, $\bar{x} = 500$ and significance 0.05. The critical *x* value for a test statistic with $\alpha = 0.05$ would be

$$x = \mu + z_{0.05}\left(\frac{\sigma}{\sqrt{n}}\right)$$

$$= 450 + 1.64\left(\frac{60}{\sqrt{9}}\right) = 482.5$$

β would be the probability associated with our *TS*. that is,

$$p(z \text{ is } TS)$$

$$p\left(z \text{ is } \frac{482.5 - 500}{\frac{60}{\sqrt{9}}}\right) = p(z \text{ is } -0.875) = 0.192$$

NOTE: to decrease β you would have to increase α. The only way to decrease both α and β would be to increase the sample size!

Hypothesis Testing
(p - value)

Example:

$$\begin{cases} H_0 : \mu = 450 \\ H_a : \mu > 450 \end{cases}$$

$\alpha = 0.01$

$\bar{x} = 492, \ \sigma = 60, \ n = 9,$

$$\boxed{\text{Reject } H_0 \ \textit{if} \ p-\text{value} < \alpha}$$

$$TS = \frac{492 - 450}{\frac{60}{\sqrt{9}}} = 2.10$$

The ***p*-value** is the area in the appropriate tail(s) of the distribution of the test statistic (TS) when H_0 is true. That is the p-value will be

$$z_{p-\text{value}} = 2.10 \Rightarrow p-\text{value} = 0.0179$$

So, in this example we would **not** reject the null hypothesis since $0.0179 \not< 0.01$.