Plot:

Decide between hypotheses

H_0 "Null hypothesis" "Basic Assumption"

"Innocent until proven guilty"

H_1 "Alternative hypothesis" "significant conclusion"

"beyond reasonable doubt"

Strategy: choose some sample statistic Y

and regions R_0 R_1 ← "Test"

R_0: accept H_0, reject H_1

R_1: accept H_1, reject H_0

Suppose we want to test hypotheses about a population mean, assume normally distributed

$H_0: \mu = 50$ $\quad$ $H_1: \mu = 85$

$n = 10$ $\quad$ $\sigma^2 = 120$

$$\bar{X} = N(\mu, \frac{120}{10})$$

look for a value x_{big} so that

if $\overline{X} \geq x_{big}$ then reject H_0

$$P(\overline{X} \geq x_{big} \mid H_0) \leq 0.001 = \alpha$$

$$H_0 \rightsquigarrow \overline{X} = N(50, 12)$$

$$\frac{\overline{X} - 50}{\sqrt{12}} = Z \qquad P(Z \geq z_{big}) = .001$$

$$P(\overline{X} \geq \underbrace{\boxed{\sqrt{12}\, z_{big} + 50}}_{x_{big}}) = .001$$

$$\overline{X} = \sqrt{12} Z + 50$$

$R_1 : \overline{x} \geq x_{big} \qquad R_0 : \overline{x} < x_{big}$.

$P(\text{type 1 error}) = .001$

$P(\text{type 2 error})$

$P(\overline{X} < x_{big} \mid H_1)$

If we don't know variance

$$T = \frac{\overline{X} - \mu}{S/\sqrt{n}}$$ is t-distributed random var w/ $n-1$ degrees of freedom.

$$P(T \geq t_{big} \mid H_0) = .001$$

$H_0 : \mu = 50$

$H_1 : \mu = 85$

statistic: T

R_0 : $T < t_{\text{hy}}$ $\quad$ R_1 : $T \geq t_{\text{hy}}$.